The Rites of Spring:

A cognitive analysis of ritual activity in the agricultural transition in south-west Asia and north-western Europe



Michael J. Gantley

School of Archaeology
Linacre College
University of Oxford

Abstract

What cognitive and cultural mechanisms facilitated the agricultural transition? In this thesis, I evaluated the hypothesis that ritual action involving large groups of people meeting regularly created a significant sense of collective purpose to bring about the social cohesion necessary for agriculture. I test this hypothesis against the archaeological record in two distinct regions: south west Asia and north-western Europe. Following Whitehouse's (2000) Modes of Religiosity theory, I show that the agricultural transition in both regions is connected with a shift from an imagistic to an increasingly doctrinal mode of religious behaviour. This result is important because it brings together insights from the prehistoric archaeology and cognitive anthropology to generate new knowledge about the agricultural transition.

Acknowledgements

I would like to express my gratitude to Professor Amy Bogaard for her advice and guidance. Similarly, I would like to thank Professor Harvey Whitehouse for his assistance and advice. It is with sincere gratitude that I acknowledge the support of the National University of Ireland (NUI) for making this research possible by awarding me the NUI Travelling Studentship. Sincere thanks to the fellows and staff at Linacre College; particularly for awarding me a travel grant that facilitated my attendance at the EurASEAA conference. I would like to acknowledge Dr Dan Lunn for his advice at the early stage of this research project. I wish convey my appreciation to Mick Monk, Department of Archaeology U.C.C. for his support and suggestions. I want to express sincere appreciation to Oliver C. Keane and Lawrence O Donnell (Cork Academy of Music) for their encouragement. I want to express my genuine thanks and deep respect to my family, Ann Gantley, Lorchan Mac Sheanlaoich and Helene Gantley for their continued love, guidance and support. Sincere and heartfelt thanks to Rosa Teira-Paz for making my world so much brighter; Graciñas! I take this opportunity to express my immeasurable appreciation to Dr James Carney for his advice and continual support. A world of thanks to Jason Daly for bringing the noise and colour at a critical point, I am forever in your debt. Thank you to my colleagues, Dan Mullins, Andreas Duering, Nela Scholma-Mason, Owain Mason, Nancy Beaven, Justin E. Lane and Veronika Rybanska for the thought provoking debates and great laughter. Thanks to Eddie, Jeff, Thom, an Taobh Tuathail and fish go deep for the soundscapes. Finally, I would like to thank my irreplaceable friends for their support; go raibh maith agat le mo chaired iontach—go speisialta: Fitch Fortune, Donnachadh Buckley and Pieter Cornelius Berkelaar.

Dedicated to the memory of my father:

“And you, my father, there on the sad height,

Curse, bless, me now with your fierce tears, I pray.

Do not go gentle into that good night.

Rage, rage against the dying of the light”

(Dylan Thomas, 1937)

Table of Contents

Chapter 1 Introduction 1

1 Introduction 1

1.1 Hypothesis, objectives and aims 3

1.2 Methodological approach of this thesis 4

1.3 Categories of variables 6

1.3.1 Ritual 6

1.3.2 Subsistence 7

1.3.3 Social complexity 7

1.4 Structure of the thesis 9

Chapter 2 Context of Research 11

2 Introduction 11

2.1 Chronology of the agricultural transition 11

2.2 Diffusion mechanisms and the agricultural transition 13

2.2.1 Genetics, diffusion and the agricultural transition 15

2.3 Previous approaches to the origins of agriculture in south-west Asia 19

2.3.1 Environmental models 19

2.3.2 Social models 22

2.3.3 Cognitive models 23

2.3.4 Ritual, subsistence and the agricultural transition 29

2.4 Theoretical approach in this DPhil project 31

2.4.1 Previous examinations of the Modes of Religiosity theory in ethnography 35

2.4.2 Previous examinations of the Modes of Religiosity theory in archaeology 38

2.4.3 The Modes of Religiosity theory in the context of this DPhil research 40

2.5 Ritual activity and the agricultural transition 41

2.5.1 Archaeological approaches to ritual 42

2.5.2 Identifying ritual the archaeological record 44

2.5.3 Ritual activity across the agricultural transition 45

2.6 Social complexity and the agricultural transition 47

2.7 Identity Fusion and Group Identification 51
2.7.1 Identity fusion 52
2.7.2 Group identification 55
2.7.3 Fusion, group identification and the Modes of religiosity 58
2.7.4 Identity Fusion, group identification and resource acquisition strategy 60
2.8 A cognitive framework 61
2.8.1 Cognitive archaeology 61
2.8.2 Cognitive approaches to religion 62
2.8.3 Cognitive mechanisms and religion 66
Chapter 3 Material and Methods 69
3 Introduction 69
3.1 Methods for sampling and assembling the cross-cultural ethnographic (eHRAF) data 69
3.2 Selection of cultures for the eHRAF study 71
3.3 Initial pilot study 77
3.3.1 Outcomes of the pilot study 78
3.4 Categorising and recording the ethnographic (eHRAF) data 84
3.4.1 General information 85
3.4.2 Subsistence practices 86
3.4.3 General ritual characteristics 88
3.4.4 Mortuary practices 90
3.4.5 Social complexity 92
3.4.6 Sharing avoidance 95
3.4.7 Community, ritual and monumental architecture 96
3.5 Methods for sampling and assembling the archaeological data 97
3.5.1 Chronology associated with the archaeological samples 98
3.5.2 Selection of archaeological site-phases 99
3.5.3 Categorising and recording the archaeological data 107
3.6 Estimating population size from archaeological material 113
3.6.1 Estimating hunter-gatherer population size from archaeological evidence 114
3.6.2 Estimating agricultural population size from archaeological evidence 116
3.7 Methods of data analysis 120
3.7.1 Databases 120

3.7.2 Designing a statistical framework for this thesis 120
3.7.3 Identifying the Independent and dependent variables 120
3.7.4 Identifying the modes of religiosity via ritual variables using archaeological material 121
3.8 Hypothesis testing 123
3.9 Statistical analysis 124
3.9.1 Multidimensional scaling (MDS) 125
3.9.2 Principal Component Analysis (PCA) 127
3.9.3 Generalised Linear Modelling (GLM) 129
Chapter 4: Exploratory analysis of the eHRAF database 138
4 Introduction 138
4.1 Multidimensional Scaling 138
4.1.1 Multidimensional scaling based on the ritual variables, coded by mode of religiosity 139
4.1.2 Multidimensional scaling based on the subsistence variables, coded by mode of religiosity 142
4.1.3 Multidimensional scaling based on the social complexity variables, coded by mode of religiosity 147
4.1.4 Multidimensional scaling based on all variable, coded by mode of religiosity 151
4.1.5 General MDS summary 154
4.2 Multidimensional Scaling coded by population size 155
4.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size 156
4.2.2 Multidimensional scaling analysis based on the subsistence variables, coded by population size 158
4.2.3 Multidimensional scaling analysis based on the social complexity variables, coded by population size 160
4.2.4 Multidimensional scaling analysis based on all variables, coded by population size 162
4.2.5 General MDS summary in relation to population size 163
4.3 Principal Component Analysis 164
4.3.1 Principal component analysis (PCA) based on the ritual variables 165
4.3.2 Principal component analysis (PCA) based on the subsistence variables 171
4.3.3 Principal component analysis (PCA) based on the social complexity variables 177

4.3.4 Principal component analysis (PCA) based on all variables 182
4.3.5 General PCA summary 186
Chapter 5: Exploratory analysis of the South-west Asian archaeological database 188
5 Introduction 188
5.1 Multidimensional Scaling 188
5.1.1 Multidimensional scaling based on the ritual variables, coded by culture-historical period 189
5.1.2 Multidimensional scaling based on the subsistence variables, coded by culture-historical period 192
5.1.3 Multidimensional scaling based on the social complexity variables, coded by culture-historical period 196
5.1.4 Multidimensional scaling based on all variables, coded by culture-historical period 199
5.1.5 General MDS summary 202
5.2 Multidimensional scaling coded by population size 203
5.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size 204
5.2.2 Multidimensional scaling analysis based on the subsistence variables, coded by population size 207
5.2.3 Multidimensional scaling analysis based on the social complexity variables, coded by population size 209
5.2.4 Multidimensional scaling analysis based on all variables, coded by population size 211
5.2.5 General MDS summary based on population size 212
5.3 Principal Component Analysis 214
5.3.1 Principal component analysis (PCA) based on the ritual variables 215
5.3.2 Principal component analysis (PCA) based on the subsistence variables 221
5.3.3 Principal component analysis (PCA) based on the social complexity variables 226
5.3.4 Principal component analysis (PCA) based on all variables 232
5.3.5 General PCA summary 236
Chapter 6: Exploratory analysis of the North-west European archaeological database 237
6 Introduction 237
6.1 Multidimensional Scaling 237

6.1.1 Multidimensional scaling based on the ritual variables, coded by culture-historical period 238

6.1.2 Multidimensional scaling based on the subsistence variables, coded by culture-historical period 243

6.1.3 Multidimensional scaling based on the social complexity variables, coded by culture-historical period 248

6.1.4 Multidimensional scaling based on all variables, coded by culture-historical period 253

6.1.5 General MDS summary 256

6.2 Multidimensional scaling analysis coded by population size 257

6.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size 258

6.2.1 Multidimensional scaling analysis based on the subsistence variables, coded by population size 260

6.2.2 Multidimensional scaling analysis based on the social complexity variables, coded by population size 262

6.2.3 Multidimensional scaling analysis based on all variables, coded by population size 264

6.2.4 General MDS summary in relation to population size 265

6.3 Principal Component Analysis 268

6.3.1 Principal component analysis (PCA) based on the ritual variables 269

6.3.1 Principal component analysis (PCA) based on the subsistence variables 275

6.3.2 Principal component analysis (PCA) based on the social complexity variables 281

6.3.3 Principal component analysis (PCA) based on all variables 286

6.3.4 General PCA summary 291

Chapter 7: Problem-oriented analysis of ethnographic and archaeological data 292

7 Introduction 292

7.1 Generalised linear models (GLM) and receiver operating characteristic (ROC) curves for the eHRAF cultures 293

7.1.1 ROC Curve for the GLM based on the PCA identified ritual variables 293

7.1.2 ROC Curve for the GLM based on the PCA identified subsistence variables 295

7.1.3 ROC Curve for the GLM based on the PCA identified the social complexity variables 297

7.1.4 ROC Curve for the GLM based on the PCA identified variables following analysis of all variables 299
7.1.5 Comparing models 301
7.1.6 Summary of the GLMs for the eHRAF cultures 302
7.2 Percentage probability classification of eHRAF cultures 302
7.2.1 Percentage probability classification of eHRAF cultures based on the PCA identified ritual variables 302
7.2.2 Percentage probability classification of eHRAF cultures based on the identified variables following PCA of all variables 307
7.3 GLMs and ROC curves for the south-west Asian archaeological site-phases . 310
7.3.1 ROC Curve for the GLM based on the PCA identified ritual variables 310
7.3.2 ROC Curve for the GLM based on the PCA identified subsistence variables 312
7.3.3 ROC Curve for the GLM based on the PCA identified social complexity variables 314
7.3.4 ROC Curve for the GLM based on the PCA Identified variables following analysis of all variables 316
7.3.5 Summary of the GLMs for the for the south-west Asian site-phases 318
7.4 Percentage probability classifications 319
7.4.1 Percentage probability classification of the known eHRAF cultures based on the subsistence variables identified via PCA of the south-west Asian site-phases 319
7.4.2 Percentage probability classification of the south-west Asian archaeological site-phases based on the identified subsistence variables 323
7.4.3 Additional model testing using a half-normal Q-Q plot 323
7.4.4 GLM output results 325
7.5 GLMs and ROC curves for the north-west European archaeological site-phases 332
7.5.1 ROC Curve for the GLM based on the PCA identified ritual variables 332
7.5.2 ROC Curve for the GLM based on the PCA identified subsistence variables 334
7.5.3 ROC Curve for the GLM based on the PCA identified social complexity variables 336
7.5.4 ROC Curve for the GLM based on the PCA Identified variables following analysis of all variables 338
7.5.5 Summary of the GLMs for the north-west European site-phases 340
7.6 Percentage probability classifications 341

7.6.1 Percentage probability classification of known eHRAF cultures based on the subsistence variables identified via PCA of the north-west European site-phases 341

7.6.2 Percentage probability classification of the north-west European archaeological site-phases based on Identified subsistence variables 345

7.6.3 Additional model testing using a half-normal Q-Q plot 345

7.6.4 GLM output results 346

7.7 Conclusions 351

7.7.1 Sets of variables as predictors 351

Chapter 8: Discussion 355

8 Introduction 355

8.1 Assessment of the methodological approach 355

8.1.1 Limitations of the approach 355

8.1.2 Advantages of the approach 362

8.2 General trends from the statistical results 365

8.3 Hypothesis testing 373

8.3.1 Percentage probability results for the archaeological databases 373

8.4 A statistical framework for predicting mode of religiosity from archaeological material 374

8.4.1 Identifying the modes of religiosity using ritual variables based on archaeological material culture 374

8.4.2 Identifying the modes of religiosity via subsistence variables based on archaeological material culture 377

8.4.3 Identifying the modes of religiosity via covariance between ritual, subsistence and social complexity variables based on archaeological material culture 379

8.4.4 Identifying the modes of religiosity via population size based archaeological material culture 381

8.4.5 Summary 382

8.5 Ritual variables as a predictor of mode in the archaeological record of the agricultural transition in both regions agricultural transition 384

8.5.1 Ritual continuity in the south-west Asian agricultural transition 386

8.5.2 Ritual change in the north-west European agricultural transition 387

8.6 Subsistence variables as an indicator of mode in the archaeological record . 389

8.7 Social cohesion, modes and the agricultural transition 390

8.8 The emergence of the doctrinal mode during the agricultural transition 401

8.9 Building a cognitive picture of a Neolithic doctrinal religion 409
8.9.1 Cognitive devices and an emerging doctrinal religion in the Neolithic .. 409
8.9.2 General socio-cognitive features of an emerging doctrinal religion in the Neolithic 412
8.10 Material culture expressions of an emerging doctrinal Neolithic mode of religiosity 414
8.11 The dynamic modes of religiosity model in the agricultural transition: gradual versus abrupt processes 416
8.12 Summary 425
Chapter 9: Conclusion and future work 427
9.1 Summary and conclusions 427
9.2 Future work 430

Thesis Bibliography…….….. 432
Bibliography for south-west Asian sites…….....480
Bibliography for north-western European sites…….....532
Appendix 1: eHRAF Codebook…….559
Appendix 2: list of Irish sites showing scoring method……..759

List of Tables

Table 2:1 Showing south-west Asian Neolithic chronology in terms of dated cultural horizons 12
Table 2:2 Contrasting modes of religiosity (derived from Whitehouse 2004, 74)..... 33
Table 2:3 Archaeological indicators of ritual (derived from Renfrew and Bahn 1991; 359-360; Renfrew 1994, 51-52) 45
Table 3:1 identifying the cultures with the highest dysphoric arousal scores and the cultures with the lowest ritual frequency/year scores respectively. This table shows the initial 16 imagistic cultures selected based on their frequency and arousal scores..... 73
Table 3:2 identifying the cultures with the lowest dysphoric arousal scores and the cultures with the highest ritual frequency/year scores respectively. This table shows the initial 21 doctrinal cultures selected based on their frequency and arousal scores. 74
Table 3:3 the complete ethnographic sample of cultures 75

Table 3:4 Samples used for pilot study 78

Table 3:5: The eHRAF OCM codes for subsistence practices..... 88

Table 3:6 the eHRAF OCM codes for general ritual characteristics 90

Table 3:7 the eHRAF OCM codes for mortuary practice 92

Table 3:8 the eHRAF OCM codes for social complexity/inequality 95

Table 3:9 the eHRAF OCM codes for sharing avoidance 96

Table 3:10 the eHRAF OCM codes for architecture..... 97

Table 3:11 South-west Asian chronology based on dated cultural horizons (Bellwood 2005; Fuller *et. al* 2011; Maher *et al.* 2012) 98

Table 3:12 European chronology based on dated cultural horizons (Larsson 1990; Price 1991; Cooney 2007; Weninger *et al.* 2009; Martinsson-Wallin and Wallin 2010; Cooney et al. 2011 Connell and Warren 2011; Whittle 2011) 99

Table 3:13 south-west Asian site-phases 103

Table 3:14 North-west European site-phases..... 105

Table 5:1: Summary of south-west Asian cultural phases, in terms of population size; showing the percentages and numbers for each category 213

Table 6:1: Summary of north-west European cultural sub-phases, in terms of population size; showing the percentages and numbers for each category 267

Table 6:2: Percentage of each archaeological phase or eHRAF culture represented in each population group 267

Table 7:1: showing AUC and shared subsistence variables for the two GLMs with the highest AUC's..... 301

Table 7:2: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the ritual variables identified via PCA of eHRAF cases…...305

Table 7:3: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on variables identified via PCA of all variables for the eHRAF cultures……..308

Table 7:4: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the identified subsistence variables identified via PCA of south-west Asian archaeological site-phases ……..321

Table 7:5: percentages and number of sites-phases classed via the GLM of the south-west Asian site-phases based on the identified subsistence variables…….327

Table 7:6: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of south-west Asian archaeological site-phases……..328

Table 7:7: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the subsistence variables identified via PCA of the European archaeological site-phases ……343

Table 7:8: percentages and numbers of European sites-phases classed via the GLM based on the identified subsistence variables…….348

Table 7:9: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of the European archaeological site-phases ……...349

Table 8:1: Variables identified via PCA and used in GLMs (showing the variables in common and the % of eHRAF cultures correctly classified using each set of ..variables)……368

Table 8:2: Summary of the most and least appropriate sets of variables for all statistical analyses 371

Table 8:3: Summary of the sets of PCA identified variables (ranked 1-5 via PCA, where 1 = highest loading) used in each GLM and the percentage of eHRAF cultures correctly classified using each set of variables 372

List of Figures

Figure: 2.1 Three transitions in human culture and cognition (derived from Donald 1991, 1993)……..27

Figure: 1.2 outlining the ritual or farming first debate (Mann 2011, 41)……...31

Figure 2:3 Ritual frequency and arousal scores from Atkinson and Whitehouse (2011): graph demonstrates that ritual frequency is negatively correlated with overall ratings of arousal, with error bars representing 95% confidence intervals for mean arousal……..37

Figure 3:1 a and b contrasting ROC curves (after Fawcett 2006 and Sing *et al.* 2004).. 134

Figure 4:1: 2-d plot base on the ritual variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Trobrianders (14), Dogon (23) and Andamans (26). 139

Figure 4:2: 3-dimensional plot based on ritual variables for ethnographic eHRAF cultures coded in terms of mode of religiosity 140

Figure 4:3: Figure 3: 2-d plot base on the subsistence variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Guaraní (19), Banyoro, (20) and Andamans (26). 142

Figure 4:4a: 3-dimensional plot based on the subsistence variables for ethnographic eHRAF cultures coded in terms of mode of religiosity 143

Figure 4:5: 2-d plot base on the social complexity variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Seminole Native American (10), Dogon (23) and Andamans (26). 147

Figure 4:6a: 3-dimensional plot based on the social complexity variables for ethnographic eHRAF cultures coded in terms of mode of religiosity 148

Figure 4:7: 2-d plot based on all variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Seminole Native American (10), Hausa, (22), Dogon (23), Wolof (25) and Andamans (26). 151

Figure 4:8: 3-dimensional plot based on all variables for ethnographic eHRAF cultures coded in terms of mode of religiosity 152

Figure 4:9: 3-dimensional plot based on the ritual variables for ethnographic eHRAF cultures, coded in terms of population size 156

Figure 4:10: 3-dimensional plot based on the subsistence variables for ethnographic eHRAF cultures, in terms of population size 158

Figure 4:11: 3-dimensional plot based on the social complexity variables for ethnographic eHRAF cultures, in terms of population size 160

Figure 4:12: 3-dimensional plot based on all variables for ethnographic eHRAF cultures, coded in terms of population size 162

Figure 4:13: Individual Factor map showing cultures clustering based on the ritual variables following PCA analysis with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square. 169

Figure 4:14: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on the subsistence variables: Hunting (H), Gathering (G), Crop Intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS.3) and Agriculture (A) 171

Figure 4:15: Individual Factor map showing cultures clustering based on the subsistence variables following PCA analysis with the Imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square. 175

Figure 4:16: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on the social complexity variables: Degree of Sedentism at 2(DS.2), Private Food Storage (PFS), Private Cooking (PC), and Food Storage Strategy at 3 (FSS.3) and Resource Monopolization (RM) 177

Figure 4:17: Individual Factor map showing cultures clustering based on the social complexity variables following PCA analysis with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square. 180

Figure 4:18: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on all variables: Agriculture (A), Crop Intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS. 3), Private Food Storage (PFS) and Degree of Sedentism at 2 (DS.2) 182

Figure 4:19: Individual factor map showing cultures analysed by PCA on the basis of all variables with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square. 185

Figure 5:1: 2-d plot based on the ritual variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Epipalaeolithic Ain Mallaha (7), PPNB Basta (11), Epipalaeolithic Beidha I (12), and PPNB Khirbet Hammam (40) 189

Figure 5:2: 3-d plot based on the ritual variables for south-west Asian archaeological site-phases, coded in terms of cultural phase 190

Figure 5:3: 2-d plot based on the subsistence variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: PPNB Catalhöyük I (16), PPNB Kfar Hahoresh (38) and Epipalaeolithic Kharaneh IV (39) 192

Figure 5:4: 3-d plot based on the subsistence variables for south-west Asian archaeological site-phases, coded in terms of cultural phase 193

Figure 5:5: 2-d plot based on the social complexity variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: PN Ain Rahub (8), PPNC Atlit Yam (10), PPNB Beidha II (13), PPNB Khirbet Hammam (40) and Epipalaeolithic Mureybit II (42) 196

Figure 5:6: 3-d plot based on the social complexity variables for south-west Asian archaeological site-phases, coded in terms of cultural phase 197

Figure 5:7: 2-d plot based on all variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected cultures: PPNC Ain Ghazal III (5), Epipalaeolithic Beidha I (12), PPNB Beidha II (13), PPNB Tell Halula (57) and Epipalaeolithic Wadi Hammeh 27 (63) 199

Figure 5:8: 3-d plot based on all variables for south-west Asian archaeological site-phases, coded in terms of cultural phase 200

Figure 5:9: 3-d plot based on the ritual variables for south-west Asian archaeological site-phases, coded in terms of population size 204

Figure 5:10: 3-d plot based on the subsistence variables for south-west Asian archaeological site-phases, coded in terms of population size 207

Figure 5:11: 3-d plot based on the social complexity variables for south-west Asian archaeological site-phases, coded in terms of population size 209

Figure 5:12: 3-d plot based on all variables for south-west Asian archaeological site-phases, coded in terms of population size 211

Figure 5:13: Percentage of each phase represented in each population group, the number of site-phases in each percentage category are shown in table 5.1 213

Figure 5:14: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the ritual variables: Ritual Buildings (RB), Burial Goods (BG), Special Treatment (ST), Flexed Burials (FB) and Individual Burials (IB). 215

Figure 5:15: Individual factor map showing site-phases based on the ritual variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square. 218

Figure 5:16: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the subsistence variables: Agriculture (A), Animal Domestication at 2 (A D. 2), Crop Intensity at 2 (CI.2), Hunting (H) and Gathering (G) 221

Figure 5:17: Individual factor map showing site-phases based on the subsistence variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square. 224

Figure 5:18: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the social complexity variables: Burial Goods (BG), Special Treatment (ST), Individual Burials (IB), Communal Structures (CS) and Storage of Cultural Knowledge (SCK) 226

Figure 5:19: Individual factor map showing site-phases based on the social complexity variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square 229

Figure 5:20: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the all variables: Flexed Burials (FB), Special Treatment (ST), Individual Burials (IB), Degree of Sedentism at 2 (DS.2) and Burial Goods (BG) 232

Figure 5:21: Individual Factor map showing site-phases clustering based on all variables following PCA analysis with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22,

PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square. 234

Figure 6:1: 2-d plot based on the ritual variables for north-west European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Lough Boora (27), Ballynagilly (30), Ballintaggart (39) and Brú Na Bóinne Complex (Newgrange) (41) 238

Figure 6:2a: 3-d plot based on the ritual variables for European archaeological site-phases, coded in terms of cultural phase 239

Figure 6:3: 2-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of cultural phase, showing selected site-phases: Tågerup (8), Sarup I (13), Clowanstown 1 (23) and Gortore (25) 243

Figure 6:4a: 3-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of cultural phase 244

Figure 6:5: 2-d plot based on the social complexity variables for European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Norsminde (Køkkenmødding) (5), Clowanstown 1 (22), Mount Sandel (28) and Brú Na Bóinne Complex (41) 248

Figure 6:6a: 3-d plot based on the social complexity variables for European archaeological site, coded in terms of cultural phase 249

Figure 6:7: 2-d plot based on all variables for European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Tågerup (8), Clowanstown 1 (23) and Brú Na Bóinne Complex (41) 253

Figure 6:8a: 3-d plot based on all variables for European archaeological site-phases, coded in terms of cultural phase 254

Figure 6:9: 3-d plot based on the ritual variables for European archaeological site-phases, coded in terms of population size 258

Figure 6:10: 3-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of population size 260

Figure 6:11: 3-d plot based on the social complexity variables for European archaeological site-phases, coded in terms of population size 262

Figure 6:12: 3-d plot based on all variables for European archaeological site-phases, coded in terms of population size 264

Figure 6:13: Percentage of each phase represented in each population group, the number of site-phases in each percentage category are shown in table 6.1 267

Figure 6:14: Correlation graph showing the first five variables that account for most of the variance in the north-west European dataset based on the ritual variables: Burial

Goods (BG), Burial Associated with Animals (BA), Inhumation (I), Monuments in the landscape (ML) and Monumental Burials (MB). 269

Figure 7:1: ROC curve for the GLM based on the ritual variables identified via PCA of the eHRAF cultures 294

Figure 7:2: ROC curve for the GLM based on the subsistence variables identified via PCA of the eHRAF cultures 296

Figure 7:3: ROC curve for the GLM based on the social complexity variables identified via PCA of the eHRAF cultures 298

Figure 7:4: ROC curve for the GLM based on the variables identified via PCA of all variables, for the eHRAF cultures 300

Figure 7:5: ROC curve for the GLM based on the ritual variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases 311

Figure 7:6: ROC curve for the GLM based on the subsistence variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases. 313

Figure 7:7: ROC curve for the GLM based on the social complexity variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases.. 315

Figure 7:8: ROC for the GLM based on the variables identified via PCA of all variables, for the south-west Asian site-phases and applied to the known eHRAF cases. 317

Figure 7:9: Half-normal Q-Q plot for the GLM of the south-west Asian site-phases based on the identified subsistence variables……325

Figure 1:10: percentages of sites-phases classed via the GLM of the south-west Asian site-phases based on the identified subsistence variable…….327

Figure 1:11: ROC curve for the GLM based on the ritual variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases…….333

Figure 1:12: ROC curve for the GLM based on the subsistence variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases……335

Figure 1:13: ROC curve for the GLM based on the social complexity variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases…….337

Figure 1:14: ROC for the GLM based on the variables identified via PCA of all variables, for the north-west European site-phases and applied to the known eHRAF cases…339

Figure 1:15: Half-normal Q-Q plot for the GLM of the European site-phases based on the identified subsistence variables……346

Figure 1:16: percentages of European sites-phases classed via the GLM based on the identified subsistence variables……348

Chapter 1 Introduction

1 Introduction

The purpose of this research is to address the problem of how hunter-gatherer communities adjusted socially to farming in south-west Asia and north-western Europe, respectively, using insights recently developed in the cognitive anthropology of ritual activity. The agricultural transition represents one of the most important socioeconomic and cultural developments in human history. This socioeconomic change is associated with a transition from a hunter-gatherer subsistence strategy to an agro-pastoral farming subsistence economy (Armelagos and Harper 2005; Bellwood 2005; Dolukhanov *et al.* 2005; Bar-Yosef 2004; Sørensen and Karg 2014). Existing archaeological scholarship concerning the agricultural transition has largely focused on the mechanics of plant and animal domestication and the spread and management of crops and livestock. Discoveries such as the monumental structures and sculpture at Göbekli Tepe, south-eastern Turkey (Schmidt 2002) or the megalithic cemetery at Carrowmore Co. Sligo, Ireland (Bergh 1995), however, present us with a fundamental problem: what role did change in ritual life play in the agricultural transition? It has been suggested that, in contrast to pre-agricultural periods, increased social cohesion and solidarity in the context of both new food resources and an expanding social network constituted a fundamental feature of agricultural societies (Kuijt 2002; Watkins 2010; Atkinson and Whitehouse 2011). The archaeology of sites such as Göbekli Tepe and Carrowmore provide us with evidence of a radical ritual change connected with the emergence of farming in both south-west Asia and north-western Europe.

In the context of a number of recent archaeological and ethnographic research investigations into the connection between ritual activity and group assimilation/cohesion, archaeologists have begun to reconsider the role of ritual activity in the agricultural transition of south-west Asia and north-western Europe. For instance,

Kuijt (2002) suggests that the standardisation of ritual practices in the Levantine Pre-Pottery Neolithic B can be considered as the first evidence for the development and legitimisation of authority in agricultural communities. However, the association between ritual activity and the agricultural transition in both regions has not been assessed systematically. This DPhil research employs insights from the cognitive anthropology of ritual to comprehensively examine the extent to which ritual activity was a social mechanism that enabled hunter-gatherer communities to adjust socially to farming in south-west Asia and north-western Europe. It is clear that as these two regions reflect contrasting forms of agricultural emergence: a gradual, indigenous process in south-west Asia, and an abrupt adoption of established farming in north-western Europe. These regions therefore present us with an opportunity to examine comparatively the relationship between social cohesion via ritual activity and the agricultural transition.

Central to this research is the Modes of Religiosity theory proposed by Whitehouse (2000; 2002; 2004). This theory proposes that there are two principal courses for the transmission of religious ideas via ritual activity: the imagistic mode and the doctrinal mode. The imagistic mode of ritual practice describes religious transmission through low frequency, high arousal experiences. Conversely, the doctrinal mode of religious transmission refers to high frequency, low arousal rituals (Whitehouse 2002). Imagistic rituals involve the transmission of religious ideas through irregularly occurring, highly emotive ritual experiences that are stored and recalled via episodic memory (*ibid*). The imagistic mode is associated with smaller human groups such as bands or tribes that rely on high levels of dependence between group members—where defection is an immediate concern (*ibid*). It is asserted that the first religions that we have archaeological evidence for reflect the imagistic mode; examples include cave paintings from the Upper Palaeolithic in south-western Europe (*ibid*). In contrast, the doctrinal mode centres on the transmission of religious ideas through frequent repetition of highly prescribed, orchestrated ritual practices which are stored in an individuals' semantic memory. The

doctrinal mode is associated with larger, often more geographically extensive human groups (Whitehouse 2000; 2002; 2004). In the context of the doctrinal mode, the regular repetition of rituals reinforces beliefs that are central to group identity and social cohesion. The doctrinal mode is considered a more recent development connected with the emergence of more centralised societies (Whitehouse 2004; Whitehouse and Hodder 2010).

1.1 Hypothesis, objectives and aims

This research utilises the Modes of Religiosity theory (Whitehouse 1996: 2000; 2002 2004) as a methodological framework to analyse changing social configurations across the agricultural transition in both south-west Asia and north-western Europe. It employs statistical analysis to explore one particular hypothesis: namely, that the solidarity-generating effect of religious ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in both regions. Directly associated with the examination of the hypothesis are three objectives:

1. to identify patterns of ritual activity in the context of the agricultural transition of both south-west Asia and north-western Europe;
2. to identify any associated patterns of change in subsistence strategy and social complexity; and
3. to examine the extent to which the archaeology of the agricultural transition in both regions reflects a shift from an imagistic to an increasingly doctrinal mode of religiosity.

Recently, the Modes of Religiosity theory has been used as a methodological framework in cognitive science, historical and anthropological research (McCauley and Lawson 2002; Malley 2004; Mithen 2004; Johnson 2004; Whitehouse and Laidlaw 2004; Whitehouse and Martin 2004; Martin and Whitehouse 2005; McCauley and Whitehouse 2005; Xygalatas 2007; Naumescu 2008; Pachis and Martin 2009; Whitehouse and

Hodder 2010 Atkinson and Whitehouse 2011). Such research provides valuable information regarding the nature of social cohesion and group identification via ritual activity. However, in archaeology (particularly, prehistoric archaeology), investigations informed by the Modes of Religiosity theory face a fundamental problem: that ritual frequency and dysphoric arousal levels are, for the most part, difficult to ascertain. A central aim of this DPhil research is therefore to develop an integrated approach incorporating archaeology, ethnography and statistical analysis in order to establish a framework for examining the evidence for the imagistic and/or doctrinal modes of religiosity across the agricultural transition in south-west Asia and north-western Europe. Thus, the theory of Modes of Religiosity is employed as a basis for generating new hypotheses concerning the cognitive dimension of the agricultural transition.

1.2 Methodological approach of this thesis

The methodology employed in this research falls directly within the framework of the *scientific method* (Bernstein 1983; Brody *et al.* 1989; Salmon 1990; Turchin *et al.* 2012; Hope *et al.* 2013). Relevant to this study, Turchin *et al.* (2012) advocate that the scientific method should be central to hypotheses generation and testing using historical databases. At the core of this research is a process of:

(1) Question asking:
    a. how did hunter-gatherer communities adjust socially to farming in south-west Asia and north-western Europe?
    b. what was the role of ritual activity in the agricultural transition?
(2) Hypothesis construction: the solidarity-generating effect of religious/ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in south-west Asia and north-western Europe.
(3) Data collection and statistical analysis:

a. coding and recording a specific sets of ritual, subsistence and social complexity variables in ethnographic and archaeological databases
b. applying appropriate statistical techniques to test the hypothesis

(4) Discussion of results in terms of (i) whether the statistics provide us with evidence of a shift from an imagistic to a more doctrinal mode of religiosity in the context of the agricultural transition and (ii) the extent to which the results add to our wider understanding of the agricultural transition in south-west Asia and north-western Europe respectively.

This research integrates three methodological components: ethnographic and archaeological data recording, database design and statistical analysis. It centres on a meta-analysis of the various types of evidence for ritual activity, subsistence strategy and social complexity from (1) a sample of ethnographic cultures categorised as either imagistic or doctrinal (Atkinson and Whitehouse 2011); (2) a sample of Epipalaeolithic and Neolithic site-phases from south-west Asia; and (3) a sample of Mesolithic and Neolithic site-phases from north-western Europe. The ethnographic component of this research focuses on the collection, cataloguing and analysis of a set of ritual, subsistence strategy and social complexity material correlates from a sample of ethnographic cultures in the eHRAF (electronic Human Relations Area Files) database. The selected ethnographic cultures were categorised as either doctrinal or imagistic based on ritual frequency and dysphoric arousal scores by Atkinson and Whitehouse (2011). The ethnographic material from the eHRAF database was used to examine sets of ritual activity, subsistence strategy and social complexity material correlate variables that could also be identified using archaeological material culture, to assess their linkages to the different modes.

The archaeological aspect of this research focuses on the collection, categorisation and analysis of a sample of well documented archaeological sites from the Epipalaeolithic to the Pottery Neolithic in south-west Asia, and from the Early Mesolithic to the late

Neolithic of north-western Europe. The archaeological material culture was used to generate a dataset of the instances and patterns of ritual activity, subsistence strategy and social complexity as the agricultural transition progressed in each particular geographic region. The purpose of generating these three datasets was to examine whether or not we can observe a common ritual, subsistence strategy and social complexity trend(s) directly associated with the agricultural transition in both regions. The data relating to ritual activity, subsistence strategy and social complexity were statistically tested in relation to the *known* ethnographic (eHRAF) sample, classified as imagistic or doctrinal by Atkinson and Whitehouse (2011). The purpose of this element of the methodology was to use the selected ethnographic cultures from the eHRAF to assess statistically the commonalities in material culture between the *known* ethnographic dataset and of the *unknown* archaeological dataset, which could be indicative of a particular mode of religiosity.

1.3 Categories of variables

Central to this thesis is the identification and recoding of sets of ritual, subsistence and social complexity variables from the eHRAF database and the archaeological material culture of south-west Asia and north-western Europe.

1.3.1 Ritual

Fundamental to the examination of the different modes in this thesis is the identification and recording of a set of ritual variables. Rituals are a particularly crucial feature of human societies as they are a framework of actions central to reinforcing group membership (Whitehouse 2000; 2002; 2004; Barett *et al*. 2002). The Neolithic cultural horizons in both south-west Asia and north-western Europe are characterised by distinctive ritual practices including intramural burial, skull plastering and monumental architecture (Mellaart 1975; Rollefson 1986; Kuijt 1996; Thomas 1996; Cauvin 2000; Goring-Morris, 2000; Verhoeven 2002a; Kuijt and Goring-Morris 2002). This thesis uses ritual material culture to examine if the agricultural transition reflects a shift from an

imagistic to a more doctrinal mode of religiosity. The definition and application of the terms ritual and ritual activity are the subject of debate in archaeological and anthropological discourse; a discussion on ritual definitions in both archaeology and ethnography is provided in Chapter Two of the thesis. As this thesis uses the Modes of Religiosity theory as a basis for hypothesis generation, the definition of ritual activity directly associated with the theory is used. Whitehouse (2004) asserts that rituals are actions that do not display inherent meanings in relation to both their intention and their outcome, and lack an explicit technical motivation or relevance. In this regard, we can suggest that ritual (and by extension ritual activity) contains aspects that extend beyond decidedly practical goals (*Ibid*). For the purpose of this project, ritual is recorded in terms of actions in which a definitive practical incentive or application cannot be readily identified. The ritual variables that are used are detailed in Chapter Three of this thesis.

1.3.2 Subsistence

The agricultural transition is intrinsically connected with a transition from a hunter-gatherer subsistence strategy to a farming subsistence economy (Armelagos and Harper 2005; Bellwood 2005; Dolukhanov *et al.* 2005; Bar-Yosef 2004). This thesis aims to identify and record a set of subsistence variables that enable us to examine the subsistence and food storage strategies form the three databases, and to assess the association (if any) between the imagistic or doctrinal mode and particular subsistence strategies. The subsistence variables that are used are detailed in Chapter three of this thesis.

1.3.3 Social complexity

The agricultural transition in south-west Asia and north-western Europe is often associated with an increase in socio-economic complexity (Tilley 1984; 1996; Larsson 1986; Harbison 1988; Skaarup 1990; Anderson 1992; Whittle 1996; Wason and Baldia 1998; Özdoğan and Basgelen 1999; Cooney 2000; Johnson and Earle 2000; Kuijt and Goring-Morris 2002; Hauptmann and Özdoğan 2007; Verhoeven 2010; Whitehouse *et al.*

2013). The concept of social complexity has generally been used in archaeology to highlight differences in the socio-economic structure of past societies (Flanary 1972; Stein and Rothman 1994; Chapman 2003; Rothman 2004; Yoffee 2005; Frachetti 2009; Hanks and Linduff 2009; Verhoeven 2010). Flannery (1972) asserts that the concept of social complexity as something that could be analysed in archaeological contexts relies on the examination of two aspects: (1) centralisation: the degree of interrelatedness of all parts of the system; and (2) segregation: the degree of specialisations and differentiation within a system. Rothman (1994, 4) defines social complexity as "the degree of functional differentiation among societal units or sub-systems". Expanding on the model of social complexity proposed Flannery (1972), Rothman (1994) presents a model based on two axes of complexity: a vertical axis representing the levels of centralisation and a horizontal axis reflecting the level of segregation within the sub-units of the system. More recently, a number of social complexity models have been proposed that take into account (1) the potentially different (independent and dependent) degrees of complexity that can be identified within one system (or society) and (2) the subjectivity of the concept of social complexity. Common to the majority of social complexity models is the examination of the level of societal stratification and segregation within a society (Verhoeven 2010). Material culture evidence of (for example) levels of centralisation, social hierarchy, degree of urbanism, level of surplus production, resource monopolisation, long-distance trade networks, formalised exchange systems, writing systems, legal systems and craft specialisation are used to examine and comment on the degree of social complexity in archaeological contexts. Using these well-established measures of defining and identifying social complexity, this thesis aims to examine and record a set of social complexity variables from the eHRAF and the archaeological sources. The social complexity variables that are used are detailed in chapter three of this thesis.

1.4 Structure of the thesis

The main focus of Chapter One is to outline the hypothesis, research questions, objectives and the methodological framework central to the DPhil research project. Chapter Two provides the contextual background to the research. It presents a review of previous explanations of the origin and adoption of agriculture in south-west Asia and north-western Europe. This chapter situates the research in relation to previous approaches to the agricultural transition, and defines the ritual and cognitive elements that are the focus of this research project. Chapter Three provides a detailed account of the materials and methodology used in this research. It explains the methodological approaches taken in relation to the sampling, data collection and data analysis strategies in the research. Chapter Four describes the results obtained through the application of multidimensional scaling (MDS) and principal component analysis (PCA) to assess the statistical similarity and dissimilarity of the ethnographic cultures and the variables that are responsible for the variance in the dataset. It discusses the extent to which the statistical results enable us to identify statistical relationships between particular modes of religiosity (imagistic or doctrinal) and sets of ritual activity, subsistence practices and social complexity variables. Chapters Five and Six describe the results obtained from the statistical analysis of the archaeological data. They outline the results generated from the multidimensional scaling (MDS) analysis and principal component analysis (PCA) of the archaeological datasets. Chapter Seven describes the results obtained following the application of generalised linear modelling (GLM) to the datasets. It discusses to what extent GLM enables us to (1) examine which set of variables result in the best predictor model of mode of religiosity for each dataset and (2) generate a percentage probability that each site-phase represents an imagistic or a doctrinal culture. Chapter Eight evaluates the results of the statistical analysis presented in the previous three chapters. It engages in a number of related discussions regarding the role of ritual activity during the agricultural transition in south-west Asia and north-western Europe. This chapter assesses the extent to which the

statistical analysis enables us to suggest that the agricultural transition is connected with a shift from an imagistic to an increasingly doctrinal mode in south-west Asia and north-western Europe respectively. Chapter nine outlines what new insights have been gained following the research project. This chapter explains how the research adds to current archaeological and anthropological interpretations of the agricultural transition in south-west Asia and north-western Europe. Additionally, this chapter describes the direction for further research that this research project provides.

Chapter 2 Context of Research

2 Introduction

This chapter sets out the theoretical background of this DPhil research. It describes and critically evaluates previous approaches to the agricultural transition in south-west Asia and north-western Europe. It also outlines how this DPhil research project diverges methodologically and theoretically from previous approaches—particularly, by focusing on the nature of social cohesion via ritual activity in the agricultural transition utilising insights from cognitive anthropology. Finally, it provides an outline of the Modes of religiosity theory, which frames the hypothesis central to this DPhil research: that the solidarity-generating effect of religious, ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in south-west Asia and north-western Europe.

2.1 Chronology of the agricultural transition

The present archaeological consensus is that around 11,700 BP human groups in south-west Asia began to incorporated plant cultivation into their subsistence practices—making the initial transition from hunter-gathering to plant cultivation (Banning 1998; Bar-Yosef and Rollefson 1998; Kuijt and Goring-Morris 2002; Bellwood 2005; Twiss 2007; Fuller *et. al* 2011; Maher *et al.* 2012). For the most part, the mechanisms and the timeframe of the development and the spread of agriculture in terms of the domestication of plants and animals constitute a well-researched area. The areas connected with the origin of farming in the south-west Asia encompasses present-day Jordan, Lebanon, Syria, Israel, southeast Turkey, Iraq and Iran (Salamini *et al.* 2002; Bellwood 2005). It is proposed that, from its origins in south-west Asia, farming expanded throughout Anatolia and Europe. Recent archaeological research demonstrates that agriculture spread throughout south-west Asia, central Anatolia and Cyprus prior to reaching mainland Europe (Colledge and Conolly 2004; Bellwood 2005). The periods of south-west Asian

prehistory under examination in this research are the Early, Middle and Late Epipalaeolithic cultural complex, the Neolithic consisting of the Pre-Pottery Neolithic A (PPNA), the Pre-Pottery Neolithic B (PPNB)—subdivided into Early, Middle and Late PPNB, the Pre-Pottery Neolithic C (PPNC) and the Pottery Neolithic period (Banning 1998; Bar-Yosef and Rollefson 1998; Kuijt and Goring-Morris 2002; Twiss 2007; Maher *et al.* 2012) (Table 2.1).

Table 2:1 Showing south-west Asian Neolithic chronology in terms of dated cultural horizons

Archaeological Period	**Calibrated Years BP**	**Years BC**
Epipalaeolithic	22,000-11,700	20,000-9,700
Early	22,000-17,500	20,000-15,500
Middle	17,500-14,500	15,500-12,500
Late	14,500-11,700	12,500-9,700
PPNA	11,700 – 10,500	9,700 – 8,500
PPNB	10,500- 8,700	8,500- 6,700
Early PPNB	10,500 – 10,100	8,500 – 8,100
Middle PPNB	10,100 – 9,250	8,100 – 7,250
Late PPNB	9,250 – 8,700	7,250 – 6,700
PPNC	8,700 – 8,250	6,700 – 6,250
PN	8,250- 7,300	6,250-5,300

The long period of the PPNB is the context of the first strong archaeological evidence for morphologically domesticated crops in south-west Asia (Bellwood 2005; Fuller *et. al* 2011; Asouti and Fuller 2012). In terms of animal domestication, the PPNB also provides the earliest widely accepted osteoarchaeological evidence for morphologically domesticated animals: sheep, goat, pigs and cattle (Tchernov 1998; Zohary *et al.* 1998; Harris 2002; Peters and Schmidt 2004). From the Middle PPNB onwards, integrated agro-pastoralism with domesticated crops and animals became firmly established in

south-west Asia (Harris 2002; Bellwood 2005; Bogaard 2005; Fuller *et. al* 2011; Asouti and Fuller 2012).

In terms of the chronology of the agricultural transition in Europe, farming was introduced into the south-east region about 9,000 BP, with archaeological evidence for Early Neolithic communities in Crete and mainland Greece representing the beginning of the process of European Neolithisation (Colledge and Conolly 2004; Armelagos and Harper 2005; Bellwood 2005; Rowley-Conwy 2011; Sørensen and Karg 2014). The archaeological evidence suggests that the spread of agriculture through Europe can be considered, in broad terms, as a movement along an east-west axis, spanning a period of about 2,500 years from 8,500-6,000 BP (Ammerman & Cavalli-Sforza 1984; Diamond 2002; Bellwood 2005). For the most part, the archaeology of the Neolithic transition in northern Europe is associated with a distinctive package of cultivars, domesticated animals, pottery, house architecture and burial practices. It is proposed that the introduced mixed farming package characteristic of the agricultural transition expanded through Europe and was adopted in north-western Europe about 6,000 BP (Whittle 1996; Bellwood 2005; Sørensen and Karg 2014). From around 6,000 BP, evidence of particular cereal cultivars, pottery, burial practices, as well as, domestic and monumental architecture appears in the north-west European archaeological record (Whittle 1996; Malone 2006).

2.2 Diffusion mechanisms and the agricultural transition

Until recently, the agricultural transition in south-west Asia was considered in terms of an expansion of agro-pastoralism out of its core areas in the southern Levant region of south-west Asia into Anatolia and the northern Zagros region (Henry 1986; Bellwood 2005). However, recent examination of archaeobotanical and faunal evidence suggests a multi-centric model of domestication, with parallel processes of domestication occurring throughout south-west Asia (Zeder 2008; 2009; Allaby *et al*. 2008; Asouti 2006; Fuller *et. al* 2011; Asouti and Fuller 2012). The transition to farming in Europe is associated

with two separate routes: one route originating in south-west Asia, arriving in Crete and mainland Greece circa 8900 B.P and following a Mediterranean trajectory, arriving in eastern Spain about 7400 B.P (Perlès 2001; Bellwood 2005), and a second route taking an east-west trajectory through the southern Balkans into central and northern Europe—the expansion into north-western Europe ending about 6,000 BP with arrival of the Neolithic package in Britain and Ireland (Whittle 1996; 2007; Bellwood 2005). The various competing theories explaining the spread of farming through south-west Asia and Europe can, to an extent, be framed in terms of two expansionist models: demic diffusion (colonisation), and cultural diffusion (the spread of ideas) (Colledge and Connolly 2004; Verhoeven 2004; Bellwood 2005). Substitutions for the term cultural diffusion include trait adoption-diffusion and adoptive diffusion. Occasionally, demic diffusion is described as demic expansion (Ammerman and Cavalli-Sforza 1984; Chikhi *et al.* 2002; Bentley *et al*. 2003; Gkiasta *et al.* 2003; Richards 2000; Bellwood 2005). According to the cultural diffusion model, the transition to agro-pastoral farming is described as a cultural phenomenon, centring on the movement of technology and ideas rather than people (Chikhi *et al.* 2002; Bellwood 2005). Conversely, the demic diffusion model suggests that the transmission of farming technology and associated material culture involved a demographic movement from south-west Asia to Europe. Demic diffusion is regarded as a gradual process of spatial and demographic replacement (Ammerman and Cavalli-Sforza 1984; Chikhi *et al.* 2002; Bentley *et al*. 2003; Gkiasta *et al.* 2003; Bellwood 2005; Armelagos and Harper 2005). Depending on the approach employed, the Neolithisation of Europe continues to be argued from a number of theoretical positions ranging from a regular progression of expansion and population replacement through to the adoption of agriculture by indigenous hunter-gatherers of Late Mesolithic Europe (Bentley *et al*. 2003; Gkiasta *et al.* 2003). However, Bellwood (2005) points out that there are a multitude of possible models of transitions which lie between the two extreme models of demic and cultural diffusion.

2.2.1 Genetics, diffusion and the agricultural transition

In the last 30 years genetic techniques have been employed to examine the process of Neolithisation in Europe (Soares *et al.* 2010; Hervella *et al.* 2012; Brotherton *et al.* 2013). For the most part, mtDNA (inherited along the maternal line) remains the most widely studied and best described marker in population genetics *(ibid*). Paralleling the wider archaeological debate, genetic assessments of the European agricultural transition, originally, set out to examine two models of transmission—the demic diffusion model and the cultural diffusion model (Chikhi *et al.* 2002; Bentley *et al*. 2003; Gkiasta *et al.* 2003; Richards 2000; Bellwood 2005; Soares *et al.* 2010; Hervella *et al.* 2012; Brotherton *et al.* 2013). Genetic assessments of the demic diffusion model examine if the Neolithic transition reflects a process of population expansion from the Near East into Europe; resulting in the eventual assimilation of the genetic pool of the indigenous hunter-gatherer groups by the incoming farming community, as they expanded across Europe (Ammerman and Cavalli-Sforza LL 1984: Sokal *et al.*1991*;* Barbujani *et al.* 1995; Cavalli-Sforza *et al.* 1997; Chikhi *et al.* 1998: 2002*;* Hervella *et al.* 2012). On the other hand, cultural diffusion models examine the European Neolithic transition in the context of the adoption of the agro-pastoralist system by local indigenous groups, with little or no genetic input from Near Eastern groups (Richards *et al.* 1996: Haak *et al*. 2005; Soares *et al.* 2010; Hervella *et al.* 2012). The different theories associated with archaeogenetic assessments can be described in terms of migrationalists, indigenists and (later) integrationist models (Richards 2000; Zvelebil 2000; Soares *et al.* 2010; Hervella *et al.* 2012; Skoglund *et al.* 2012).

Firstly, advocates of the migrationalist position suggest that the Neolithic transition entailed the genetic replacement of indigenous, Mesolithic European populations (Richards 2000; Zvelebil 2000). Early population genetic studies proposed that clines in genetic variation within Europe are indicative of a Neolithic expansion involving substantial replacement of indigenous hunter-gatherer populations (Cavalli-Sforza *et al.*

1994; Novembre and Ramachandran 2011; Skoglund *et al.* 2012). For example, based on classical genetic markers, Ammerman and Cavalli-Sforza (1984), proposed the wave-of-advance model, in which demic diffusion from the Near East into Europe contributed to the genetic composition of present-day European populations

Secondly, indigenism proposes that the Neolithisation of Europe involved no transfer of genes, and hence that the Neolithic transition was a product of purely cultural diffusion (Whittle 1996; Richards 2000). The inevitable result of this entirely cultural transition is two genetically distinct regions—Europe and south-west Asia (Richards 2000; Zvelebil 2000; Soares *et al.* 2010; Hervella *et al.* 2012). For example, a number of studies employing founder analysis of mtDNAs (subtracting ancestral Near Eastern source diversity from lineages in Europe) to examine patterns of mitochondrial diversity, have argued that less than 15% of European lineages were contributed from the Near Eastern Neolithic component and that high percentages of the modern European population reflect a Late Glacial/postglacial origin. This suggests small groups of Near Eastern people settling Europe and a wide-scale adoption of agricultural technology by indigenous Mesolithic populations (Richards *et al.* 2000; Zvelebil 2000; Soares *et al.* 2010).

Between these migrationalists and indigenists models there are a number of researchers that suggest a varying intensity of the genetic impact from the Neolithic farming communities in different regions of Europe (Hervella *et al.* 2012). Integrationalist models propose that the Neolithisation of Europe reflects a genetic exchange between indigenous Mesolithic European populations and incoming Neolithic populations (Richards 2000; Zvelebil 2000; Dupanloup *et al.* 2004; Soares *et al.* 2010; Hervella *et al.* 2012). The integrationalists' model originally proposed a transition involving both an initial 'leapfrog' colonisation (small groups seeking out suitable land) and a subsequent acculturation process (Richards *et al.* 1998; 2000; Zvelebil 2000; Soares *et al.* 2010; Hervella *et al.* 2012)

More recently, we are developing a far greater understanding of the genetic aspect of the European Neolithic transition as we examine and incorporate a number of genetic studies from different regions in Europe. For example, in relation to central Europe, Bramanti *et al*. (2009) examined the mtDNA sequences of 20 hunter-gatherer and 25 early farmers across the transition. They assert that the two groups are genetically distinct and that the first farmers in this region did not descend from the local hunter-gatherer population. The mtDNA samples that they analysed indicate that the first Neolithic farmers of Central Europe demonstrate a genetic affinity with present-day populations from the Near East (Anatolia and the Levant). This finding is suggestive of a connection between the initial introduction of farming in Central Europe and a substantial genetic input from Near Eastern farmers (Haak *et al.* 2005; Hervella *et al.* 2012).

In terms of a general picture of the Neolithic transition in Europe, ancient DNA studies have been utilised to examine and challenges both the demic diffusion and cultural diffusion models—providing use with a more complex picture of the process of Neolithisation. For instance, a number of researches advocate a random dispersion model for the Neolithic transition; which proposes different genetic impacts on the various European geographic regions. Modelling the diffusion of mtDNA during the transition, Hervella *et al.* (2012) suggest two routes to explain Neolithic diffusion in Europe: (1) an acculturation model based on a dispersion route through North-Central Europe and (2), a demic diffusion model applicable in the context of a southern or Mediterranean route (Sampietro *et al*. 2007; Lacan *et al.* 2011; Hervella *et al.* 2012). Based on 249 million base pairs of genomic DNA, Skoglund *et al.* (2012) suggest that early farmer groups (initially) provide us with evidence that indicates a barrier to gene flow between indigenous hunter-gather groups and the colonizing farmer groups during the initial stages of expansion and settlement. However, over time, it is proposed that gene flow between farmer and hunter-gatherer populations eventually gave rise to the present pattern of genetic variation in Europe. Fu *et al.* (2012) assert that (1) H-type mtDNAs in

the European mtDNA gene pool show evidence of a population expansion associated with the Neolithic transition in Europe and (2) U-type mtDNAs seem to represent earlier hunter gatherers that adopted farming practices and admixed with immigrant farming populations.

Following a comparative study of ancient and modern genomes, Lazaridis *et al.* (2014) assert that most present-day Europeans derive from at least three highly differentiated populations:

1. West European hunter-gatherers, who contributed ancestry to all Europeans but not to Near Easterners;
2. ancient north Eurasians related to Upper Palaeolithic Siberians, who contributed to both Europeans and Near Easterners; and
3. early European Farmers, who were mainly of Near Eastern origin but also had west European hunter-gatherer related ancestry

In doing so, they suggest that only a limited number of European populations reflect a two-way mixture and that a majority of European population represent a three-way mixture of the three populations (Lazaridis *et al.* 2014). They assert that migrants from the Near East played a significant role in the initial introduction of agriculture to Europe. However, it is proposed that the early European farmers' ancestry in Europe today ranges from, 30% in the Baltic region to circa 90% in the Mediterranean (*ibid*).

Current genetic patterns of mitochondrial DNA (mtDNA) distribution patterns indicate a complex series of events in European prehistory (Bramanti *et al.* 2009; Haak *et al.* 2010; Soares *et al.* 2010; Lacan *et al.* 2011; Gamba *et al.* 20012; Pinhasi *et al.* 2012) and provide us with evidence of population inputs from outside Central Europe (Richards *et al.* 2000; Pereira *et al.* 2005; Soares *et al.* 2010; Skoglund *et al.* 2012; Brotherton *et al.* 2013). It is suggested that as farming crossed Europe, hunter-gatherers were incorporated into the farming populations, and passed their genes on into future generations. This

process progressively diluted the genetic legacy of Near Eastern immigrants. This would account for the majority of hunter-gatherer genes in modern European populations (Rowley-Conwy 2009).

In general, the results from archaeogenetic research indicates that the Neolithic transition in Europe, to varying degrees, entailed (1) a population dispersal from the Near East to the central regions of Europe; (2) a spread of farming by indigenous acculturation—particularly in more northerly and western regions (Soares *et al.* 2010); and (3) that the Near Eastern genetic contribution decreases as the transition moved from eastern to western Europe (Dupanloup *et al.* 2004).

2.3 Previous approaches to the origins of agriculture in south-west Asia

A multitude of past and current theoretical approaches and models offer us insights into questions concerning the transition to and establishment of farming practices in south-west Asia. In general, these theories and models focus on environmental conditions, demographics, socio-economics, behavioral/cognitive changes or a combination of these factors (Flannery 1969; Moore and Hillman 1992; Rosenberg 1998; Bogucki 1999; Bar-Yosef and Belfer-Cohen 2002; Bellwood 2005). Verhoeven (2004) points out that the majority of approaches are theoretically aligned to either cultural or environmental determinism. For the purpose of this chapter, I shall synthesise previous and contemporary approaches/models to the agricultural transition under three distinct headings: (1) environmental (2) social and (3) cognitive theoretical approaches.

2.3.1 Environmental models

Environmental approaches to the agricultural transition have a long history in archaeological research, and can be traced to early work by Childe (1928, 1936) (Henry 1986; Moore and Hillman 1996; Belfer-Cohen and Bar-Yosef 2000; Grosman and Belfer-Cohen 2002; Wright and Thorpe 2003; Verhoeven 2004; Byrd 2005; Maher *et al.* 2010).

Environmental approaches represent the most widespread form of explanation for the agricultural transition. From the initial assertions made by Childe (1928), environmental explanations for the transition to agriculture in the south-west Asia have continually been espoused, generally employing evidence of climate change as a key mechanism for the origin and establishment of agriculture (*ibid*). Central to this particular approach is hypothesis testing through the reconstruction of past environmental conditions using sources such as geo-morphological data, deep-sea cores, pollen cores, plant, human and faunal remains (Zohary and Hopf 2000; Bottema 2002; Grosman and Belfer-Cohen 2002; Kohler-Rollefson and Rollefson 2002; Cappers *et al*, 2002; Leach 2003; Verhoeven 2004). Environmental approaches primarily focus on the relationship between agricultural intensification, environmental change, the availability of land and human demographic pressures (*ibid*). Environmental approaches encompass a multitude of theories/models including: the oasis model, the marginality model, the Younger Dryas models, the seasonality model, the proto-farming model, the co-evolution model and the CO_2-limitation hypothesis (Childe 1928; 1936; Binford 1968; Rindos 1984; McCorriston and Hole 1991; Hillman 1996; Sage 1995; Tudge 1998; Bar-Yosef and Belfer-Cohen 1989, 1991; 2002; Bar-Yosef 2001, 2002). For example, the seasonality model proposed by McCorriston and Hole (1991) suggests that increased summer aridity associated with increased seasonality resulted in a shortage of both resources and arable land. In light of such shortages, human population continually overexploited their immediate environments (*Ibid*). Subsequently, the combination of resource shortages and demographic pressure forced people to increase food storage and coalesce at particular environmental locations (e.g. lake shores), resulting in increased sedentism and initial cultivation of legumes and cereals, leading to the transition to agriculture (*Ibid*). The Younger Dryas stadial is cited as an important factor in both past and current environmental-focused hypotheses concerning the transition to agriculture (Binford 1968; Bar-Yosef and Belfer-Cohen 1989, 1991; 2002; Hillman 1992; Bar-Yosef 2001; 2002; Munro 2003). The Younger Dryas (ca. 12,800– 11,500 cal B.P.) refers to an intense

global cold and dry period that followed a period of climatic improvement after the Late Glacial Maximum (Hillman *et al*. 2001; Robinson *et al*. 2006; Haldersen *et al*. 2011). Essentially, Younger Dryas-based models of the agricultural transition in south-west Asia assert that this abrupt, intense climatic event represents a major initial causal factor in the agricultural transition (Bar-Yosef and Belfer-Cohen 1989, 1991; 2002; Hillman 1992; Bar-Yosef 2001; 2002; Munro 2003; Haldersen *et al.* 2011). The argument is that resource stress associated with the Younger Dryas created a situation where Epipalaeolithic groups in the southern Levant began cultivating wild cereals, which is considered as the initial step towards full-scale intensive agriculture (Binford 1968; Bar-Yosef and Belfer-Cohen 1989, 1991; 2002; Hillman 1992; Bar-Yosef 2001; 2002; Munro 2003). However, the emergences of multi-centric models of agricultural origins (Fuller *et al.* 2011) have questioned the validity of asserting a single climatic event as the prime factor in the emergence of agriculture. Proponents of multi-centric models advocate that the evidence for the gradual emergence of agriculture in a number of locations, suggests that the domestication of crops (leading to the agricultural transition) cannot be considered as the result of one particular climatic event (Fuller *et al*. 2011).

Proposing the CO_2-limitation hypothesis, Sage (1995) asserts that low levels of atmospheric CO_2 during the Pleistocene had the effect of restricting plant productivity and, ultimately, provided an environmental impediment to the development of agriculture. It is suggested that a rise in CO_2 in the postglacial period resulted in an increase in the productivity of wild plants, making a shift to agriculture possible. Cunniff *et al*. (2010) experimentally examined the CO_2-limitation hypothesis proposed by Sage (1995). To test this hypothesis they investigated the response of a number of C4 and C3 plants to varying CO_2 levels. The results showed that C3 and C4 plants demonstrated a consistently positive response in terms of productivity to increased levels of CO_2—with higher CO2 levels increased yield by 50% in C3 species and 10–15% in C4 species.

This result indicates that an increase level of atmospheric CO_2 in the post-Pleistocene period may have been a causal factor in the transition to agriculture (Cunniff *et al*. 2010). It asserted that a multiple region model of the origin of agriculture associated with an increased level of atmospheric CO_2 encompassing a number of areas of the globe is the most plausible explanation for the origin of agriculture (Sage 1995; Cunniff *et al*. 2010). For the most part, environmental models centre on some form of environmental determinism or possibilism to explain the agricultural transition. While environmental approaches offer a useful assessment of the palaeoenvironmental conditions associated with the agricultural transition, they do not offer insight into the socio-cultural dynamics of the process.

2.3.2 Social models

The central focus in social models is on human agency and interactions. For the most part, social models of the agricultural transition are critical of environmentally deterministic models of the transition (Harlan 1995; Ingold 1996; Verhoeven 2004). Instead, social models identify social aspects such as group structure, exchange and social alliance as explanatory factors (*Ibid*). Social approaches comprise a number of models used to examine the agricultural transition including: the hilly flanks model, the marginality model, the population pressure model, the social relations model, the socioeconomic competition model, the domestic society model and the path-dependent model (Braidwood 1951; 1960; Flannery 1972; Bender 1978; Hayden 1991, 1992, 1995; Shennan 2000). For instance, in the marginality model proposed by Flannery (1969; 1972; 1973) it is suggested that the agricultural transition reflects a societal response to population pressures brought about by demographic changes. He asserts that an increase in population resulted in increased sedentism and the beginning of cultivation in the marginal zones of south-west Asia. On the other hand, according to the socioeconomic competition or 'feasting' model proposed by Hayden (1991; 1992; 1995), social interaction is considered central to the development of agriculture. For example, based on

ethnographic studies, Hayden identifies competitive feasting as the key factor in the establishment of agriculture, since it created a situation of increased human intervention and management of food resources which led to agriculture.

In the context of a social relations model, Bender (1978) suggests that social relations via obligations and reciprocation produced the necessary social environment that enabled the agricultural transition. Using ethnographic studies, Bender (1978) proposes that social relations based on trade networks and marriage created a situation that enabled the emergence of a social hierarchy centred on the rise of a dominant class (Bender 1978). A particular social group would assert control over the use and distribution of resources. Eventually, according to Bender, due to the pressure of an increased alliance within social networks it became necessary to increase and control both food production and storage strategies, which led to sedentism and the full adoption of agriculture. Generally, social models of the agricultural transition focus on elements of social dynamics and social pressure. A number of social models present plausible assertions relating to the emergence and adoption of agriculture. However, it is a contention of this research that social models do not explain the socio-cultural mechanisms through which increased group cohesion essential to an increased investment and reliance on resource management associate with the agricultural transition was achieved.

2.3.3 Cognitive models

In a similar manner to the social approaches, cognitive approaches reject environmentally deterministic models which place humans as passive agents in the agricultural transition (Hodder 1990; Verhoeven 2004; Asouti 2006). A number of cognitive models place human cognition and psychology at the centre of the emergence of farming. Advocates of the cognitive approach assert that rather than solely economic or social pressure motives, the agricultural transition is connected to distinct features of human cognition manifested in ideological and/or symbolic aspects of the transition (Hodder 1990; Mithen 2004). For example, Wilson (1988) focuses on the connection between human psychology and social

interactions. He suggests that social relations are both the product of psychological/cognitive perceptions of the world and have the effect of reinforcing these particular perceptions. Wilson (1988) states that the process of sedentism, fundamentally, changed social organization and perceptions of the world at both an individual and a group level. In this regard, Wilson (1988) considers the agricultural transition primarily as a process of metaphorical *domestication* of human society rather than purely about the domestication of plants and animals. To examine this claim, Wilson contrasts anthropological data on hunter-gatherer groups and sedentary groups engaged in agriculture. He asserts that architecture (settlement organisation) is the main distinction between these groups, and points out that settlement organisation entails boundaries, structural distinctions and access restrictions. Wilson (1988) argues that in agricultural societies settlement organisation visually reinforces the social structure of the group; the settlement organisation actually influences the world view of the individual and the wider members of the group. For Wilson, settlement organisation provides the perfect platform from which to examine the extent to which the new material culture resulted in a new psycho-cultural framework for human groups—which was continually reinforced as new members of the society were born and encultured into this particularly social structure (and world view). Thus, the *domestication* of human society is the most crucial psycho-cultural element of the agricultural transition, without which the process could not have been successful.

Using a broadly cognitive-symbolic framework, Hodder (1990; 2003) considers the agricultural transition as a gradual socio-symbolic process that resulted in a fundamental change in human society. Hodder (1990) considers the parallels between agricultural domestication and socio-cultural changes associated with the agricultural transition: the control of nature via the process of domestication is considered as a metaphor for the control or domestication of society. In doing so, Hodder (1990; 2003) places human agency at the centre of the process of Neolithisation—exemplified by the transition from

the wild to the domestic spheres. In this approach, the domestic sphere (*domus*) is contrasted with the wild (*agrios*), with the *domus* typified by the house. The *domus* is placed at the centre this hypothesis as it is suggested that during the agricultural transition a number of elements of the natural world such as plants, animals, clay and death were brought under human control (or domesticated). To demonstrate the point that natural processes were being domesticated (quite literally) by being integrated into houses, Hodder (1990; 2003) uses examples such as the burial of humans under floors in houses. He stresses the link between the *domus* and the control of the larger society. In this regard, the *domus* is considered as a socio-cultural conduit for greater group investment, inter-reliance and cohesion. It is suggested that actions that centre on the *domus*, such as building houses, making clay figurines and the burial of the dead are directly associated with both the transformation of the natural into the cultural sphere and the *domestication* of society, characterized by the symbolic aspects of the period reflecting/representing the increased control of the environment directly associated with the agricultural transition (Hodder 1990; 2003). Overall, the agricultural transition is considered as a gradual process in which psychological, social and symbolic factors played a central role, leading to sedentism, greater agricultural intensification and an increase in social complexity. The model proposed by Hodder (1990; 2003) offers an important theoretical framework from which to assess the socio-psychological aspect of the agricultural transition—particularly, in relation to the recurrence of aspects of Neolithic material culture. However, Hodder (1990; 2003) does not position the theory in the context of the aspects of human cognition (i.e. cognitive mechanisms) associated with group cohesion and symbolic expression that would have been essential to the socio-symbolic changes during the agricultural transition. Thus, Hodder does not seek to explain the mechanisms of group cohesion that resulted in the shared symbolic identity that he identifies.

Taking an explicitly cognitive approach to the agricultural transition, Watkins (1990; 1992; 2002; 2004) considers the agricultural transition in terms of a cognitive (psycho-

cultural) transformation which was externalised via the emergence of new symbolism in the Neolithic of the south-west Asia. Watkins uses recorded changes in architecture and mortuary rituals in the Neolithic (in comparison to the Epipalaeolithic) to suggest that a cognitive/psycho-cultural change preceded the change in subsistence strategies that characterise the agricultural transition. He combines archaeological and cognitive anthropological data to assert that changes in symbolic expression in the Neolithic reflect (1) an advancement/modernisation of human cognitive abilities and (2) a change in our ability to express and/or transmit ideas. Watkins (2004) uses a combination of the memetic approach developed by Dawkins (1976) and the four phase human cognitive schema espoused by Donald (1991; 1993) (Fig 2.1) to support the fundamental assertion that new forms of symbolic expression evident in the Neolithic archaeological record of south-west Asian are a product of the evolution of human cognitive abilities. Watkins (2004) employs this largely cognitive methodology to propose that architecture and mortuary ritual in the early Neolithic of south-west Asia reflect a mode of external symbolic expression which enabled the emergence of new, larger and more complex forms of social organisation. Watkins (2004) concludes that the earliest agricultural communities in south-west Asia provide clear material evidence for the emergence of fully modern cognitive abilities—a point that is even contentious in relation to the Upper Palaeolithic transition circa 30,000 BP (Mellars and Stringer 1989; Mithen 1996; Mc Brearty and Brooks 2000; Abramiuk 2012). However, as Watkins approaches the agricultural transition from an overtly cognitive framework, it represents an innovative approach to particular questions concerning the relationship between human cognition and the establishment of agriculture. However, the major criticism of Watkins (2004) is the assertion that Epipalaeolithic people were cognitively different to their Neolithic counterparts.

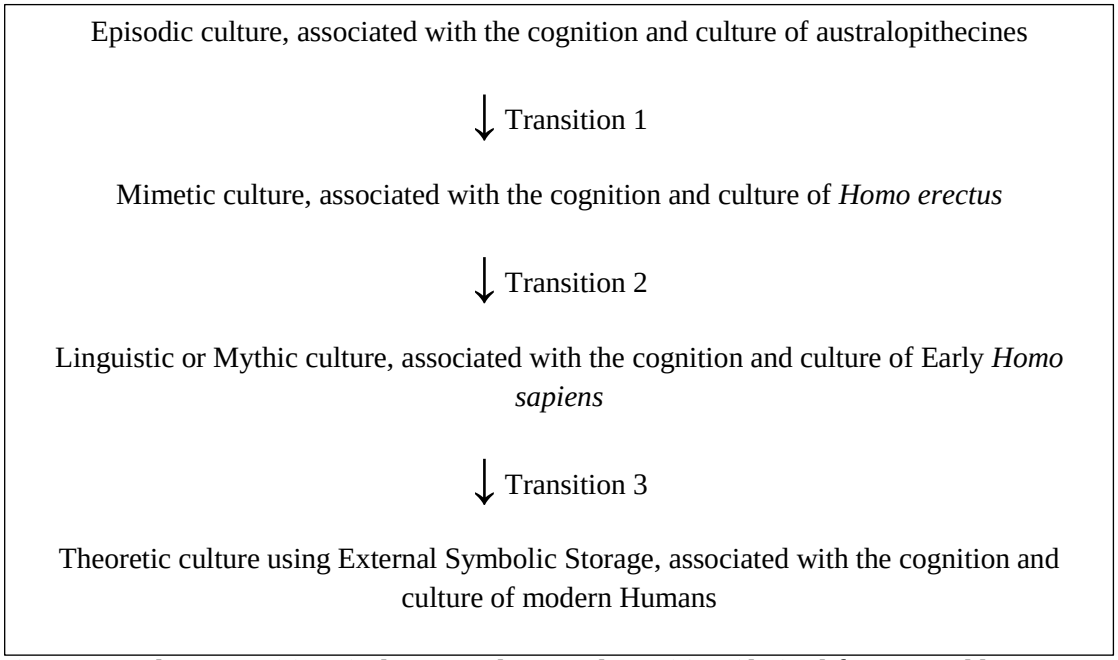


Figure: 2.1 Three transitions in human culture and cognition (derived from Donald 1991, 1993)

A key inspiration for Watkins' approach is the work of Jacques Cauvin (1994; 2000), who considered the agricultural transition as psycho-cultural revolution centered on a set of dominant symbols. Cauvin asserted that the PPNB cultures of south-west Asia reflect a new departure in human cognition expressed through the use of new symbolism. He suggests further that the recurring nature of some aspects of PPNB material culture – such as rectangular architecture, anthropomorphic figurines and animal symbols – reflect a 'macro-culture' that spreads through a large area of south-west Asia. At the basis of the macro-culture was a shared identity and world view externalized via symbols, effectively akin to a religion. Cauvin (1994; 2000) points to the importance of cattle cults among the earliest farming communities in south-west Asia and suggests that cattle were an ideal symbolic expression of internal psychological and social problems associated with the process of domestication. Similar to Hodder (1990), Cauvin (1994; 2000) makes a connection between the domestication of wild cattle and an attempt to control large-scale society. Cauvin asserts that group affiliation (i.e. a Neolithic religion) was organised around two symbols: the adult female [figure] and the bull [figure]. In terms of an

association between these dominant symbols, human cognition and the agricultural transition, he asserted that the geographic range of the archaeological evidence of PPNB material culture in southwest Asia reflects fundamental changes in human cognition, associated with a shared religious expression. For Cauvin the process of animal and plant domestication was a product of a crucial shift in human cognitive abilities that resulted in a desire to gain control over nature.

In Cauvin's view, the symbols and ideas associated with an emerging PPNB religion diffused throughout south-west Asia and, subsequently, influenced the symbolism and religious activity of Neolithic Europe. In sum, Cauvin (1994; 2000) argues that the origins of agriculture are inextricably linked to aspects of human cognition—particularly, in relation to the transmission of religion or a shared world view. In the theoretical model proposed by Cauvin, the agricultural transition is considered, fundamentally, as a cognitive development in which new conceptual structures including religious beliefs played a significant role in the development of the sedentary society that preceded the transition to food production. Cauvin (1994; 2000) has been criticized (e.g. Hodder 2001; Rollefson 2001) as his argument suffers from the implicit assumption that pre-Neolithic peoples somehow were not quite fully modern in their cognitive capabilities.

On the whole, previous cognitive assessments of the agricultural transition offer some innovative methodological approaches to the establishment of agriculture. However, there are a number of criticisms that have been directed at cognitive approaches to the agricultural transition. These criticisms range from the observation that cognitive approaches are overly theoretical to the point of disassociation from the archaeological evidence (Mithen 2004) to problems associated with the inference that Neolithic people represented the emergence of fully modern human cognition (Abramiuk 2012). For instance, a number of authors have asserted that fully modern cognition can be identified in the European Upper Palaeolithic, and possibly in the African Middle Stone Age (McBrearty and Brooks 2000; Abramiuk 2012). Moreover, it is a contention of this

research project that previous cognitive approaches to the emergence of farming have not systematically assessed the relationship between human cognition and social adjustments from hunting and gathering to agriculture.

2.3.4 Ritual, subsistence and the agricultural transition

An important debate in the archaeology of the agricultural transition focuses on the role of religion and the emergence of agriculture. Essentially, the arguments can be considered in terms of two divergent schools of thought (1) ritual activity preceded the development of agriculture (Hayden 1990; 1992; 1995; 1996 2001a; b; 2004; 2009; Cauvin 1994; 2000; Schmidt 2001; 2010 Watkins 2001; 2004; 2010; Peters *et al.* 2005; Dietrich *et al.* 2012; Nortroff *et al.* 2014) and (2) ritual activity was a product of or paralleled the agricultural transition (Kuijt 2000 a; b; 2008 Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; 2004; Zeder 2009a; b; 2011 Atran 2010; People and Marlowe 2012) (Fig 2.2). For example, Hayden (1990; 2001a; b; 2003; 2004; 2009) presents us with a competitive feasting model for the origin of agriculture. This model centres on the role of group leaders or ambitious individuals who could accumulate surplus food resources (often the more rare species) for the purpose of hosting feasts. It is suggested that the hosting of feast allowed these individuals to gain social capital by both hosting the feast and being able to command the labour force necessary to supply and host a feast At the core of this model is the assertion that the increased need of the host to exert social status via feasting resulted in an increase need for the supply of foods for feasts that led to the domestication of plants and animals, central to the agricultural transition in south-west Asia (*ibid*). Dietrich *et al.* (2012) and Nortroff *et al.* (2014) assert that sites such as Göbekli Tepe and Nevalı Çori in southeastern Anatolia provides us with evidence of a ritual sites that were used by a large network of interconnected hunter-gather groups in the Middle to Late PPNA, for ritual activities including feasting. Similarly to Hayden's competitive feasting model, it is suggested that large-scale events involving feasting at these sites resulted in an increased need to secure a food surplus; which led to domestication.

On the other hand, Zeder (2011) asserts that the archaeological evidence does not support many of the models that suggest that agriculture was preceded by a ritual or symbolic change(s). In relation to the competitive feasting model advocated by Hayden Dietrich and Nortroff, it is asserted that current archaeological evidence of the earliest Near Eastern domesticated cereals and pulses cannot be categorised as limited-access, labour-intensive rare foods. For instance, it is asserted that the archaeological evidence demonstrates that groups were, already, engaging in plant cultivation and limited animal husbandry in the mid to late PPNA; when Göbekli Tepe and Nevalı Çori were being constructed (Zeder 2011). It is suggested that many of the "ritual first" models cannot account for the archaeological evidence of multiple communities across south-west Asia engaged in regional variations of cultivation (which gradually result in intensive agriculture). In this sense, it is pointed out that there is no archaeological evidence of a "threshold moments" (Zeder 2011, 47) in the plant and animal record of south-west Asia. In general, it is asserted that the archaeological, archaeobotanical, and genetic evidence do not support the ritual first models. Instead the archaeological evidence present us with a picture of a gradual shift from broad based foraging, to economies based on a mix of foraging and garden-type cultivation of early domesticated cereals and pulses, to agricultural economies relying on fully domesticated plant and animals (Zeder 2011). It is proposed that we must consider the agricultural transition as a gradual process associated with a number of contemporary and interrelated subsistence and socio-cultural changes.

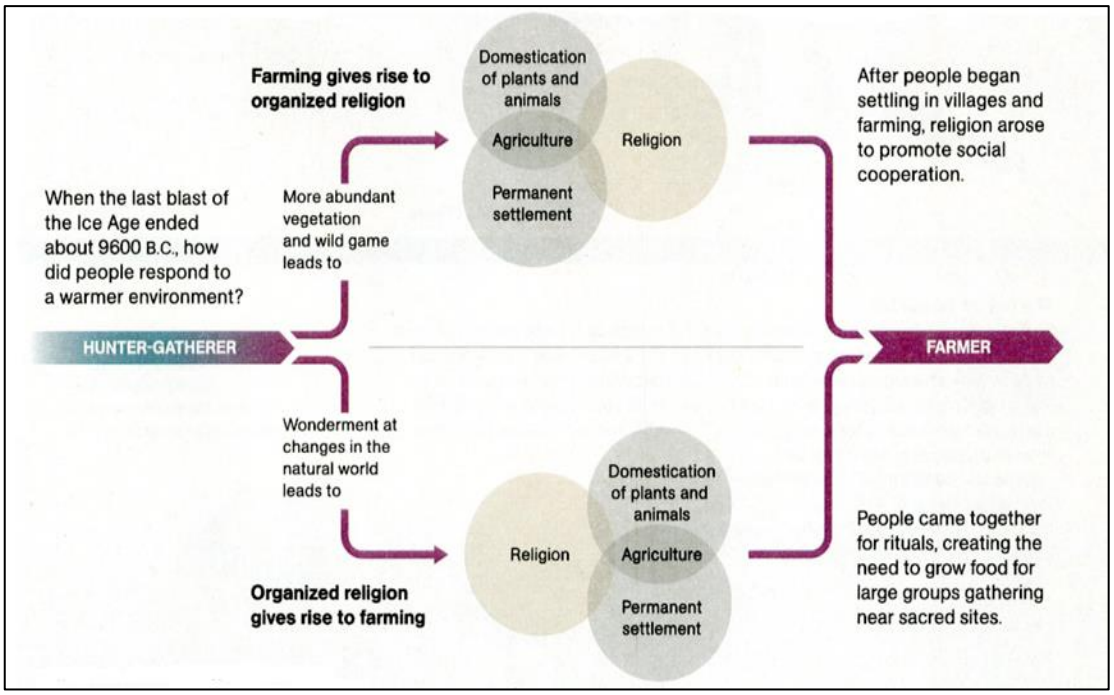


Figure: 2.2 outlining the ritual or farming first debate (Mann 2011, 41)

2.4 Theoretical approach in this DPhil project

This research utilises insights recently developed in the cognitive anthropology of ritual activity to address directly the problem of how hunter-gatherer communities adjusted socially to farming. It uses the theory of Modes of Religiosity as proposed by Whitehouse (2000; 2002; 2004) as a basis for generating new hypotheses concerning the cognitive dimension of the agricultural transition. The theory of Modes of Religiosity is based on cross-cultural observations of ritual behaviour, and its role in the transmission of religious ideas/beliefs. Whitehouse proposes that the frequency and level of dysphoric arousal of religious ritual performance is inherently connected with the transmission of religious ideas. In essence, the theory of Modes of Religiosity proposes two courses for the transmission of religious ideas via ritual activity: the doctrinal mode and the imagistic mode. The imagistic mode describes religious transmission in relation to low frequency, high arousal religious experiences (rituals). This mode is connected with rituals that evoke strong emotions which subsequently persist in the episodic memory and have an enduring impact on the religious imagination. Examples of imagistic mode rituals include

group initiation ceremonies, rites of passage and state funerals. Conversely, the doctrinal mode of religiosity is considered to rely on high frequency, low arousal rituals, allowing large bodies of religious teachings to be stored in semantic memory, reproduced reliably and spread efficiently (Whitehouse 1996; 2000; 2002; 2004). The doctrinal mode allows, via the transmission of complex ideas, generic identity markers to be ascribed to large-scale cohesive communities. Examples of these types of rituals include liturgical ceremonies, propitiatory rites and blessings. The doctrinal mode is also thought to encourage the emergence of centralized ecclesiastic hierarchies, exerting influence over the content and organization of authoritative religious knowledge.

Whitehouse asserts that the imagistic mode of religiosity reflects an earlier (or earliest) mode of religiosity. The first religions to have appeared in human prehistory are considered to have been imagistic in nature, dating back to at least the Upper Palaeolithic. It is asserted that the emergence of the doctrinal mode is directly connected with the establishment of early state formations; the emergence of the first civilisations marked the appearance of large-scale routinized religions, monitored by a centralised political and religious organisation, associated with the doctrinal mode. At the core of the Modes theory is the relationship between ritual activity and a set of cognitive hypotheses deriving from the ways in which ritual frequency and arousal are processed in the human mind (Whitehouse 2004). It is suggested that no particular ritual can be described as imagistic or doctrinal; rather, it is the *collective* aspects of ritual practice in a group that are indicative of the mode of religiosity. Whitehouse describes the subsequent psychological effects directly associated with ritual activity as the *psychological features* of a particular mode (Table 2.2). It is asserted that central to the Modes theory is the relationship between the *psychological features* (ritual frequency and level of arousal and a set of cognitive mechanisms related to the processing of ritual activity in the human mind) and a collection of *sociopolitical features* (Table 2.2). For the set of psychological features, it is proposed that "there is no independent variable driving the rest, only a set of

conditions that some patterns of human activity manage to satisfy" (Whitehouse 2004, 75). Concerning the relationship between the *psychological features* and the *sociopolitical features* (Table 2.2), it is asserted that the *sociopolitical features* often cluster around one or the other of the two groups of psychological conditions. It is asserted that "the activation of these psychological conditions provides the underlying cause of the distributed (population-level) effects depicted as the sociopolitical features of religion" (Whitehouse 2004, 75). Thus, there is a causal relationship between psychological conditions (effects of ritual activity) and the population-level, sociopolitical features.

Table 2:2 Contrasting modes of religiosity (derived from Whitehouse 2004, 74)

Variable	**Doctrinal**	**Imagistic**
Psychological Features		
1. Transmissive Frequency	High	Low
2. Level of Arousal	Low	High
3. Principal Memory System	Semantic Schemas and Implicit Scripts	Episodic Memory
4. Ritual Meaning	Learned/Acquired	Internally Generated
5. Techniques of Revelation	Rhetoric, Logical Integration and Narrative	Iconicity, Multivocal and Multivalence
Sociopolitical Features		
6. Social Cohesion	Diffuse	Intense
7. Leadership	Dynamic	Passive/Absent
8. Inclusively/Exclusivity	Inclusive	Exclusive
9. Spread	Rapid, Efficient	Slow
10. Scale	Large-scale	Inefficient
11. Degree of Uniformity	High	Low
12. Structure	Centralised	Non-centralised

Whitehouse (2004) and Atkinson and Whitehouse (2011) statistically identify a connection between ritual activity (via frequency and arousal) and a number of society-level variables. It is asserted that the two modes constitute *attractor positions* around which other socio-cultural variables cluster. Whitehouse (2004) and Atkinson and Whitehouse (2011) state clearly that ritual and society-level variables co-vary. Thus, it is

proposed that, within the framework of the Modes theory, aspects of ritual activity, subsistence practices and social complexity should cluster predictably with respect to each mode of religiosity. Of particular relevance to this research project, is the suggestion that doctrinal mode rituals are central aspects of group cohesion for groups engaged in intensive agriculture, and it is suggested that doctrinal mode rituals may have been tied to the advent of agriculture and subsequent emergence of the first large-scale civilizations (Whitehouse 2004; Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011). In comparison to hunter-gatherer groups, it is proposed that agricultural activity is responsible for a general increase in the frequency of communal rituals and indirectly presents opportunities for other features of the doctrinal mode to appear, including the establishment of uniform and prescribed regional traditions. Atkinson and Whitehouse (2011) examined the relationship between agricultural intensity and the doctrinal mode. Their study was predicated on the assertions by Whitehouse (2004) that (1) highly arousing rituals should be less prevalent in societies that rely more on agriculture; and (2) dysphorically arousing rituals should be more prevalent in cultures that rely more on hunting and foraging and less on agriculture. Using hierarchical regression analysis, they demonstrated that agricultural intensity is a significant cross-cultural predictor of dysphoric arousal i.e. mode of religiosity. Furthermore, it is suggested that ritual activity (the frequency and dysphoric level of) is directly related to group size and human cognitive architecture. Whitehouse (2004) asserts that ritual dynamics are linked to group size and structure. The doctrinal mode of religious transmission is associated with larger, more hierarchically organised human groups (Whitehouse 2004; Atkinson and Whitehouse 2011). This claim aligns with other studies suggesting that group size limits are directly connected to information processing and associated cognitive mechanisms (Flannery 1972; Forge 1972; Wright and Johnson 1975; Wright 1977; Johnson 1982; Kosse 1989; Dunbar 1992; 1993; Hernando *et al.* 2009; Wellman 2012). Moreover, it has been proposed that levels of social complexity are directly linked to the information

processing abilities and advantages of the cognitive architecture associated with long-term versus episodic memory (*ibid*).

2.4.1 Previous examinations of the Modes of Religiosity theory in ethnography

Recently, the Modes of Religiosity theory has received attention from historians, anthropologists and cognitive scientists (McCauley and Lawson 2002; McCauley and Whitehouse 2005; Xygalatas 2007; Naumescu 2008; Atkinson and Whitehouse 2011). For example, Malley (2004) uses the framework of the Modes of Religiosity theory to examine Evangelical Christianity in the United States. His ethnographic work (from 1998 to 2001) focused on interviews and regular attendance at Creekside Baptist Church in Michigan—with a congregation of 300 - 400 people attending Sunday service. Malley (2004) informs us that their beliefs centre on (1) the authority of the protestant bible and (2) and the idea of salvation through belief in the resurrection of Jesus Christ. Malley asserts that the Creekside Baptist religious system can be considered in terms of a doctrinal mode as it relies on regular attendance of church services where rituals are performed and major beliefs and themes (such as forgiveness) are repeated on a weekly basis. Particularly, Malley (2004) considers Evangelical Christianity practiced in the Creekside Baptist Church as doctrinal as (1) the frequency of transmission is high; (2) the arousal level is, generally, low; (3) there exists a high level of cohesion between members of the congregation; and (4) the transmission of the central beliefs and rituals is diffuse with a high level of uniformity.

In the context of the Creekside Baptists church community, Malley outlines how more frequent but lower-attendance (i.e. the local congregation) rituals provide the necessary occasions for stable information transmission throughout a localized community network. The effect of such rituals is that beliefs and practices are learned and replicated with a high degree of information integrity. In a wider context, it is asserted that the frequent reputation of the liturgy of the Bible and a number of fundamental beliefs by the entire (regional/national) network of the Baptist church movement results in an extended

network composed of the larger congregation who all believe that they belong to a single religious community that (1) share the same set of beliefs; (2) follow the same set of religious/ritual codes; and (3) engage in the same religious/ritual practices. Thus, although the members of the Creekside Baptists church perform rituals in a small(er) group situation, the high frequency of rituals (1) binds the group members to each other; (2) consolidates the Baptist church doctrine; and (3) creates a situation where the members of the Creekside Baptists church identify with the larger "Baptist community". The identification with the larger Baptist community is further reinforced through:

a. Retreat effect: infrequent but emotionally arousing situations in a doctrinal system which serve to codify relational ties and facilitate reflection on conceptual tie. This is achieved by the attending large religious retreats.
b. Intichiuma effect (Durkheim 1912): semantic rehearsal through euphoric arousal at larger annual gatherings.

The result is the creation of social identification among a number of geographically spread-out Baptist congregations. The interesting aspect of this study is that we are seeing levels of cohesion via ritual practices that are reliant on (1) regular/frequent meetings to ensure the transmission and replication of beliefs and (2) less frequent retreats and meetings to generate a sense of a larger group identity.

Moving on, Atkinson and Whitehouse (2011) examine data on frequency, arousal level and social structure for 645 religious rituals from 74 cultures from around the world using the electronic Human Relations Area Files (eHRAF). They use multilevel/hierarchical modelling to examine whether or not certain ritual features cluster together along frequency and arousal dimensions, as predicted by the Modes of Religiosity theory. The analysis of the data resulted in distinct associations with different levels of ritual frequency and arousal (Fig 2.3). Their results enable them to assert that globally there is a correlation between ritual frequency and arousal level consistent with the Modes of Religiosity theory—with the "ratings of emotional arousal experienced by ritual

participants are inversely correlated with ritual frequency, such that less frequent rituals tend to elicit higher emotional arousal ratings" (Atkinson and Whitehouse 2011, 56). Of special relevance to this DPhil project, Atkinson and Whitehouse (2011) assert that the global ethnographic record suggests a correlation between the level of agricultural intensity and the doctrinal mode of religiosity, as summarised above. The ethnographic research by Atkinson and Whitehouse (2011) suggests that the agricultural transition was associated with a parallel change in religious practices and social organisation. Furthermore, it is suggested that, in ritual terms, the emergence of agriculture as the primary subsistence method may reflect a transition from an imagistic to a more doctrinal mode of religiosity.

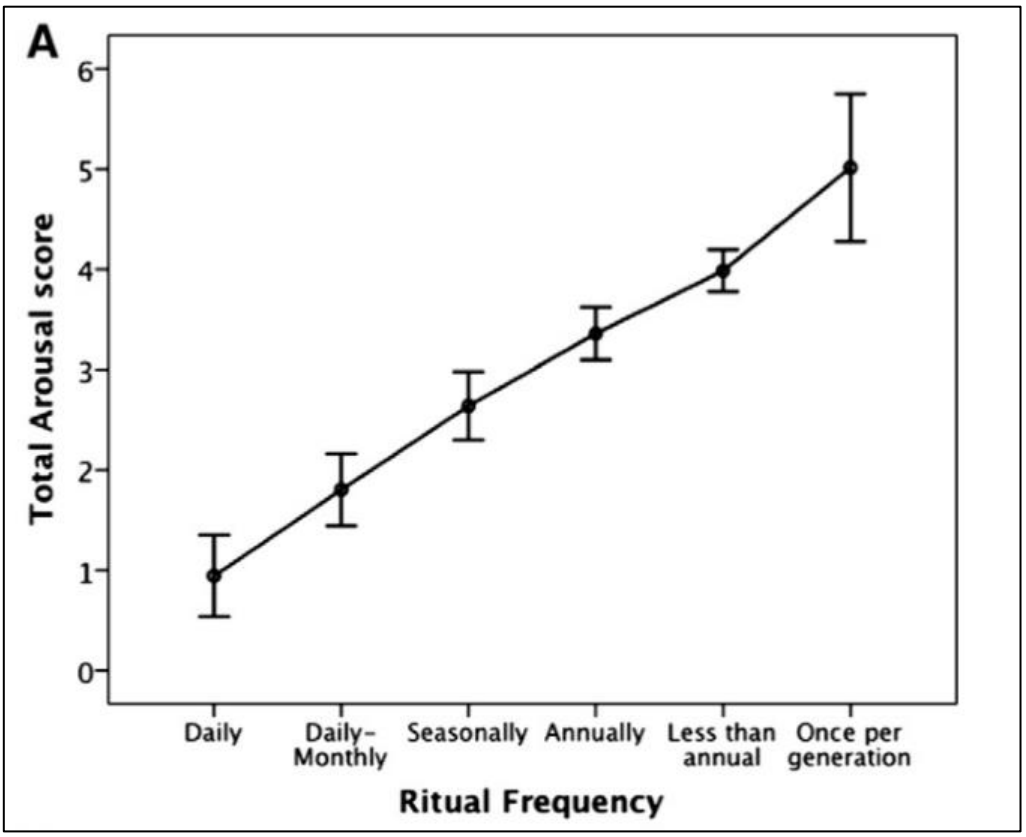


Figure 2:3 Ritual frequency and arousal scores from Atkinson and Whitehouse (2011): graph demonstrates that ritual frequency is negatively correlated with overall ratings of arousal, with error bars representing 95% confidence intervals for mean arousal.

2.4.2 Previous examinations of the Modes of Religiosity theory in archaeology

The Modes of Religiosity theory has been subject to recent evaluation in relation to its application to archaeological questions. However, it has not been comprehensively applied to the agricultural transition in south-west Asia and has not been applied in any fashion to transitional sequences in Europe. In general, only tentative archaeological assessments using the Modes of Religiosity theory have been made due to a central difficulty: that ritual frequency and, even more so, arousal level are difficult to determine from archaeological evidence. For example, Mithen (2004) states that descriptions of the types of initiation rites connected with the imagistic mode, such as extended isolation and bodily scarification, would "leave either no archaeological trace or residues that are more likely to be interpreted in functional rather than religious terms, such as living structures and utilitarian artefacts" (Mithen 2004, 20). In reference to the validity of the Modes theory of Religiosity to archaeological enquiries, he states that the cognitive framework of the Modes theory provides a valuable basis on which to examine the archaeological evidence of the connection between economic, political and social organisation in the archaeological record. It is asserted that the Modes theory presents us with an insight into the development of religiosity in human society (*Ibid*). He suggests that the Modes theory has the potential to 'enrich our interpretations of specific aspects of the archaeological record, making some interpretations more plausible than others, and help us identify previously unrecognised causal links between religious practices and political structure' (Mithen 2004, 18). Using the Modes theory as a theoretical framework, Mithen (2004) examines the association between social cohesion and ritual structure at the site of Göbekli Tepe in south-eastern Turkey. Göbekli Tepe is an artificially constructed mounded site with the earliest levels dated to the approximately the time of the agricultural transition (11,000 BP). This site presents evidence of a number of construction phases of subterranean stone structures and enclosures associated with a number of large radially set T-shaped stone monoliths and central T-shaped monoliths measuring up to 5.5m in height. The T-shaped monoliths include animal images carved in

raised relief such as wild bulls, boars, foxes, cranes, snakes, spiders and scorpions (Mithen 2004; Perters and Schmidt 2004; Schmidt 2006; Watkins 2010; Dietrich *et al.* 2012). The scale of this site suggests that its construction and use were connected with a coalescence of a number of PPNA hunter-gatherer groups (some of whom may have begun to practice cultivation, as evidenced elsewhere in the wider region) from the surrounding region (estimated 200 km) (Mithen 2004; Dietrich *et al.* 2012; Zeder 2011). Mithen (2004) proposes that both the construction and probable ritual use of the site are suggestive of a centralised ritual organisation. It is asserted that the apparent level of centralised ritual, religious coordination at this site presents evidence of either the diverse nature of the imagistic mode of religiosity or the emergence of the doctrinal mode of religiosity at this early stage of the agricultural transition. Similarly, Mithen (2004) comments on material culture relating to a possible doctrinal mode of religiosity in the PPNB sequence at Ain Ghazal, an extensive settlement site in Jordan. For instance, it is suggested that the use of evocative animal symbols and mortuary practices such as skull plastering are compatible with the imagistic mode of religiosity. However, Mithen (2004) asserts that the extent of the site (circa 30 acres with an estimate population of 3,000) would suggest that some form of centralised organisation was essential to sustain cohesion at such a large scale. It is suggested that Ain Ghazal may reflect a type of societal centralisation associated with the doctrinal mode of religiosity (Mithen 2004).

In relation to ritual organisational evidence, Mithen (2004) proposes that distinctive large rectangular buildings and plastered statues can be considered as evidence of a more doctrinal religious structure. It is important to note that the application of the Modes of Religiosity theory by Mithen (2004) predates the identification of a relationship between ritual practice and agricultural intensity as espoused by Atkinson and Whitehouse (2011). Mithen (2004) had no explicit relationship between the Modes theory and the agricultural transition to use as a methodological framework. Both Whitehouse and Hodder (2010) and Mithen (2004) also consider the possibility of a connection between the Modes of

Religiosity and socio-religious dynamics at the Neolithic site of Çatalhöyük in the Konya plain of central Anatolia. It is proposed that archaeological evidence of the regular re-plastering of house walls and house installations, as well as, recorded architectural and artistic conformity are suggestive of a more routinised, ordered ritual and societal structure adhering to the doctrinal mode of religiosity (Mithen 2004; Whitehouse and Hodder 2010). Whitehouse and Hodder (2010) suggest that evidence for the emergence of the doctrinal mode of religiosity may be present towards the end of the Neolithic occupation period at this site. From the ethnographic work by Atkinson and Whitehouse (2011) and the archaeological investigations of settlement sites such as Çatalhöyük and Ain Ghazal (Mithen 2004; Whitehouse and Hodder 2010), it is apparent that a number of researchers have asserted that the agricultural transition is associated with a parallel change in religious practices and social organisation. It has tentatively been suggested that the emergence of agriculture as the primary subsistence strategy may be connected with a transition from an imagistic to a more doctrinal mode of religiosity. However, this assertion has not been comprehensively explored. It is in this context that the present research aims to explore the association (if any) between the agricultural transition and the emergence of the doctrinal mode of religiosity.

2.4.3 The Modes of Religiosity theory in the context of this DPhil research

The central contention of this DPhil research is that, despite some promising starts, the full explanatory force of the Modes of Religiosity theory has yet to be exploited in the analysis of the archaeological record for the agricultural transition. This research project employs the Modes of Religiosity theory to frame a hypothesis as to *how* communities adjusted socially to farming. This research uses the Modes of Religiosity theory to generate related hypotheses concerning the relationship between ritual activity, subsistence strategy and social cohesion in the context of the agricultural transition. It is suggested that current theories do not fully examine to what extent ritual practices and belief structures played a fundamental role in the adoption and continuation of farming

practices. For instance, Bogaard and Jones (2007) note that there is a tendency to treat 'ritual' and 'subsistence' aspects of the agricultural transition as almost mutually exclusive perspectives. A challenge that remains in both south-west Asian and Europe archaeology is to construct balanced accounts of the nature of the agricultural transition that bring together both ritual and non-ritual material culture. It is in this context that this research seeks to integrate cognitive anthropological and archaeological methodologies to address central issues concerning the nature of the agricultural transition. Central to this project is the assertion that new conceptual structures established through ritual activity played a significant role in the development of a new agricultural society. It is proposed that the extent of this religious change can be examined via the evidence of ritual activity in the archaeological record. This research examines further the extent to which patterns in ritual activity associated with the agricultural transition in south-west Asia are replicated in the north-west European Neolithic transition. The use of the archaeological material from both of these regions is important as the south-west Asian material reflects a gradual process of agricultural transition whereas the north-west European archaeological record reflects a comparatively abrupt adoption of faming. In relation to the association between social cohesion and ritual activity, the archaeological data from both regions are utilised to examine social cohesion through the transmission of religious ideas via ritual activities in the context of two distinct types of agricultural transitions—indigenous/gradual versus introduced/rapid (Whittle 1996; Bellwood 2005; Fuller *et. al* 2011; Asouti and Fuller 2012; Warren 2013). The use of the two regional sets of archaeological data allows for a comparative examination of the association between group cohesion via the transmission of religious ideas and the transition to agriculture.

2.5 Ritual activity and the agricultural transition

Two aspects of religious practice are central to the modes of religiosity theory: ritual frequency and dysphoric arousal. However, ritual frequency and dysphoric arousal are difficult to observe in the context of prehistoric archaeology. This section outlines the

problem associated with identifying and recording ritual activity from the archaeological record. In doing so, it gives examples of the various approaches and definitions of ritual often used in the archaeological literature.

2.5.1 Archaeological approaches to ritual

The study of ritual and religion is a widely debated aspect of archaeology in general and prehistoric archaeology in particular (e.g. Leroi-Gourhan 1964; Cauvin 1972; 2000; Renfrew 1985; 2007; Garwood *et al.* 1991; Derks 1998; Carmichael *et al.* 1994; Hill 1996; Gibson and Simpson 1998; Rice 1998; Cunningham 1999; Gosden 1999; Verhoeven 2000; 2002a; b; Morris 2006; 2007; Kyriakidis 2007; Marcus 2007). One of the few points of agreement is that ritual was an important feature in prehistory and it is a necessary area of enquiry. Particularly in prehistoric archaeology, material culture relating to ritual (e.g. burials) forms a major component of the archaeological record (Verhoeven 2002b; Renfrew 2007). A number of aspects of the study of ritual in archaeology make it problematic. Debates concerning the archaeology of ritual can generally fall under three headings: (1) defining ritual; (2) the multitude of approaches to the archaeology of ritual; and (3) identifying ritual in the archaeological record (Renfrew 1985; 2007; Bloch 1989; Verhoeven 2002b; Kyriakidis 2007; Marcus 2007).

One of the fundamental problems in the archaeology of ritual is defining ritual. For example, in the context of the functionalist approach, ritual is defined as a sub-system of society that provides a regulatory framework for that society (Malinowski 1944; Radcliffe-Brown 1956; Verhoeven 2002b). Radcliffe-Brown offers a functionalist definition of ritual, stating that "ritual acts differ from technical acts in having in all instances some expressive or symbolic element in them" Radcliffe-Brown (1956, 143). Turner (1982) presents us with a symbolic definition of ritual as "prescribed behaviour for occasions not give over to technical routine, having reference to beliefs in mystical (or non-empirical) beings or power" Turner (1982, 79).

There are a multitude of theoretical frameworks and approaches related to the study of ritual in archaeology. These include: intellectualism, phenomenology, emotionalism, functionalism, symbolism, Marxist/neo-Marxist and cognitivism (Evans-Pritchard 1937; Lévi-Strauss 1966; Horton 1973; Godelier 1977; Morris 1987; Bloch 1989; Lawson and McCauley 1990; Humphrey and Laidlaw 1994; Durkheim 1995; Bell 1997; Rappaport 1999; Tarlow 1999; Boyer 2001; Verhoeven 2002b; Marcus and Flannery 2004; Whitehouse 2004; Kyriakidis 2007; Lewis-Williams 2008; Whitehouse and Hodder 2010). Each theoretical approach presents a different model of the role and function of ritual in past groups. For example, symbolic approaches are concerned with the meaning of ritual symbols; in this approach ritual activities are regarded as special activities that utilise sets of symbols to transmit specific meanings (Morris 1987). Symbols can include physical artefacts, as well as signals, metaphors and gestures (Morris 1987; Verhoeven 2002b; 2010). On the other hand, Marxist/neo-Marxist theory considers social organisation in terms of a superstructure and infrastructure (Friedman and Rowlands 1978; Gilman 1981; Kirk 1993). In this theoretical dictum, the superstructure is regarded as the ideology or system of belief of the society and the infrastructure refers to the economic base of a society (Friedman and Rowlands 1978; Gilman 1981; Parker Pearson 1984; Kirk 1993). In the context of a Marxist interpretation, ritual is considered as false set of beliefs that are used to legitimate social inequality. Considering the plurality of approaches and definition it is difficult to find some commonalities. Kyriakidis (2007) states that the lack of a consensus on the definitions of ritual leaves researchers without a fixed point of reference when trying to discuss or examine archaeological material culture. However, Verhoeven (2002b; 2010) suggests that, to an extent, most definitions consider ritual as a multidimensional phenomenon which is often considered as irrational and non-functional.

2.5.2 Identifying ritual the archaeological record

Despite the various definitions of ritual, a number of authors have offered methods to identify ritual in the ethnographic and archaeological records. For example, Bell (1997) presents us with six elementary characteristics of ritual: (1) formalism, (2) traditionalism, (3) disciplined invariance, (4) rule-governance, (5) sacral symbolism, and (6) performance. In relation to archaeological material culture, it is asserted that, due to the repetitive nature of ritual, we have a greater chance of identifying it in the archaeological record than other types of behaviour or actions (Kyriakidis 2007; Marcus 2007). Marcus (2007) suggests that archaeologists should (1) identify the places where rituals were most likely to take place; (2) consider why those places were perceived as appropriate for rituals; and (3) consider the material culture that may have been preserved in the archaeological record. Whitehouse (1996) defined six sub-types of ritual assemblages: sacra, votaries, offerings, objects used in rites, grave goods and amulets that can be identified in the archaeological. In context of late Neolithic ritual settings and structures in the Mediterranean, Renfrew and Bahn (1991) and Renfrew (1994) offer one of the clearest methods to identify ritual in the archaeological record (Table 2.3). Although there is no general consensus in the archaeological community regarding defining, identifying and theoretically framing ritual activity, Renfrew and Bahn 1991, Renfrew (1994), Whitehouse (1996) and Marcus (2007) provide a relatively coherent framework to identify ritual activity in prehistoric contexts—which is applied in this thesis to identify and record ritual material culture in the datasets.

Table 2:3 Archaeological indicators of ritual (derived from Renfrew and Bahn 1991; 359-360; Renfrew 1994, 51-52)

Attention focusing devices	Natural settings with exceptional associations; special or sacred architecture; connection with symbols (symbolic meaning)
Boundary zones	Division between public display and exclusivity
Deities	Represented in imagery, symbols, and iconography; ritual stages and practices including rites of passage, sacrifices and offerings; construction of the temples and monuments
Participation and offering prayer	Prayers, offerings and sacrifices. The construction of communal ritual buildings such as construction and monuments temples

In terms of a specific definition of ritual, this research uses the definition of ritual directly associated with Modes of Religiosity theory. Whitehouse (2004) defines rituals as actions that do not display inherent meanings in relation to both their intention and their outcome, and lack an explicit technical motivation or relevance. In this regard, we can suggest that rituals contain aspects that extend beyond decidedly practical goals (*Ibid*). There are two cultural means that facilitate the transmission of religious ideas: (1) ritual activity, which serves as a formal manner to transmit religious concepts and (2) material culture, which reinforces religious ideas in a more informal setting (Mithen 1997).

2.5.3 Ritual activity across the agricultural transition

A number of researchers have examined the group solidarity aspect of ritual practice in the agricultural transition in south-west Asia. The majority of interpretations emphasise the social function of ritual activity in creating and maintaining community cohesion (Garfinkel 1994; Kuijt 1996; 2000 a; b; 2008; Rollefson 1998; Verhoeven 2002a; b; Goring-Morris 2005). For instance, it is suggested that the prominent place of mortuary ritual practices in certain Neolithic communities provides evidence of how individual and collective identities and memories were developed during the agricultural transition (Kuijt 2008). It is pointed out that MPPNB mortuary rituals may provide evidence of

standardisation in relation to both bodily processing and mortuary material culture (Bar-Yosef and Belfer-Cohen 1989; Bienert 1991; Rollefson *et al.* 1992; Kuijt 1996; 2000 a; b; Rollefson 1997). It is suggested that mortuary rituals served an important integrative function within many communities. Furthermore, mortuary ritual served to maintain or increase solidarity by reinforcing associations between individuals, family groups and the wider community (Flanagan and Rayner 1988; Flanagan 1989; Feinman 1995; Plog 1995; Kuijt 2002). Kuijt (2008) suggests that the social construction of identity and memory expressed through mortuary ritual promoted a shared identity within early agriculturalist communities. Kuijt (2000a; b; c; 2002) states that, in the archaeology of the MPPNB, we can observe how members of large settlements standardised a multitude of mortuary ritual practices including: bodily processing, skull caching, skull painting/plastering and the caching of cultic objects.

Apart from mortuary ritual elements, it is suggested that the MPPNB provides evidence of architectural and symbolic standardisation throughout the southern Levant region of south-west Asia directly associated with the agricultural transition (Bar-Yosef and Belfer-Cohen 1989; Harris 2002; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; c; Asouti 2006). The PPNB of the southern Levant represents the first "archaeologically documented occurrence of a pan-regional culture involving such developments as the emergence of a new religion, centred on the reoccurring symbols" (Asouti 2006, 88). Kuijt (2008) asserts that the evidence of broad similarities in regional "religious" practices in relation to the Levant and south-east Anatolian Neolithic support the argument that they were part of a shared system of beliefs, collective memory, and identity/community membership. Considering the standardised nature of cultic and ritual practices within and among communities, Kuijt and Goring-Morris (2006) suggest that social cohesion and collective identity were important aspects of the agricultural transition. Kuijt (2002) asserts that the standardised nature of rituals that emerged in the MPPNB is suggestive of a more centralised, leader orientated ritual framework. In this

regard, the MPPNB is considered as a period which may have given rise to ritual leaders in the context of highly standardised ritual practices that were replicated over a large geographical region (Kuijt 2002).

In relation to European ritual material culture, a number of authors have commented on the possible commonalities that exist in the archaeology of different regions. For instance, enclosures and long barrows in Britain and Ireland are frequently used to demonstrate links to the Neolithic *Linearbandkeramik* traditions of central Europe (Hodder 1990; Bradley 2003; Cooney 2007). For north-western Europe, it is suggested that Neolithic portal tombs can be seen in the context of a Neolithic Atlantic European long cairn tradition (Cooney 2007). In the north-west European Neolithic archaeological record, megalithic tombs serve as one of the most prominent remains of ritual activity (Herity 1974; Tilley 1984; 1996; Larsson 1986; Harbison 1988; Skaarup 1990; Anderson 1992; Whittle 1996; Cooney 2000). From these examples, it is clear that previous research has noted a level of ritual connectedness and/or standardisation associated with the agricultural transition in south-west Asia and north-western Europe. Although none of the above mentioned expositions can be categorised as explicitly working within the context of the theory of Modes of Religiosity, they provide valuable preliminary insights into the type of (ritual) archaeological evidence that is relevant to an examination of the association between the agricultural transition and the emergence of the doctrinal mode of religiosity.

2.6 Social complexity and the agricultural transition

As outlined in Chapter 1, section 1.3.3, the agricultural transition has been connected with an increase in social complexity (Wason and Baldia 2000; Özdoğan and Basgelen 1999; Johnson and Earle 2000; Kuijt and Goring-Morris 2002; Hauptmann and Özdoğan 2007; Verhoeven 2010; Whitehouse *et al.* 2013). The agricultural transition, at its most fundamental level, can be characterised by a change in subsistence strategy centring on increased sedentism and the domestication of plants and animals (Armelagos and Harper

2005; Bellwood 2005; Dulukhanov *et al.* 2005; Bar-Yosef 2004). Directly related to the engagement in agriculture as a long-term subsistence strategy is an associated increase in population sizes (Boone 1992; Kuijt and Goring-Morris 2002; Verhoeven 2002 a; Peoples and Marlowe 2012). The general model of social complexity suggests that the transition to agriculture presented Neolithic communities with a number of new challenges relating to an increased reliance on a long-term food production strategy (with district periods of planting and harvesting), the need construct houses, food storage facilities, defensive parameters and an increased community-based reliance on communal labour for construction and agriculture. It has been proposed that the archaeological material culture associated with the agricultural transition from both southwest Asia and north-western Europe present us with evidence of organised/coordinated ritual and civic activity (Byrd, 1994; Kafafi and Rollefson, 1995; Schmidt, 1995; Tilley 1996; Whittle 1996; Cooney 2000; Kuijt and Goring-Morris 2002).

An additional aspect of the agricultural transition is an increase in craft or task specialisation. For example, Quintero and Wilke (1995) present evidence of stone tool workshops associated with the production of highly standardised tools form the Middle PPNB site-phase at Ain Ghazal, north-western Jordan. It is suggest that the need (1) to organise crucial communal labour aspects of Neolithic communities; (2) to ensure high levels of cooperation; and (3) to reduce group defection, a highly stratified social systems with definite leadership, developed during the transition (Boone 1992). The general models of social complexity in the Neolithic could be considered in terms of three interrelated hierarchal aspects of Neolithic communities: (1) organisation for the safeguarding food supply via agriculture; (2) organisation for communal projects (including craft specialization); and (3) organisation for ritual purposes. While this appears to be an appropriate method to examine the level of social complexity and organisation of the earliest Neolithic communities, many archaeologists assert that there is little material culture evidence of organized social hierarchies (exemplified by the

existence of hereditary elites who control resources) in the early farming communities of PPNA south-west Asia (Kuijt and Goring-Morris 2002; Verhoeven 2002b). Generally, it is asserted that social stratification based on the control of resources only becomes evident in the later cultural horizons of the pre-pottery Neolithic—exemplified in the archaeological record, for example, by differentiation among the architecture and food storage capacity of individual households (Byrd, 1994; Kuijt, 2001b; Rollefson, 2000; Kuijt and Goring-Morris 2002). Verhoeven (2002a) states that evidence for a defined social hierarchy is, to an extent, absent in the many of the pre-pottery Neolithic cultural horizons of south-west Asia. Rather than an extant, centralised "proto-state" level and type of social organisation/regulation (and its associated social stratification), it is suggested that the archaeology of the PPN (and particularly the PPNB) presents evidence that agricultural communities were regulate via religious hierarches (Kujit 2001; 2002). As previously mentioned, Kujit (2002) asserts that the level of ritual standardization in the PPNB is indicative of a more organized leader-focused ritual structure. Therefore, the general consensus is that early agricultural communities relied on symbolic systems and ritual activity to regulate society. Thus, it is hierarchically organised ritual activities that provide us with evidence of social differentiation in early farming communities (Byrd 1994; Kuijt 2001; Rollefson 2000; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b). This proposal ties in with a recent assertion in the cognitive science of religion, which proposes a connection between particular religious forms and levels of social complexity. For instance, both Whitehouse (2004) and Atran (2010) suggest that as groups transitioned from hunter-gatherer tribes to states, an increase in more regular and orchestrated rituals resulted in the emergence of full-time priests, sponsored by society.

The archaeological record for the PPN presents evidence of *religious* systems and associated rituals which likely had important regulatory functions. The PPN (particularly the PPNB) is considered as a period with increased standardisation of ritual practice (Kuijt and Goring-Morris 2002; Verhoeven 2002). Communal rituals (and their

standardisation) would have played a crucial role in creating and maintaining community cohesion. It is proposed that community rituals were essential to creating a sense of interdependence and shared identity in early farming communities to reduce the possibility of disputes over land ownership of food security (Mellaart 1975; Rollefson 1986; Kuijt 1996; Cauvin 2000; Goring-Morris 2000; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b). Standardised community rituals centred on a number of dominant symbols may have been imperative in regulating social behaviour (and creating a consensus on sanctions). In the context of this essential role of ritual, it is asserts that the need for dedicated ritual practitioners emerged (Mellaart 1975; Rollefson 1986; Kuijt 1996; Cauvin 2000; Goring-Morris 2000; Kuijt and Goring-Morris 2002; Verhoeven 2002b). These ritual practitioners, more than likely, would have had an important position in community in contrast to the majority of members. The groups of ritual practitioners themselves could have been hierarchically organised based on experience, knowledge or age. It is suggested that the earliest evidence of social complexity in emerging Neolithic communities is indicated by social differentiation associated with ritual practitioners, arguably reflected in special architectural features or burials (Byrd 1994; Rollefson; Kuijt 2001; Kuijt and Goring-Morris 2002; Kuijt *et al*. 2011)

In north-western Europe, the discourse on Neolithic ritual and social complexity centres on the idea of a lineage society (Thomas 1987; Cooney 2000). Thomas (1987) points out that the concept of lineage refers not to a purely biological relationship between people but, also, to a social relationship between people and land. It is asserted that any Neolithic community may have comprised of a central lineage or related group with a certain number of additional, non-related members. Central to the identity of the lineage is the interpretation of sacred landscape(s) regarding the idea of ancestry (Thomas 1987; Cooney 2000). For instance, Cooney (2000) asserts that central to the societal change in the Irish Neolithic is a gradual change of emphasis from burial rites to ancestral rites. In relation to passage tombs, it is suggested that essential to the symbolic and cultural

importance of these tombs is their direct association with the ancestors—and their embodiment in the landscape (Cooney 2000). In this connection the landscape plays a central role in the recounting of history and genealogy; this is what leads Cooney (2000) to state that "landscape is history" (Cooney 2000, 90). Landscapes and monuments such as passage tombs are unlikely to have been experienced on an egalitarian basis (Hodder 1990; Tilley 1994). Thus, it is suggested that the knowledge and use of these tombs can be related to a socio-economic systems centred on relations of dominance and sub-ordinance within a society (Parker Pearson 1982; 1984; Hodder 1990; Tilley 1994). The building of passage tombs involved the organisation of a large investment in labour by both specialist and non-specialist. Consequentially, we can consider a tomb as both an important ideological representation of a social group and a method by which to define social positions within that group (Hodder 1990). Furthermore, we can postulate that the ability to control both the access to and knowledge associated with monuments is fundamental to a social strategy involving social dominance in the context of a specific ideological framework (ritual practitioners or community leaders) (Parker Pearson 1982; 1984; Hodder 1990; Tilley 1994). In this regard, we can use the example of the passage tomb to consider the hierarchical nature of north-west European Neolithic communities—providing us with important insight into Neolithic social complexity via burials, land control, task specialisation and social hierarchy in the context of the European Neolithic transition. In this research a set of social complexity material correlate variables are employed to identify and record the material culture and level of social complexity in the three databases. The specific variables are outline in chapter three.

2.7 Identity Fusion and Group Identification

Research in evolutionary psychology indicates that the tendency for humans to cooperate may be hard-wired as a result of a long evolutionary history of cooperative big-game hunting and food sharing (Cosmides and Tooby 1992; Hill 2002; Hoffman *et al.* 1998; Gurven 2004). In the study of the connection between cooperation and social bonding in

human groups, one of the lines of research focuses on the distinction between two separate mechanisms of group bonding—namely, identity fusion and group identification. The term identity fusion is, often, referred to as local fusion or fusion; similarly, group identification is, also, referred to as social identification or identification (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Whitehouse and McQuinn 2013; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014; Jong *et al.* 2015; Salali *et al.* 2015; Atran 2016). Whitehouse and Lanman (2014) assert that the comparative research on identity fusion and group identification suggest that they are diverse phenomena reflecting different associated psychological mechanisms. The key difference between identity fusion and group identification centres on how personal and social identities interact when people align themselves with a group. Personal identity relates to the idiosyncratic features of an individual and group identity refers to the aspects of identity that an individual shares with a particular group (Swann *et al.* 2012; Swann *et al.* 2014a; b). Personal identity is derived from those qualities that are unique to the individual-self and distinguish individuals from other group members—for example, extravert or musical. (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Jong *et al.* 2015). Whereas group identity refers to the overall identity of the group(s) with which an individual align themselves with—for example, British, European or socialist. Although both personal and group identities are integral aspects of the larger self-system, it is suggested that most people consider a definite distinction between the two—labelled as the "self–other barrier" (Swann *et al.* 2009, 995). This is a psychological divide that serves to separate an individual's personal identity from the identities of others in a group (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b).

2.7.1 Identity fusion

It is asserted that identity fusion occurs when people experience a visceral sense of oneness with their group (Swann *et al.* 2012; Swann *et al.* 2014a; b; Jong *et al.* 2015).

This sense of oneness characteristic of Identity fusion, involves the union of personal identity and group identity to the point where the individual's self-concept and group-concept overlap. Thus, among fused individuals, group identity becomes an essential component of personal self-concept (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014; Jong *et al.* 2015). It is proposed that identity fusion emerged as a biological adaptation to support and promote cooperation within early human groups. The hypothesis is that that identity fusion evolved as a psychological mechanism for demarcating tribal groups and ensuring cooperation between members in small-scale groups (Swann *et al.* 2012). It is proposed that identity fusion emerged in the context of small-scale hunter-gatherer groups such as families, bands and tribes in which all the members of the group, generally, had regular face to face contact—essentially, an extended kin networks where the members share key characteristics such as genes and values/beliefs (Swann *et al.* 2012; Swann *et al.* 2014a; b). Research into the mechanism of psychological kinship enables us to suggest that the awareness of these shared characteristics creates and reinforces the perception of familial ties among group members (Bailey and Nava 1989; Park *et al.* 2008; Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014). The effect is that, rather than perceiving the group as a relatively abstract social category, a fused individual considerers the group as psychological kin (not just co-operators in a group) (Gómez *et al*. 2011a; Whitehouse and Lanman 2014). The result is that identity fusion creates a psychological situation in which pro-self and pro-group-actions are considered of equal importance (Jong *et al*. 2015). It is, generally, stated that there are two important effects of identity fusion: (1) the willingness of fused individual to engaged in dangerous pro-group actions to ensure the survival of the group and (2) costly altruistic actions among fused individuals (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014 Jong *et al*. 2015; Atran 2016). A number of researchers have documented how measures

of identity fusion can reliably be used to predict self-sacrifice for the group (*ibid*). It is proposed that strongly fused individuals are highly likely to endorse and engage in extremely dangerous activities for the group (to defend their perceived kin) (*ibid*). It is asserted that the merging of the personal-self and group-self and the associated relational ties via kinship psychology, explain why measures of identity fusion constantly outperform measures of group identification in predicting the endorsement of and engagement in extremely dangerous actions by individual members for the group (*ibid*). In terms of human cognitive mechanisms, identity fusion is associated with reflections upon infrequent (and dysphoric) experiences stored and recalled via episodic memory (Swann *et al.* 2012; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Jong *et al*. 2015). An important distinction between fusion and brainwashing is highlighted by a number of authors (Zimbardo 2007; Swann *et al*. 2012). It is pointed out that a fused individual maintains a definite sense of personal agency that is connected with group identity. On the other hand, it is asserted that victims of brainwashing "abdicate their sense of personal agency to external agents such as group leaders" (Swann *et al*. 2012, 451).

2.7.1.1 Devoted actors: sacred values and identity fusion

In relation to the connection between beliefs or values and extreme pro-group actions such as self-sacrifice, Atran *et al.* (2014) and Atran (2016) consider the phenomenon of extreme actions in the context of the devoted actor framework which integrates two concepts—namely, sacred values and identity fusion. Atran *et al.* (2014) and Atran (2016) refer to a category of highly fused individuals, holding sacred values and ready to take extreme action for the group as devoted actor(s); a theoretical framework developed by researchers at *Artist International* (Atran 2016). In this fame work, it is asserted that the interaction of identity fusion and sacred values indicates (and enable us to predict) the potential of an individual to becoming a devoted actor and engage in extreme pro-group actions (including self-sacrifice) for a perceived kin who share the same beliefs (sacred

values) (Atran *et al.* 2014). Sacred values are defined as "non-negotiable preferences whose defence compels actions beyond evident reason that is, regardless of calculable costs and consequences" (Atran 2016, 2). It is suggests that people resist attempts to compromise sacred values in spite of the potential consequences for themselves or others—which serves as the motivation for extreme actions (Baron and Spranca 1997; Tetlock 2003; Atran 2016). While the term sacred values has inherent religious association, the concept of a sacred value refers to any strongly held principle(s) regarding beliefs, values or practices that an individual considers as fundamental to the conception of self and the group (Atran 2016). In the devoted actor framework presented by Atran, the interaction of identity fusion and sacred values provides us with an example in which the psychological mechanisms directly connected with identity fusion (kinship recognition) combined with intense bonding rituals directly connected to a fundamental group belief to create a moral or spiritual group mission. In turn, the high levels of fusion and associated dedication to the groups' mission explains the endorsement of extreme pro-group actions—particularly, self-sacrifice (Atran 2016).

2.7.2 Group identification

Group identification refers to the development of a sense of strong socio-cultural bonds to the other members of a group in which face-to-face contact with all the members is not required or possible. However, feelings of identification with a group are considered sufficient to predispose individuals to participate in cooperative actions on behalf of the group (Swann *et al*. 2010a). In the context of group identification, members are bound to one another through collective ties that are based on "the degree to which members embody the prototypic qualities of the group rather than the unique relationships they establish with one another" (Swann 2014a, 913). Individuals with high group identification are strongly motivated to engage in cooperative actions for the benefit of the group (Branscombe *et al.* 1999; Hewstone *et al.* 2002; Swann *et al*. 2010a; Swann *et al*. 2014a). In group identification, identified individuals often sense that they share

certain prototypical features with other group members that are considered as important identity makers in terms of an individual's idea of being part of a particular group (group identity) but not essential to the individual's self-concept (personal identity) (Gómez *et al*. 2011; Whitehouse and Lanman 2014). In comparison to identity fusion, the psychological mechanisms central to group identification are less associated with autobiographical self-concepts and kin recognition. Moreover, it is proposed that group identification is a product of ethnic and coalitional psychology (Henrich and Henrich 2007; Kurzban and Neuberg 2005; Whitehouse and Lanman 2014). These psychological mechanisms allow us to develop, establish and enforce the social norms of larger (more anonymous) group networks—with the result being that the entire group can benefit from cooperative actions, particularly in times of uncertainty and threat (Whitehouse and Lanman 2014). It is asserted that recognisable and easily transmitted symbolic identity markers are essential to generate the perception of *the group* in the context of larger and more geographically extended networks. In terms of the cognitive processes, it is proposed that group identification reflects the storing of a large corpus of group identity information acquired through instruction, in the semantic memory. it is suggest that evidence of this relationship between group identification and information stored in semantic memory is reflected in the emergence of intuitions of shared group membership associated with cooperation in larger social networks (Henrich and Henrich 2007; Richerson and Boyd 2005; Whitehouse and Lanman 2014). For individuals who are identified with the group, external threats to this large social network are not considered as threats to one's immediate kin group but to the overall group identity/principles/beliefs. In the case of group identification, physiological arousal does not necessarily result in pro-group action carried out by the individual—particularly, if such activities are dangerous or extreme (i.e. self-sacrifice) (Simon and Klandermans 2001; Klandermans *et al.* 2002; Swann *et al*. 2009; Swann *et al*. 2010a; Whitehouse and Lanman 2014). For instance, a number of researchers have demonstrated that measures of group identification were relatively poor predictors of extreme pro-group actions by

individuals (Buhrmester *et al.* 2012; Gómez *et al.* 2011; Swann *et al*. 2012; Swann *et al*. 2014a). On the other hand, group identification is an essential social cohesion mechanism for maintain cooperation in extended networks.

2.7.2.1 Extended fusion

It has been demonstrated that an intense type of fusion can occur in larger, extended social networks. The type of fusion associated with larger networks is labelled as extended fusion (Swann *et al*. 2009; Gómez *et al*. 2011a; Swann *et al*. 2012; Swann *et al*. 2014b Swann *et al*. 2012). As discussed in section 2.7.1, identity fusion typically emerges in relatively small groups such as families, bands or tribes; where relational ties with others members of the group can develop through face-to-face contact and shared experiences (Swann *et al*. 2014a). However, it is suggested that in extended fusion, individual group members project the kinship-based relational ties (usually associated with identity fusion) onto members of an extended social networks, many of whom they have no personal connection with (Swann *et al*. 2009; Gómez *et al*. 2011a; Swann *et al*. 2012; Swann *et al*. 2014b Swann *et al*. 2012). The relational ties that emerge in the context of extended fusion are considered as metaphorical ties rather than literal ties (Swann *et al*. 2012; Swann *et al*. 2014b). For example, members of a given ethnicity, may fuse with ethnically similar members of a nation states (e.g. France or Europe) based on common ancestry or shared cultural values (Swann *et al*. 2009; Gómez *et al*. 2011a; Brooks, *et al* 2011; Swann *et al*. 2012; Swann *et al*. 2014b). Similarly, an individual may fuse with a group on the basis of an abstraction, such as a common cause or important value—an examples being political parties or religious beliefs (Buhrmester *et al*. 2012; Swann *et al*. 2012; Swann *et al*. 2014b). Essentially, in the case of extended fusion the cognitive mechanisms associated with kinship psychology are utilised to project a sense of relational ties onto a larger non-kin group that the individual shares certain identity markers with.

There may be a number of ways in which extended fusion may emerge; however, it is asserted that the kinship recognition mechanism may be activated in large group scenarios by the sharing of traumatic experiences, such as invasions, wars and national disasters. The general effect of extended fusion in the context of such events is an increase in both in-group altruistic behaviour (even in a group largely comprised of strangers) and out-group hostility (Buhrmester *et al.* 2014; Whitehouse and Lanman 2014; and Jong *et al.* 2015). In relation to extreme actions such as deliberately engaging in dangerous activities or self-sacrifice in the context of large group networks, it is stated that the level of psychological kinship associated with extended fusion can provide the motivation for extreme pro-group action. Drawing a contrast between group identification and extended fusion in large groups, it is proposed that group identification produces individuals committed to cooperation to further the interests of an extended group but not a readiness to engage in dangerous actions or self-sacrifice on behalf of a (largely) anonymous social network (Swann *et al*. 2012). Thus, it is extended fusion that facilitates the perceptions that encourage persons who are fused with large groups to endorse extreme actions for "their" group (Atran 2010; Swann *et al* 2012; Swann *et al*. 2014b).

2.7.3 Fusion, group identification and the Modes of religiosity

In relation to the modes of religiosity, it is suggested by that the two modes and their associated levels of arousal and frequency evolved (through a process of cultural group selection) to produce the required levels of group cohesion in the context of different, resource acquisition strategies and ecological contexts (Whitehouse and Hodder 2010; Turchin *et al.* 2012; Whitehouse and Lanman 2014). In the regard, we can consider the emergence of the imagistic and doctrinal modes as adaptions to particular resource acquisition problems connected with different social networks sizes, for the purpose of producing the necessary level of identity fusion or group identification (Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014). It is proposed that identity fusion and group identification parallel the essential distinction between the two modes of religiosity

where: (1) Imagistic rituals are associated with creating identity fusion in the context of small-scale, non-centralized but highly cohesive social networks where avoiding defection is crucial to group survival and (2) doctrinal rituals are connected with creating and re-enforcing group identification in the context of large-scale, diffuse social networks where high levels of cooperation among non-kin is required (Whitehouse 2002; 2004; Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Salali *et al*. 2015). It is proposed that sharing important bonding experiences with other members of the group represents an ideal method to create identity fusion in the context of small-scale social networks such as bands or tribes (Swann *et al.* 2012; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). Moreover, it is asserted that shared dysphoric rituals produce a strong sense of kinship with those who have shared the same experiences (Whitehouse 1995, 2000, 2004; Whitehouse and Lanman 2014). Whitehouse and Lanman (2014) propose a direct relationship between imagistic rituals and the production of the sense of psychological kinship essential to Identity fusion—stating that imagistic rituals "produce fusion among participants, binding them together as psychological kin and preparing them to participate in high-risk activities such as hunting dangerous animals and going to war" (Whitehouse and Lanman 2014, 679). As discussed previously (section 2.7.1), the sense of psychological kinship motivates (1) high levels of in-group altruism and (2) the participation in dangerous actions to ensure kin-group survival (Whitehouse and Lanman 2014).

On the other hand, it is suggested that doctrinal mode practices/rituals produce the level of group identification that is required to encourage and secure pro-group cooperation in the context of a large-scale, hierarchically organised social network comprising of a number of strangers (Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al*. 2015). The routinized nature of doctrinal rituals/practices provides an effective schema of standardised beliefs and easily remembered identity markers that produce and reinforce group identification among

members of an extended social network (*ibid*). It is suggested that in large-scale social networks associated with activities such large-scale agriculture and extended trade, doctrinal practices are essential to the production of group identification necessary to ensure trust and pro-group cooperation.

2.7.4 Identity Fusion, group identification and resource acquisition strategy

Importantly in the context of this thesis, a connection is proposed by a number of authors between (1) the resource acquisition strategy employed by a group; (2) the required level of identity fusion or group identification and; (3) a particular mode of religiosity (Whitehouse and Hodder 2010; Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). It is suggested that groups engaging in different resource acquisition strategies require higher or lower levels of identity fusion or group identification (*ibid*). For instance, a resource-acquisition strategy involving taking part in dangerous activities such as hunting (in which defection would be detrimental to the entire group) requires high levels of identity fusion (*ibid*). It is asserted that the imagistic rituals (and their associated reflection via episodic memory) are central to the production of the levels of identity fusion necessary in small-scale, hunter-gatherer groups (*ibid*). On the other hand, it is suggested that a resource strategy such as the model associated with fully sedentary agriculturalists within an extended social network requires high levels of group identification to ensure high levels of long-term cooperation between members. It is proposed that doctrinal mode practices produce the required levels of group identification through the establishment of a shared set of identity markers that can be diffused and remembered easily in a large group context.

In general, it is proposed that groups utilise the mode of religiosity necessary to produce the levels of fusion and/or identification required for their particular resource strategy (*Ibid*). If this is the case, than we should expect to see a relationship between the resource acquisition strategies (in our case subsistence strategy variables) and each of the two modes of religiosity respectively—particularly, in relation to the *known* eHRAF cultures.

In addition, it may be the case that the subsistence variables may reflect/indicate a change (if any) in mode of religiosity associated with archaeology of the agricultural transition.

2.8 A cognitive framework

2.8.1 Cognitive archaeology

Since the 1980s archaeologists have increasingly examined the archaeological record to investigate questions concerning human cognitive abilities. The influence and use of elements of cognitive science in archaeology can be observed in terms of a greater trend in the social sciences from the latter part of the 1970s. As a result of this new methodological departure aspects of cognitive science were used as tools in many social sciences to investigate human behaviour. The use of the archaeological record to examine the cognitive abilities of past populations has been referred to as cognitive archaeology (Renfrew 1994; Nowell 2001; DeMarrais *et al.* 2004; Abramiuk 2012). The essential premise in cognitive archaeology is that the products of human actions can inform us about the minds of the agents in the past (Wynn 2002). Thus, cognitive archaeology can be defined as the study of past ways of thought as inferred from material remains (Renfrew 1994; Wynn 2001; Abramiuk 2012). For the most part, cognitive archaeologists employ a number of approaches including the *Materiality approach* the *General comparative approach*, the *Structural approach* and the *Associative approach* (DeMarrais *et al.* 2004; Malafouris 2004; Meskell 2004; Knappett 2005; Abramiuk 2012). For example, the associative approach is based on the assumption that humans think in terms of associations and, thus, behaviourally express or externalise these associations through symbols or material culture. In a cognitive archaeological framework, an attempt is made to discern these associations by analysing the context of the material culture in question (Abramiuk 2012). Cognitive archaeology can be separated into two distinct types: (1) cognitive archaeology of the Palaeolithic, and (2) cognitive archaeology of the Neolithic onwards (Nowell 2001). Cognitive archaeology of the Palaeolithic focuses on the evolution and development of human cognition in relation

to the Palaeolithic archaeological record (*Ibid*). In particular, Palaeolithic cognitive archaeology seeks to understand the emergence of language and symbolism (*Ibid*). Cognitive archaeology of the Neolithic onwards, for the most part operates under the premise that modern cognitive capabilities were present (at the latest) following the upper Palaeolithic transition (Europe between ca. 45 and 30 ka BP). The aim of cognitive archaeology of the Neolithic onwards is to use the knowledge of how human perception functions and changes in different environments; with the goal being to use experimental psychological and cognitive anthropological information to re-construct past peoples' perceptions.

2.8.2 Cognitive approaches to religion

There are a number of cognitive approaches to the study of the transmission and establishment of religious ideas. These include the *Modes of Religiosity theory*, the *Memetic approach* and the *Epidemiology of Representation theory*. As discussed in section 2.4 of this chapter, the theory of Modes of Religiosity proposes two routes of transmission: (1) the imagistic mode centred on low frequency high dysphoric arousal religious experiences, which activate episodic memory; and (2) the doctrinal mode based on low dysphoric, frequent repetition of core concepts and the connections that bind them together is semantic memory. The Memetic approach centres on the idea of religious transmission via memes (Dawkins 1976; Dennett 1987; 1990; 1991; 1995; Sperber 1996; Watkins 2002). A meme is a unit of inheritance of transition in a culture—a unit of information capable of being stored in the brain and transmitted via social learning (*ibid*). In this approach to religious transmission, it is proposed that culture evolves as result of the differential replication of memes. According to advocates of the memetic approach artefacts are seen as having three functions: (1) as a representation of meme; (2) as expressions of memes; and (3) in a manner that conflates representations with expressions (Dennett 1987; 1990; 1991; 1995; Sperber 1996; Watkins 2002; Whitehouse 2004). In this framework, it is suggested that religious ideas are passed-on as memes. The

epidemiology of representations theory proposes that a human population is inhabited by a much wider population of mental representations (Sperber 1996; 2000; 2001; Sperber and Hirschfeld 1999; Whitehouse 2004; 2008 Whitehouse and Laidlaw 2007; Bermúdez 2010). Essentially, this theory focuses on the causal connections in which mental and public representations are present. The core assertion is that the construction or retrieval of mental representations may cause individuals to modify their physical environment, for instance to produce a public representation. These modifications of the environment may cause other individuals to construct mental representations of their own; these new representations may be stored and later retrieved, and, in turn, cause the individuals who hold them to modify the environment, and so on (*Ibid*). Religious actions are considered as methods of externalisation and reinforcement of particular mental representation—which are replicated at a group or population level.

In number of cultural evolution models, cultural traits are assumed to be discrete—acquired in social life and transmitted through interaction/communication (Cavalli-Sforza and Feldman 1981; Boyd and Richerson 1985; Henrich and Boyd 1998; Richerson and Boyd 2000; Henrich *et al.* 2008). Cultural evolution models often propose that culture has influenced human cognition, both directly and indirectly by shifting the selective environment faced by genes (Henrich *et al.* 2008). It is suggested that in different environments, individuals will find particular cultural variants useful. Henrich *et al.* (2008) assert that, depending on the particular environmental conditions, Humans selectively acquire essential information from specific, successful individual(s) via instruction/learning or imitation. It is asserted that this psychological propensity for *model selectivity* operates across the majority of domains of culture, influencing a multitude of aspects of individual and (eventually) behaviour/choices e.g. language, new technology, as well as, political and religious beliefs (*ibid*).

For example, according to Boyd and Richerson (1985; 1998; 2000; 2005) culture is information capable of affecting individuals' behaviour that they acquire from other

members of their species through teaching, imitation, and other forms of social transmission. They assert that cultural information spreads across members of a population through their interactions; via events and objects that carry information that others can acquire (Boyd and Richerson 1985; 1998; 2000; 2005). They examine the way in which the adoption of a *variant* by some individuals may cause others to adopt it too. They state that the role of innate cognitive capacities in cultural transmission reflects a limited part of the explanations for cultural transmission and that most culture is established cumulatively over generations through observational learning, rather than on information stored and transmitted genetically. In this sense, cultural reproduction is not matter of replication but of selection (Boyd and Richerson 2000). For them, to explain the accumulation of cultural knowledge over generations, it is necessary to identify mechanism of transmission that are *extra genetic*. Thus, it is asserted that individuals employ model-based cues of skill, success, health, prestige, and self-similarity to identify and select the individual(s) in the group that offer the best potential for cultural learning—e.g. people tend to imitate healthy or otherwise successful individual (Boyd and Richerson 1985; Henrich and McElreath 2006). Similarly, it is proposed that, in the absence of a significant group member for the purpose of social learning, individuals rely on copying the behaviour of the majority of their network for success (Boyd and Richerson 1985; 1998; 2000; Henrich and Boyd 1998; 2001). In doing so, they present a cultural evolutionary model in which the rules for cooperation are acquired via two mechanisms directly associated with the *social learning* model they propose:

(1) Payoff biased transmission: a tendency to copy the most successful individual(s) in a group—in a given environmental condition. The higher an individual's payoff the more likely that individual is to be imitated. Thus, humans do not simply copy their parents, kin or other group members randomly (Boyd and Richerson 1998; 2000; Henrich and Boyd 1998; Henrich and Gil-White 2000).

(2) Conformist transmission: a tendency to copy the most frequent behaviour in the group. Copying the behaviour(s) of the majority enables individuals to (a) limit the costs of individual learning and trialling and (b) directly acquire important adaptive behaviours (Boyd and Richerson 1985; Henrich and Boyd 1998).

These specialized social learning mechanisms provide a means of efficiently acquiring the crucial information necessary for success that is available in a given group and environmental situation (Boyd and Richerson 2000; Henrich and Boyd 2001). Thus, in many environments and in relation to collective action behaviours, these cultural transmission mechanisms provide a quick and effective manner to acquire complex, highly adaptive behavioural information. Thus, *social learning* represents a non-genetic mechanism by which individuals in a population can efficiently acquire a given pattern of behaviour. Furthermore, it is asserted that cultural evolutionary processes of social learning successfully stabilizes cooperation as the combination of conformism and payoff biased transmission enable the maintenance of stable cooperation in groups (Henrich and Boyd 2001). It is proposed that, in many circumstances, cultural group selection favouring cooperation will (relatively quickly) diffuse group-beneficial behaviours from a single group to a number of groups.

In relation to religious beliefs, Boyd and Richerson (1985) state that central to the cultural continuity of groups is the inheritance of beliefs and values and not merely a result of the effects of individual learning and imitating in a given social group or environment. Religious beliefs are proposed to be spread effectively by the social learning model. Social learning of beliefs that are integral to a group is suggested as one of several non-genetic mechanisms by which individuals in a population can acquire a given pattern of behaviour and, ultimately, acculturate. They propose that social learning reflects the properties of an inheritance system in which beliefs are a product of gradual vertical transmission: from one generation to another. Boyd and Richerson (1985) demonstrate that parent-offspring similarities for religion are generally robust—for the most part,

progeny learn and maintain the same religious beliefs as their parents and the larger social group that they are part of.

A number of cognitive anthropologists have criticized by Boyd and Richerson's approach. For example, Atran (2001, 2002) argues that the mental representations that support cultural traits reflect discrete, gene-like entities (rather than extra-genetic qualities). Similarly, Whitehouse (2004) asserts that by identifying mechanism of transmission that are considered as extra genetic they directly negate the possibility or potential of any cognitive explanations for cultural reoccurrence or transmission.

2.8.3 Cognitive mechanisms and religion

As this research aims to relate religious changes associated with the agricultural transition to aspects of human cognition, it is important to outline the cognitive mechanism and mental tools that are central to the transmission and establishment of religions ideas. It is asserted that there are two types of religious beliefs: (1) reflective beliefs and (2) non-reflective beliefs. Reflective beliefs are described as beliefs that we develop by employing deliberate reflection and are consciously maintained. Non-reflective beliefs are considered as beliefs residing in the subconscious mind (Barrett 2007). Cognition is central to the transmission of religious beliefs and concepts. If the information (religious concept) is to be accepted, remembered and transmitted, the information must gain support from cognitive structures (Whitehouse 2007). Therefore, it is proposed that religious thought and behaviour is shaped and transmitted by cognitive processes—"discrete cognitive mechanism-sometimes considered as modules or domain specific systems [..] encapsulated cognitive modules" (Whitehouse 2007, 250). However, it is suggested that an individual cognitive system is flexible as it can modify itself on the basis of experience (Barrett 2007). The complex cognitive mechanisms that are central to the transmission of and establishment of religious ideas include: episodic memory, semantic memory, relevance mechanisms, somatic markers, cross-domain-analogical

thinking system, theory of mind (TOM) and hyper-sensitive agency detection devices (HADD).

For example, episodic memory (concentrated in the hippocampus) is referred to as the autobiographical memory as it enables us to recall in detail specific episode in our lives (Whitehouse 20074; 2007; Hassabis and Maguire 2007; Schacter *et al*. 2011). On the other hand, the semantic memory system (associated with frontal and temporal cortices) enables us to store general knowledge about the world and recall it when required. Semantic memory enables us to store and transmit large amounts of information (*ibid*). Relevance mechanisms are central to the communication of an idea or concept as they enable intentional communications to be transformed into general logic statement (Sperber 1994; Whitehouse 2007). Relevance mechanisms enable us to combine new information with previously acquired background information to decide if the new information communicated is relevant. This mechanism is central to the transmission of any religious idea. Theory of mind (TOM) is the cognitive mechanism that enables us to attribute mental states to oneself and others (Barrett 2004; 2007; Walker 2011; Seyfarth 2013). Hyper sensitive agency detection devices (HADD) are a set of cognitive mechanism that are central in producing non reflective beliefs regarding agency or that agency is present—leading to the perception of objects as intentional agents (supernatural forces) and events being attributed to supernatural agents (spirits or Gods) (Barrett 2000; 2003; 2004; 2007)

Barrett (2007) presents an example of how these cognitive mechanisms aid/result in beliefs. He suggests that TOM is responsible for generating inferences about mental states without biological considerations. The example is that we can infer a mental state on a deceased person (even if we understand that the person is biological dead). It is asserted that cognitive mechanisms can combine to produce a number of characteristics or religious beliefs. For example, the ability to infer mental states on (for example) a deceased person via theory of mind (TOM) can be aided/augmented by hyper-sensitive

agency devices (HADD) creating non-reflective beliefs regrading agency or presence; the combination of HADD and TOM enables us to maintain the concept life after death or ancestors (Barrett 2004; 2007). In this regard, we can see how a number of cognitive mechanisms/devices are central to the establishment and transmission of religious ideas.

It is beyond the scope of this thesis to examine the actual cognitive abilities and mechanisms associated with the transmission of ritual/religious practices and beliefs. However, as the modes or religiosity is a cognitive theory, this thesis uses the framework of cognitive anthropological/archaeological research, to investigate the role of ritual practices (connected with aspects of human cognition) in the context of changing social configurations across the agricultural transition. By employing the cognitive anthropological approach developed in relation to the Modes of Religiosity, the aim of this DPhil research is to establish a framework to investigate a hypothesized causal association between social cohesion via religious, ritual practice and the establishment of farming in south-west Asia and north-western Europe, respectively. Consequently, it will enable us to re-assess both past and contemporary models that use economic and social hierarchies as explanatory paradigms.

Chapter 3 Material and Methods

3 Introduction

This chapter describes the sampling and analysis strategies applied to the cross-cultural ethnographic and archaeological material used in this research project. The core of this research project is an analysis of archaeological evidence relating to ritual activity, subsistence practices and social complexity across the agricultural transition in south-west Asia and north-western Europe. In order to frame this analysis, ethnographic material from the eHRAF (electronic Human Relations Area Files) database pertaining to a set of cultures with contrasting religious 'modes' (Atkinson and Whitehouse 2011) was used to assess predicted relationships between ritual activity, subsistence practices and social complexity and particular modes of religiosity. To this end, the ethnographic component of this research centred on the collection, cataloguing and analysis of a set of specific material correlate variables from a sample of ethnographic cultures. The archaeological aspect of this research focused on the analysis of a sample of well documented archaeological sites from the Early Epipalaeolithic to the Pottery Neolithic of south-west Asia and from the Early Mesolithic to the Late Neolithic of north-western Europe (Southern Scandinavia and Ireland).

3.1 Methods for sampling and assembling the cross-cultural ethnographic (eHRAF) data

This section details (1) the approach used to examine the eHRAF ethnographic record and (2) the specific *Outline of Cultural Material* (OCM) codes that were used to extract and record information from the eHRAF database. The OCM codes are search codes relating to specific cultural information provided by the host of the eHRAF database (Yale University). The ethnographic data source for this thesis consisted of the ethnographic reports available via eHRAF. The eHRAF is an online cross-cultural ethnographic archive hosted by Yale University that contains approximately 1,200,000 pages of

ethnographic materials from thousands of original ethnographies of cultural and social life from a global sample of cultures/societies. The eHRAF is unique in having subject-indexing at the paragraph level which facilitates detailed and targeted searching using both keywords and specific OCM searches. Every paragraph contained in the eHRAF has been coded for one of more than 700 numbered subjects (e.g., 224 = hunting and trapping; 314 = architecture; 764 = burial practices). The eHRAF (and its predecessor HRAF) has been utilized as a primary and secondary source of material for cross-cultural studies for over 60 years by researchers in a multitude of disciplines including anthropology, archaeology, sociology, history, psychology, economics and linguistics—e.g (Rogoff *et al.* 1975; Levinson (1981); Beals *et al.* (1984); Burbank (1987); Shalinsky and Glascock (1988); McGrath (1991); Russell (1991); Ember and Ember (1994); Hupka *et al.* (1999); Schrauf (1999); Carpenter (2000); Nelson *et al.* (2000); Dickson *et al.* (2005); Bagwell (2006); Breedlove (2007); Moore and Cassidy (2007); McCall (2009); Owens (2008); Kline and Boyd (2010); Gray and Young (2011); Moritz *et al.* (2011). Currently, an estimated 400 colleges, universities, libraries, museums and research institutions conduct research via the eHRAF (eHRAF incorporated 2015).

The selected ethnographic cultures that formed the eHRAF sample in this research had been previously classified by Atkinson and Whitehouse (2011) as either doctrinal or imagistic based on the frequency and level of dysphoric arousal of their rituals. Atkinson and Whitehouse (2011) examined ritual frequency and dysphoric arousal data from 645 religious rituals across 74 cultures from around the world using the electronic Human Relations Area Files (eHRAF). They used multilevel, hierarchical modelling to examine whether or not certain ritual features cluster together along frequency and arousal dimensions as predicted by the Modes of Religiosity theory (Whitehouse 2004). In this DPhil research I employed this *known* ethnographic sample, classified as imagistic or doctrinal by Atkinson and (Whitehouse 2011), to assess whether or not the *unknown* archaeological cases reflect a shift from an imagistic to an increasingly doctrinal mode of

religiosity. The approach taken in this research was to examine and record a set of *material correlate variables* relating to ritual activity, subsistence practice and social complexity from the *known* ethnographic cross-cultural sample of imagistic and doctrinal cultures. This methodological approach was developed following an initial pilot study (section 3.6), which identified the difficulty of assessing ritual frequency and arousal level from archaeological data. It was therefore necessary to identify a set of relevant *material correlates* derived from the defined imagistic and doctrinal cultures that could be tracked in archaeological material culture. This approach resulted in the identification and recording of a set of ritual activity, subsistence and social complexity data from the eHRAF cultures that were used:

1. to record a set of material correlate variables for ritual activity in a *known* sample of eHRAF cultures representing both modes of religiosity, for use in statistical analysis to examine a number of predictions associated with the modes of religiosity theory;
2. to record similarly a set of subsistence and social complexity material correlate variables in a *known* sample of eHRAF cultures in order to examine further predictions associated with the modes of religiosity theory;
3. to act as a basis for statistical modelling to identify which set of variables provides the best prediction of mode of religiosity; and
4. to act as a basis for generating statistical probabilities that the archaeological cases reflect a particular mode of religiosity.

3.2 Selection of cultures for the eHRAF study

The choice of a particular set of cultures from the eHRAF database was achieved through an examination of 74 cultures from the study carried out by Atkinson and Whitehouse (2011). Two criteria were used to select cultures from this set of 74 cultures, namely the dysphoric arousal levels (average dysphoric mean) and ritual frequency (frequency per year). The reason for concentrating on these two criteria was to generate an ethnographic

sample that would relate most directly to the Modes of Religiosity theory, for which ritual frequency and arousal level are central. Therefore, the 74 cultures were examined to identify the cultures that represented the 'extremes' of dysphoric arousal levels (average dysphoric mean) and ritual frequency (frequency per year), respectively. The following four groups were identified:

1. cultures with the lowest scores in terms of dysphoric arousal levels (average dysphoric mean)
2. cultures with the highest scores in terms of dysphoric arousal levels (average dysphoric mean)
3. cultures with the lowest scores in terms of ritual frequency (frequency per year)
4. cultures with the highest scores in terms of ritual frequency (frequency per year)

In keeping with the assertions of the Modes of Religiosity theory regarding the relationship between dysphoric arousal levels and ritual frequency, two sets of data were combined and assessed in terms of cultures that overlap or appear in both categories (ritual frequency and dysphoric arousal) resulting in:

1. cultures with the highest dysphoric arousal *and* the lowest ritual frequency per year scores (Table 3.1); and
2. cultures with the lowest dysphoric arousal *and* the highest ritual frequency per year scores (Table 3.2).

This combination of the respective groups resulted in a total of 17 cultures in group 1 (imagistic cultures) (Table 3.1), and a total of 21 cultures in group 2 (doctrinal cultures) (Table 3.2). These 38 cultures formed the *known* ethnographic (eHRAF) sample used in this DPhil research (Table 3.3). The *imagistic* Massi and Mataco and the *doctrinal* Kogi and Mbuti cultures were excluded from the final list of cultures because of the lack of information regarding aspects of social complexity material correlates. Thus, for the eHRAF data gathering and analysis component of this research, a total of 34 cultures (15 imagistic and 19 doctrinal) were used.

Table 3:1 identifying the cultures with the highest dysphoric arousal scores and the cultures with the lowest ritual frequency/year scores respectively. This table shows the initial 16 imagistic cultures selected based on their frequency and arousal scores.

Identified/selected Cultures	Culture	Cultures with highest dysphoric arousal score	Cultures with lowest ritual frequency/year score
1	Andamans	X	X
2	Aranda	X	X
	Bahia Brazilia	X	
3	Banyoro	X	X
	Blackfoot	X	
4	Bororo	X	X
	Chuuk	X	
5	Dogon	X	X
	Garo		X
6	Hausa	X	X
	Highland Scots	X	
	Iran		X
	Igbo	X	
7	Jivaro	X	X
	Kanuri		X
9	Kapauku	X	X
	Khasi	X	
	Klamath	X	
	Kuna		X
10	Lozi	X	X
11	Maasai	X	X
	Mongol		X
12	Mataco	X	X
	Mentawai	X	
	Navajo		X
13	Ojibway	X	X
	Ona	X	
	Orokaiva	X	
	Ovimbundu		X
	Pashtun		X
	San	X	
	Santal		X
	Serbs		X
	Shulh	X	
14	Tiv	X	X
	Tlinjit		X
15	Toradja	X	X
	Tzeltal		X
	Waro		X
16	Wolof	X	X
	Yaama	X	
	Yukut	X	

Table 3:2 identifying the cultures with the lowest dysphoric arousal scores and the cultures with the highest ritual frequency/year scores respectively. This table shows the initial 21 doctrinal cultures selected based on their frequency and arousal scores.

Identified/selected Cultures	Culture	cultures with lowest dysphoric arousal score	cultures with highest ritual frequency/year score
1	Aymara	X	X
	Azande		X
2	Bemba	X	
	Bosnian Muslim	X	X
3	Central Thai	X	X
	Chuuk		X
4	Croats	X	X
	Garifuna	X	
	Garo	X	
5	Guaraní	X	X
6	Hopi	X	X
7	Iban	X	X
8	Ifagao	X	X
	Igbo		X
9	Iroquois	X	X
10	Kogi	X	X
11	Korea	X	X
	Kuna	X	
	Kurds		X
12	Lepcha	X	X
	Maya	X	
13	Mbuti	X	X
	Metawai		X
	Mongor	X	
	Navajo	X	
	Ona		X
15	Palestinians	X	X
16	Pawnee	X	X
	San		X
17	Saramaka	X	X
	Shulh		X
18	Somali	X	X
	Taiwan Hokkien	X	
19	Tikopia	X	X
20	Tongans	X	X
21	Trobrianders	X	X
	Tzeltal	X	
	Yakut		X

Table 3:3 the complete ethnographic sample of cultures

No.	eHRAF culture	Mode classification #	Chronological context	Geographic Location
1	Somali	Doctrinal	1800s -1980s	Somalia, Northeast Africa
2	Lepcha	Doctrinal	1880s-1960s	Southern and eastern slopes of Mount Kanchenjunga, Himalayas, South Asia
3	Korean	Doctrinal	1880s-1990s	Korea, East Asian
4	Iban	Doctrinal	1940s-1970s	Island of Borneo, Malay archipelago, Southeast Asia
5	Ifugao	Doctrinal	1920s-1970s	The mountainous region of northern Luzon, Philippines, southeast Asia
6	Central Thai	Doctrinal	1940s-1990s	Thailand, Southeast Asia
7	Bosnian Muslim	Doctrinal	1960s-1990s	Bosnia and Herzegovina, South-eastern Europe
8	Palestinians	Doctrinal	1830s-2000s	Palestinian territories (West Bank and the Gaza Strip), Southwest Asia
9	Iroquois	Doctrinal	1900s-1970s	Quebec and Ontario, Canada and New York, Pennsylvania, Wisconsin, and Oklahoma, USA
10	Seminole	Doctrinal	1930s-2000s	Central Oklahoma, USA, North America
11	Pawnee	Doctrinal	1850-1970s	Oklahoma, USA, North America
12	Croats	Doctrinal	1840s-1980s	Croatia Bosnia and Herzegovina, Serbia, and Slovenia, South-eastern Europe
13	Hopi	Doctrinal	1880s-1920s	Arizona, USA, North America
14	Trobrianders	Doctrinal	1900s-1930s	Kiriwina, Kaileuna, Kitava and Vakuta, South-western Pacific
15	Tikopia	Doctrinal	1920s-1990s	Solomon Islands, South Pacific Ocean
16	Tongan	Doctrinal	1900s-2004	Tonga, South Pacific Ocean
17	Saramaka	Doctrinal	1880s-1930s	The Republic of Suriname, north-eastern coast of South America
18	Aymara	Doctrinal	1900s-1960s	Bolivia and Peru, South America
19	Guaraní	Doctrinal	1940s-1990s	Amazon Basin, South America

Table 3:3 the complete ethnographic sample of cultures (continued)

No.	eHRAF culture	Mode classification #	Chronological context	Geographic Location
1	Banyoro	Imagistic	1950s-2000s	Uganda, East Africa
2	Lozi	Imagistic	1870s-1960s	Zambia, Southern Africa
3	Hausa	Imagistic	1900s-1960s	Nigeria and Niger, West Africa
4	Dogon	Imagistic	1930s-1990s	Mali, West African
5	Tiv	Imagistic	1930s-1980s	Nigeria and Niger, West Africa
6	Wolof	Imagistic	1950s-1980s	Senegal and Gambia, West African
7	Andamans	Imagistic	1850s-1960s	Andaman Islands, Bay of Benga, Indian Ocean
8	Eastern Toraja	Imagistic	1890s 1940s	Sulawesi, Eastern Indonesia
9	Ojibwa	Imagistic	1850s-1950s	Ontario, Manitoba and Saskatchewan, Canada and Michigan, Wisconsin and Dakota and Minnesota, USA, North America
10	Aranda	Imagistic	1900s-1940s	Central Australia
11	Kapauku	Imagistic	1950s-1970s	West Papua , Indonesia
12	Jivaro	Imagistic	1880s-1950s	Ecuadorian and Peruvian Border, South America
13	Tukano	Imagistic	1939 -1980s	Colombia and Brazil, South America
14	Yanoama	Imagistic	1880s-1920s	South-eastern Venezuela and upper North-western Brazil, South America
15	Bororo	Imagistic	1920s-1990s	Central Brazil, South America

 # Mode classification after Atkinson and Whitehouse (2011)

3.3 Initial pilot study

A pilot study was carried out in the first year of the DPhil research. The main question surrounding the pilot project was: what types of material culture are available in the *known* eHRAF sample that could also be examined in the archaeological samples from each region? It was this question that formed the basis of the *materials correlate* approach used in this research. The material correlate approach is a product of the reality that, although ritual frequency and dysphoric arousal data are central to the Modes of Religiosity theory, such data are difficult to ascertain in the archaeological record. As the *known* eHRAF data [classified by Atkinson and Whitehouse (2011)] was used in this research as a basis to examine the presence of the imagistic or doctrinal modes of religiosity in an archaeological sample, it was decided to focus on a set of (initially) ritual and (subsequently) subsistence and social complexity material correlates that could be identified in both the *known* eHRAF cultures and the archaeological site-phases. The pilot study used six ethnographic (eHRAF) cultures and four archaeological site-phases (Table 3.4) to test the viability of the material correlates approach. The pilot study was undertaken:

1. to examine whether or not the material correlate approach using the *known* eHRAF data would result in the identification of a set of variables that could be used to examine the different modes in the archaeological samples; and
2. to identify the OCM codes that would be necessary to yield the required material correlate variables data from the eHRAF.

Table 3:4 Samples used for pilot study

Site/culture	Sample	Mode /Site-phase
Lepcha	eHRAF	Doctrinal
Hopi	eHRAF	Doctrinal
Central Thai	eHRAF	Doctrinal
Tukano	eHRAF	Imagistic
Kapauku	eHRAF	Imagistic
Aranda	eHRAF	Imagistic
Beidha I	South-west Asian archaeology	Epipalaeolithic
Ain Ghazal	South-west Asian archaeology	MPPNB
Lough Boora	North-west European archaeology	Early Mesolithic
Lough Gur	North-west European archaeology	Late Neolithic

3.3.1 Outcomes of the pilot study

It was observed that recording general ritual activity and mortuary practices variables resulted in the identification of sets of material correlate variables that could be used to examine/identify ritual trends in the *known* eHRAF data that could be used to distinguish between the imagistic and doctrinal cultures. For instance, among the cultures classed as doctrinal, ritual activity was associated with more permanent communal ritual structures and monuments. For example, in central Thai culture, the temple is a prominent feature in each village. On the other hand, secondary burial practices appeared to be more associated with the cultures that were classed as imagistic. For example, the Aranda and the Kapauku both place corpses upon wooden platforms for the purpose of de-fleshing the body before burial (excarnation). Similarly, the Tukano (imagistic) engage in secondary burial practices involving interring the corpse in the centre of the long-house. Generally, secondary burial practices were correlated with cultures engaging in imagistic mode practices. As the burial record and aspects of ritual material culture such as ritual structures and monuments represent examples of material culture that were identified in the *known* eHRAF cultures and could be examined in archaeological contexts, it was decided to target a set of ritual and mortuary practice material correlate variables to

examine the ritual/religious practices associated with the *known* eHRAF cultures (using a specific set of OCM codes) and the archaeological site-phases (sections 3.4.3 and 3.5.3 and Appendix 1).

In addition to the ritual data, a focus of the pilot study was to examine the non-ritual data that could be used to distinguish between cultures engaged in rituals reflecting each of the two modes. As explained in Chapter 2, section 2.4.1, Atkinson and Whitehouse (2011) demonstrate a statistical relationship between agricultural intensity and the doctrinal mode. Therefore, a focus of the pilot study was to examine whether or not specific material correlate variables relating to subsistence strategy could be connected with eHRAF cultures representing the imagistic or doctrinal mode. The pilot study demonstrated that different subsistence strategies appeared to be associated with imagistic or doctrinal cultures, respectively. For example, the Aranda (imagistic) are mobile hunter-gatherers with no long-term food storage strategy. The Tukano (imagistic) are a semi-sedentary group that abandon their communal longhouse circa every five years and have a subsistence strategy focusing on hunter-gathering and garden cultivation. Conversely, the Hopi (doctrinal) represent fully sedentary groups that live in compact pueblo villages with each pueblo (unit of seven rooms) clustered around a central area used for ceremonies. Although the Hopi engage in hunting and gathering, a large focus of their subsistence strategy involves intensive, large-scale maize cultivation. Similarly, the Central Thai (doctrinal) represent a fully sedentary culture which relies on domesticated animals and large-scale rice cultivation. As a number of subsistence strategies reflect variables that (1) appear to be indicative of imagistic or doctrinal cultures respectively and (2) represent well researched aspects of the archaeological record, it was decided to target a specific set of material correlate variables to examine the subsistence practices associated with the *known* eHRAF cultures (using a specific set of OCM codes) and the archaeological site-phases (sections 3.4.2 and 3.5.3 and Appendix 1).

As explained in Chapter 2, section 2.6, It is suggested that sedentary, agricultural groups demonstrate a greater level of centralisation, societal hierarchy and social inequality (that is also associated with doctrinal mode religious practices) (Whitehouse 2002; Atkinson and Whitehouse 2011; Peoples and Marlowe 2012). Therefore, it became necessary to examine whether or not material correlate variables relating to social complexity or inequality could, potentially, be used to delineate between imagistic and doctrinal cultures. Social inequality in the doctrinal cultures appeared to be reflected in resource monopolization and domestic architecture, with community leaders or those with control over resources having much larger dwellings. For example, in Lepcha culture (agriculturalists in eastern Nepal) the majority of houses consist of two rooms and an attic for storage, whereas, the larger houses (associated with those who have larger farms) generally have an additional storeroom to the rear of the house. Similarly, in Central Thai culture (doctrinal), a larger house signifies economic prosperity, usually relating to landownership. Additionally, the pilot study demonstrated that a number of ritual characteristics (particularly mortuary practices) present us with a method to examine the hierarchical or socially unequal structure of a number of cultures. For instance, social inequality was identified in the burial record of both imagistic and doctrinal cultures, as "important" members of the community were often afforded special burial treatment including the interment of valuable grave goods with the person. Therefore, it was decided to utilise a set of material correlate variables relating to evidence of resource monopolisation, domestic architecture and burial practices, to identify social inequality in the *known* eHRAF cultures (using a specific set of OCM codes) and the archaeological data (sections 3.4.5 and 3.5.3 and Appendix 1).

Evidence of sharing avoidance or theft concerns exemplified via the location of food storage and cooking areas was identified as a possible method to distinguish between the *known* eHRAF cultures. For example, the Aranda (imagistic) provide evidence of communal cooking and appear not to engage in private food storage. In the Tokano

(imagistic) longhouse, each family unit has its own storage facility which can be readily accessed by others as it is not protected. However, the Lepcha and the Hopi (both doctrinal) provide examples of private cooking and long-term private storage. For example, a typical Lepcha house consists of two rooms and an attic for storage which is entered via a stepladder. Similarly, the Hopi pueblo has rooms with storage bins and a fire for each family unit. The Hopi store about 40% of the harvest yield on the first floor of the multi-storey pueblo, in a family storeroom (Kaniki). Although the Hopi utilise larger store houses in denser populations, these are mainly used to store food for each individual family unit. Traditionally, each Hopi household stored up to a year's supply of maize. As the location of food storage and evidence of private or communal cooking (1) appeared to reflect variables that may be associated with imagistic or doctrinal cultures; and (2) represent material culture that could be identified in archaeological contexts, it was decided to target a set of material correlate variables indicative of private versus communal food storage and private versus communal cooking to examine the occurrences of sharing avoidance or theft concerns associated with the *known* eHRAF cultures (using a specific set of OCM codes) and the archaeological data (sections 3.4.6 and 3.5.3 and Appendix 1).

Another important part of the pilot project was to establish a method of estimating population size for each sample and to find categories of population size in which to group the different estimated population sizes. As outlined in section 2.4, a number of authors have commented on the relationship between group size limits and aspects of subsistence practices, social organisation and ritual practices. Whitehouse (2004) suggests that ritual activity (frequency and dysphoria) is directly related to both group size and aspects of human cognitive architecture. This claim aligns with other studies suggesting that group size limits are directly connected to information processing and associated cognitive mechanisms (Flannery 1972; Forge 1972; Wright and Johnson 1975; Wright 1977; Johnson 1982; Kosse 1989; Dunbar 1992; 1993; Hernando *et al.* 2009;

Wellman 2012). As population size represented a prospective means to explore the mode of religiously across the agricultural transition, it was necessary to find a method of population estimation that could be used in this research; across 111 site-phases and 34 eHRAF cultures. As the population sizes are provided for each eHRAF in the files, the focus of the pilot study was to find a method for the archaeological samples which could be integrated with the eHRAF cases.

Following the pilot study involving the examination of a number of methods of population calculation (section 3.6 this chapter), it was decided to:

(A) categorise the archaeological and eHRAF cases in terms of three population measures: (1) populations less than 150 people, (2) populations between 150 and 500 people; and (3) populations between 500 and 5000 people. This calculation relates to a number of studies that have stated that group size limits are directly connected to information processing and cognitive mechanisms associated with group size (Forge 1972; Flannery 1972; Wright and Johnson 1975; Wright 1977; Johnson 1978; Kosse 1989; Dunbar 1993; 1992; Hernando *et al.* 2009; Atkinson and Whitehouse 2011; Wellman 2012). For example, it is proposed that in a given social network, an individual can only securely maintain 150 stable relationships. Furthermore, it is suggested that a network size larger than this generally requires a set of preventive rules, laws, and enforced norms to maintain group cohesion. Thus, 150 was taken as the minimum limit and, following examination of the literature on group stability and the ethnographic and archaeological record the other two categories were decided upon. Using these three categories enabled me to classify the archaeological and ethnographic samples, in a standardised manner.

(B) focus on the mathematical relationship between population size and site-phase area to estimate population and to use site population size as an estimate of community size—with area being extrapolated from the area of the site-phase excavated and surveyed, not

just the areas of the excavated trenches. Two formulae based on the area of the archaeological site-phases were used; P = 2.9379 A.37 for the Mesolithic and Epipalaeolithic site-phases and P = 146 √A for the Neolithic site-phases (section 3.6 this chapter). The main potential limitations of population estimation in the research are discussed in chapter 3 section 3.6 and Chapter 8 section 8.1.1. In spite of the limitations, this population estimation method was used as it represents an accessible calculation in relation to each site-phase (and the eHRAF cultures) and provides a method for comparing many site-phases across a region or between regions.

The pilot project demonstrated that the material correlates approach represented a viable method (1) to identify common aspects of material culture from the eHRAF cultures representing each mode of religiosity; and (2) to provide a set of variables that could be used to explore the presence of material culture connected with the imagistic or doctrinal mode in the archaeological samples. The pilot study was used to identify the set of OCM codes for each category that would enable a comprehensive recording of the material correlate variables from the eHRAF cultures (section 3.4). Following the pilot study, it was decided that that ritual activity would be recorded in to relation to two categories: (1) general ritual activity and (2) mortuary activity, so that both the overall "religious" framework and the specific mortuary practices of each eHRAF culture and archaeological site-phase would be recorded. The pilot study demonstrated that categories of subsistence practice and social complexity material correlate variables could be added to the ritual material correlate categories to distinguish between cultures engaged in an imagistic or doctrinal mode of religiosity, resulting in a set of ritual, subsistence and social complexity material correlates that can be used (1) to record and statistical analyse the data generated form the *known* eHRAF sample and (2) to represent aspects of material culture that could be identified and analysed in the archaeological samples. To augment the category of social complexity, two associated categories were added: sharing avoidance/theft control and community, ritual and monumental architecture. These were given a separate sub-

section in the social complexity category as the presence of sharing avoidance and community and ritual architecture seemed to be a viable way to distinguish between imagistic and doctrinal cultures. In total, it was decided to use seven categories to record the data from each eHRAF culture and site-phases (sections 3.4 and 3.5.3 and Appendix 1):

1. General information
2. Subsistence information
3. General ritual/religious characteristics
4. Mortuary practices
5. Social complexity
6. Sharing avoidance or theft control
7. Community, ritual and monumental architecture

(Appendix 1: Codebook)

3.4 Categorising and recording the ethnographic (eHRAF) data

This section details the specific aspects of the categories that were recorded for each culture and the *Outline of Cultural Material* (OCM) codes that were used to extract and record the information relating to each of the categories from the eHRAF database. The OCM codes are a specific set of search codes used to catalogue the cultural information provided by the eHRAF database. Relevant ethnographic material was extracted and coded using standard structured coding procedures (Ember and Ember 2009). The data gathering procedure for the eHRAF cultures is outlined in the codebook (Appendix 1). As with all synchronic cross-cultural surveys, each eHRAF culture in this research was assigned an explicit historical contextualization: a single time period directly related to the available documents in the eHRAF cross-cultural files, often referred to as an *ethnographic present* (Swanson 1980; Ember and Ember 2009) or chronological context (Table 3.3). The eHRAF ethnographic record was used to identify and record a set of ritual activity, subsistence and social complexity material correlate variables that were

directly connected to the *known* (identified as imagistic or doctrinal) cultures in the ethnographic record. To record the eHRAF data, a *Microsoft Access* database was used. A pilot study (section 3.6) utilizing a number of OCM codes was carried out to determine which OCM codes and variable categories could be employed to gather a relevant sample of ritual, subsistence and social complexity material from the eHRAF dataset. For this research project, a total of 59 OCM codes were used to collect data from the eHRAF, resulting in the extraction and analysis of 65,432 paragraphs across the 34 eHRAF cultures under examination (24,763 from imagistic mode cultures and 40,669 from doctrinal mode cultures). Following the pilot study (section 3.6), the three categories of ritual, subsistence and social complexity variables were sub-divided into a total of seven categories:

1. General information
2. Subsistence information
3. General ritual/religious characteristics
4. Mortuary practices
5. Social complexity
6. Sharing avoidance
7. Community, ritual and monumental architecture

   (Appendix 1: Codebook)

3.4.1 General information

General information about each culture was entered into a *Microsoft Access* database. This information included the name of the culture, the geographic location of that culture and its estimated population size. Population size at a given location was recorded from the eHRAF database and it is this number that was used as an estimate of community (as it could be integrated with the archaeological material). The ethnographic (eHRAF) cultures were categorised in terms of three population measures: (1) populations less the 150 people, (2) populations between 150 and 500 people; and (3) populations between

500 and 5000 people. Using these three categories enabled me to classify the archaeological and ethnographic samples, in a standardised manner. The main potential limitations of population estimation in the research are discussed in chapter 3 section 3.6 and Chapter 8 section 8.1.1. The OCM codes 105, 131, 132, 161 and the eHRAF cultural summary were used for the purpose of recording the general information about each eHRAF culture (Appendix 1: Codebook). The categories used to record general information for both the eHRAF were:

1. Name of eHRAF culture*: (descriptive) Name given in the ethnographic account(s) provided by the eHRAF
2. Geographic region: This is the continent that ethnographic culture are located
3. Geographic sub-region: This includes as much regions/local information as possible
4. Period covered by ethnographic account(s)*: The period covered by the ethnographic accounts given in the eHRAF database.
5. Estimated average population: (1, 2, 3) (1 = population < 150 people, 2 = 150 to 500 and 3 = 500 to 5,000 people)
6. Degree of sedentism: (0, 1, 2) (0= no sedentism, 1= moderate sedentism/ semi-sedentary, 2= fully sedentary communities

   * recorded only for eHRAF cultures

   (Appendix 1: Codebook)

3.4.2 Subsistence practices

As Atkinson and Whitehouse (2011) highlighted a correlation between agricultural intensity and the doctrinal mode it was decided to record a set subsistence material correlates. Also, during the pilot study (section 3.6) it was found that a number subsistence practices enabled us to distinguish between the imagistic and doctrinal cultures. Therefore, this section of the database was used to record the subsistence

practices of each culture using specific OCM codes. Categories of absence or presence (0/1) and Likert scales were used to identify and record the subsistence strategy employed by each culture, as well as the level of intensity of engagement in the particular subsistence strategy (Table 3.5 and (Appendix 1: Codebook). For example, practices such as hunting, fishing and agriculture were scored using absence or presence (0/1). Three Likert scale categories were employed to further asses the intensity levels of the subsistence and the storage strategy of the particular culture. The material correlate categories (*materials correlate* approach explained in section 3.6) used to identify and classify the subsistence strategy of each culture were:

1. Hunting: (0 = absent, 1 = present)
2. Gathering: (0/1)
3. Fishing: (0/1)
4. Animal husbandry: (0/1)
5. Animal domestication (0 = no evidence of animal domestication, 1 = some domestication and 2 = full domestication; including cattle)
6. Cultivation/agriculture: (0/1)
7. Crop cultivation intensity: (0 = no evidence of cultivation, 1 = cultivation of non-staples and 2 = intensive cultivation/agriculture with domesticated staples)
8. Evidence of settled forager activity: (0/1)
9. Evidence of nomadic pastoralism: (0/1)
10. Food storage strategy: (likert scale: 0, 1, 2, 3; with 0 = no storage strategy, 1 = daily/weekly, 2 = monthly (less than 3 months), 3 = seasonal/year.)

(Appendix 1: Codebook)

Table 3:5: The eHRAF OCM codes for subsistence practices

OCM Code	Description
222	collecting
224	hunting and trapping
225	marine hunting
226	fishing
231	domesticated animals
233	pastoral activities
234	dairying
241	tillage
243	cereal agriculture
246	forage crops
251	preservation and storage of food
262	diet

3.4.3 General ritual characteristics

During the pilot study (section 3.3) it was found that a number general ritual characteristic (other than frequency and dysphoric arousal) could be employed to examine the cultures engaged in imagistic or doctrinal rituals. This approach is important, as explained in Chapter 2, section 2.4.2, as frequency and dysphoric arousal are difficult to identify and record from prehistoric contexts; but it was necessary to identify ritual material correlates that could be used in relation to both the eHRAF and archaeology databases. Therefore, this section of the database was used to record the general ritual characteristics of each culture using specific OCM codes (Table 3.6 and Appendix 1: Codebook). This section used categories of absence/presence (0/1) to identify and record the overall ritual characteristics of each culture and Likert scales to assess the levels of ritual standardisation and ritual hierarchy. This section of the recording process was used to identify and record ritual material correlate variables (other than frequency and

dysphoric arousal level) that are associated with doctrinal and imagistic cultures. The material correlate categories used were:

1. Evidence of ritual standardisation: (0 = absent, 1 = present)
2. Level of ritual standardisation: (0, 1, 2) (0 = no evidence of ritual standardisation, 1 = some degree ritual standardisation with variations of practices observed and 2 = evidence of highly standardised practices).
3. Evidence of ritual practitioner (s): (0 = absent, 1 = present)
4. Levels of religious hierarchy: this category is recorded in terms of a likert scale: (0, 1, 2, 3, >3) *
5. Evidence of the standardisation of mortuary practices: (0/1)
6. Evidence of ritual domestic space: (0/1)
7. Evidence of communal ritual buildings (not monuments): (0/1)
8. Evidence of communal ritual monuments/monuments in the landscape: (0/1)
9. Evidence of large statues (and totems): (0/1)
10. Evidence of anthropomorphic figurines: (0/1)
11. Evidence of zoomorphic figurines: (0/1)
12. Evidence of association between food with ritual: (0/1)
13. Evidence of feasting: (0/1)
14. Evidence of an association between food and taboo(s): (0/1)*
15. Evidence of in belief in sorcery/witchcraft/demons (malevolent spiritual forces): (0/1)*

* recorded only for eHRAF cultures

(Appendix 1: Codebook)

Table 3:6 the eHRAF OCM codes for general ritual characteristics

OCM Code	Description
628	inter-community relations
764	burial practices
766	special burial practices and funerals
767	mortuary Practices
771	general character of religion
778	scared objects and spaces
780 (780-789)	religious practice
795	sects
796	organised ceremonial
869	transmission of beliefs

3.4.4 Mortuary practices

This section of the database was used to record the mortuary practices of each culture using specific OCM codes (Table 3.7 and Appendix 1: Codebook). During the pilot study (section 3.3) it was found that a number mortuary practices could be employed to examine the cultures engaged in imagistic or doctrinal rituals. Mortuary rituals presented us with a set of material correlates that could be used in relation to both the eHRAF and the archaeology databases. Therefore, this section used categories of absence/presence (0 /1) to identify and record the mortuary practices of each culture. The material correlates categories used to record the mortuary practices of each culture were:

1. Evidence of the standardisation of mortuary practices: (0=Absent 1=Present)
2. Evidence of cemetery burial/interment: (0 /1)
3. Evidence of non-cemetery burial/interment: (0 /1)
4. Evidence of intramural burial/interment: (0 /1)
5. Evidence of extramural burial/interment: (0 /1)
6. Evidence of burial in ritual building(s): (0 /1)

7. Evidence of monumental burial/interment: (0 /1)
8. Evidence of burial/interment in domestic context: (0 /1)
9. Evidence of single individual burial/interment: (0 /1)
10. Evidence of group burial/interment: (0 /1)
11. Evidence of flexed burial/interment: (0 /1)
12. Evidence of extended burial/interment: (0 /1)
13. Evidence of inhumation: (0 /1)
14. Evidence of cremation: (0 /1)
15. Evidence of secondary burial practice: (0 /1)
16. Evidence of grave disturbance: (0 /1)
17. Evidence of grave goods: (0 /1)
18. Evidence of skulls manipulation: associated with mortuary practices: (0 /1) Including:
    - evidence of skulls caching: (0 /1)
    - evidence of plastered skulls: (0 /1)
    - evidence of painting skulls: (0 /1)
    - evidence of post-mortem decapitation: (0 /1)
19. Evidence of burial associated with animals: (0 /1)
20. Evidence of special burial treatment: (0 /1)

(Appendix 1: Codebook)

Table 3:7 the eHRAF OCM codes for mortuary practice

OCM Code	Description
761	life and death
764	burial practices
766	special burial practices and funerals
767	mortuary practices
769	cult of the dead
771	general character of religion
778	scared objects and spaces
788	ritual
796	organised ceremonial

3.4.5 Social complexity

This section of the database was used to record the evidence of social complexity associated with each culture, using specific OCM codes (Table 3.8 and Appendix 1: Codebook). As explained in Chapter 1 section, 1.3.3 and Chapter 2, section 2 .6, different levels of social complexity are associated with the doctrinal and imagistic mode; with the doctrinal mode considered to reflect more hierarchically organised and complex human groups (Whitehouse 2000; 2002; 2004). Categories of social complexity including the presence of resource monopolisation, exchange networks and communal buildings were recorded in terms of absence or presence (0/1). Levels of community hierarchy and ritual hierarchy were recorded using a Likert scale (0, 1, 2, 3, >3), for the eHRAF cultures. The evidence of social inequality recorded as absent or present (1/0) is assessed in the context of the other categories in this section which are used cumulatively to establish if there is evidence of social equality in each ethnographic culture (Appendix 1: Codebook). During the pilot study (section 3.3) it was found that a number of general ritual characteristics and mortuary practices offer a method to examine the hierarchical or socially unequal structure of a number of cultures; for example, the presence of grave

goods or special burial treatment appeared to be indicative of status difference. These findings relate to a number of theoretical interpretation of mortuary practices relating to social status proposed by authors such as Binford (1971), Saxe (1970), Tainter (1978) and Parker Pearson (1982: 1999). For instance, Binford (1971) asserts that the form and complexity of the organizational characteristics of a society are directly reflected in the manner and structure of the mortuary practices of that society. Thus, the variability in mortuary practices equates to the variability in the forms and organisation of society. Similarly, Tainter (1978) suggests that in the context of a highly organised and ranked society the social disparities and complexities will be reflected in the treatment of the deceased—via an obvious high degree of diversity in mortuary practices. Furthermore, it is proposed that distinctions of rank are identifiable in terms of discernible differences in the effort and wealth expended in mortuary rituals; reflected by the method of treating the corpse, the nature of the grave goods and the extent or complexity of the burial. Generally, it is asserted that there is a direct relationship between the social rank of the deceased and the mortuary practices employed (Saxe 1970; Binford 1971; Tainter 1978; Parker Pearson 1982; 1999; Mount 1997).

Similarly, examples of resource monopolization and domestic architecture (size and/or elaboration) could be used to identify social inequality. Therefore, a number of mortuary practice material correlates, aspects of domestic architecture and evidence of resource monopolization were used to provide information in relation to social inequality (Table 3.8 and Appendix 1: Codebook). Pottery was included in the social complexity category as pottery represents a defining feature in the archaeology of the Neolithic transition, indicating a technical innovation that is directly associated with a new technical operation to develop a better way to store food or other material. In spite of the pottery being simple or very detailed it points to a storage system for food or other aspects of material. During the pilot study it was highlighted as an important separating variable in relation to aspects of craft specialization, food storage strategy, private food storage, resource

monopolization (social inequality), exchange networks and the storage of cultural knowledge. For this purpose, the presence of pottery was recorded. If you were to extend this aspect of the study using network analysis (e.g. Coward *et al*. 2010) pottery could be examined as (1) a material culture to track the trajectory of the Neolithic transition, in different regions; (2) to examine exchange networks: the exchange of ideas, technology and information. The material correlates used to record the level of social complexity were:

1. Evidence of social inequality: (0=absent 1=present)
2. Degree of sedentism: (0 /1)
3. Subsistence strategy variables: (0 /1)
4. Levels of community hierarchy*: (0 /1)
5. Evidence of resource monopolisation: (0 /1)
6. Evidence of permanent settlement: (0 /1)
7. Evidence of settled forager activity: (0 /1)
8. Evidence of nomadic pastoralism: (0 /1)
9. Evidence of temporary settlement: (0 /1)
10. Evidence of large(r) domestic dwellings: (0 /1)
11. Evidence of feasting: (0 /1)
12. Evidence of craft specialisation: (0 /1)
13. Evidence of pottery: (0 /1)
14. Evidence of exchange networks: (0 /1)
15. Storage of cultural knowledge: (0 /1)
16. levels of religious hierarchy*: (0 /1)
17. Evidence of interpersonal violence: (0 /1)
18. Evidence of single individual burial: (0 /1)
19. Evidence of grave goods: (0 /1)
20. Evidence of special burial treatment: (0 /1)

21. Evidence of cemeteries: (0 /1)

* recorded only for eHRAF cultures

(Appendix 1: Codebook)

Table 3:8 the eHRAF OCM codes for social complexity/inequality

OCM Code	Description
341	architecture
342	dwellings
346	religious and educational structures
362	housing
560	social stratification
622	community heads
628	inter-community relations
682	offenses against life
683	offenses against the person
631	territorial hierarchy
681	sanctions
764	burial practices
766	special burial practices and funerals
767	mortuary practices
769	cult of the dead

3.4.6 Sharing avoidance

This section of the database was used to record the evidence of sharing avoidance or theft control observable in each eHRAF culture using specific OCM codes (Table 3.9 and Appendix 1: Codebook). During a pilot study (sections 3.3) it was observed that the location of food storage and evidence of private or communal cooking seemed to reflect variables that could be used to distinguish imagistic or doctrinal cultures. For instance,

the doctrinal mode is associated with increased privatization (Whitehouse 2002; 2004). Therefore, it was decided to add a separate sub-category focussing on sharing avoidance as part of the social complexity section. This section used categories of absence or presence to identify and record the evidence of sharing avoidance or theft control in each eHRAF culture. The material correlates categories used to examine sharing avoidance and theft concerns were:

1. Evidence of communal food storage: (0 = absent, 1 = present)
2. Evidence of domestic/private food storage: (0/1)
3. Evidence of communal cooking area: (0/1)
4. Evidence of domestic/private cooking area: (0/1)

(Appendix 1: Codebook)

Table 3:9 the eHRAF OCM codes for sharing avoidance

OCM Code	Description
251	preservation and storage of food
252	food preparation
261	gratification and food control
264	eating
341	architecture
342	dwellings
362	housing

3.4.7 Community, ritual and monumental architecture

This section of the database was used to record the evidence of community, ritual and monumental architecture connected with each culture using specific OCM codes (Table 3.10 and Appendix 1: Codebook). During the pilot study (section 3.3), it was found that a number of doctrinal cultures had community buildings for both secular and ritual purposes. Furthermore, community architecture and large buildings are often associated with a greater level of social complexity in the archaeology of the Neolithic transition

(Kuijt and Goring-Morris 2002). Following the pilot study, it was decided to add a separate sub-category focussing on the evidence of community, ritual and monumental architecture to the social complexity category. This section of the database used categories of absence or presence to identify and record the occurrence of community, ritual and monumental architecture in each eHRAF culture. The material correlates used to identify the presence of community, ritual and monumental architecture were:

1. Evidence of communal building(s): (0=absent 1=present)
2. Evidence of communal ritual structures: (0 /1)
3. Evidence of communal ritual monuments/monuments in the landscape: (0 /1)
4. Evidence of large statues (and totems): (0 /1)

Table 3:10 the eHRAF OCM codes for architecture

OCM Code	Description
340	structures
341	architecture
344	public structures
346	religious and educational structures
621	community structures
628	inter-community relations

3.5 Methods for sampling and assembling the archaeological data

This section outlines the recording and categorising strategies employed for the archaeological material used in this research project. It details (1) the sampling approach used to generate an appropriate representative sample from each region under investigation and (2) the specific aspects of material culture that were used to construct the archaeological databases.

3.5.1 Chronology associated with the archaeological samples

For the south-west Asia sample, the periods under examination in this research include the Epipalaeolithic cultural complex and the Neolithic cultural complex consisting of the Pre-Pottery Neolithic A (PPNA), the Pre-Pottery Neolithic B (PPNB), the Pre-Pottery Neolithic C (PPNC) and the Pottery Neolithic (PN) periods (Twiss 2007; Verheoven 2004; Kuijt and Goring-Morris 2002; Banning 1998; Bar-Yosef and Rollefson 1998) (Table 3.11). For the north-west European archaeological sample the periods under examination include: the Early, Middle and Late Mesolithic, as well as Early, Middle and Late Neolithic (Table 3.12).

Table 3:11 South-west Asian chronology based on dated cultural horizons (Bellwood 2005; Fuller *et. al* 2011; Maher *et al.* 2012)

Archaeological Period	**Calibrated Years BP**	**Years BC**
Epipalaeolithic	22,000-11,700	20,000-9,700
Early	22,000-17,500	20,000-15,500
Middle	17,500-14,500	15,500-12,500
Late	14,500-11,700	12,500-9,700
PPNA	11,700 – 10,500	9,700 – 8,500
PPNB	10,500- 8,700	8,500- 6,700
Early PPNB	10,500 – 10,100	8,500 – 8,100
Middle PPNB	10,100 – 9,250	8,100 – 7,250
Late PPNB	9,250 – 8,700	7,250 – 6,700
PPNC	8,700 – 8,250	6,700 – 6,250
PN	8,250- 7,300	6,250-5,300

Table 3:12 European chronology based on dated cultural horizons (Larsson 1990; Price 1991; Cooney 2007; Weninger *et al.* 2009; Martinsson-Wallin and Wallin 2010; Cooney *et al.* 2011 Connell and Warren 2011; Whittle 2011)

Region	Archaeological Period	Calibrated Years BP	Calibrated Years BC
Southern Scandinavia	Early Mesolithic	10,000-8,000	8,000-6,000
	Late Mesolithic	8,000-5,900	6,000-3,900
	Early Neolithic	5,900–5,300	3,900–3,300
	Middle Neolithic	5,300–4,300	3,300–2,300
	Late Neolithic	4,300–3,700	2,300–1,700
Ireland	Early Mesolithic	9,000-7,500	7,000-5,500
	Late Mesolithic	7,500-6,000	5,500-4,000
	Early Neolithic	6,000-5,200	4,000-3,200
	Middle Neolithic	5,200-4,800	3,200-2,800
	Late Neolithic	4,800-4,500	2,800-2,500

3.5.2 Selection of archaeological site-phases

The archaeological aspect of this research focused on the collection, categorisation and analysis of a sample of previously excavated and documented archaeological sites from the Early Epipalaeolithic to the Pottery Neolithic from south-west Asia and from the Early Mesolithic to the Late Neolithic in north-west Europe (southern Scandinavia and Ireland respectively) (Table 3.13 and 3.14). The Southern Scandinavian and Irish site-phases were chosen as it was a focus of the project to compare the south-west Asian sites-phases with the areas of Western Europe that represent the final phase of the Neolithic transition in Europe. Originally, the project was going to utilise Irish sites (only); however, (during the pilot study described in sections 3.3) it was decide to include a number of sites from Southern Scandinavia due to its superior Mesolithic archaeological record, compared to the Irish archaeological record. It should be noted that archaeological information relating to ritual and subsistence practices for six of the south-west Asian sites used in this study were partially recorded by Camilla Mazzucato at the *institute of*

Cognitive and Evolutionary Anthropology, University of Oxford as part of a collaborative research project in 2012. The six sites were: Tell 'Abr, Aşıklı Höyük, Boncuklu, Çatalhöyük, Dja'de and Hilazon Tachtit.

A selective sampling strategy was employed to gather the archaeological data used in this DPhil research project. The selective sampling strategy was based on the level of archaeological documentation available for each of the site-phases—to achieve a sample that reflects the available archaeological material in terms of the material correlates under examination (ritual, subsistence and social complexity data). This sampling method was decided upon following a pilot study which set out to examine what aspects of material culture could be used to integrate both archaeological and eHRAF data to examine the hypothesis central to this thesis. As I could not ascertain ritual frequency or dysphoric arousal information from the archaeological data, the sample had to maximise the ritual activity data that could be recorded and statistically analysed for each archaeological region (and could be integrated with the eHRAF material correlates database). This selective sampling strategy was designed so that a substantial number of site-phases could be included representing each of the archaeological periods under investigation. The archaeological data for this thesis were gathered by analysing available published archaeological reports; published books and journals relating to each site-phase included in the databases (see site-phase bibliography). The selection criteria for the archaeological site-phases from each region centred, primarily, on two related aspects (1) the availability and the accessibility of published material through excavation reports, journals and books which could be accessed through Oxford or associated library resources and (2) the presence of material culture relating to the ritual, subsistence and social complexity data for each site-phase. The specific factors that were applied to the selective sampling strategy were divided into primary and secondary factors. The primary factors that influenced the selection criteria were (1) the accessibility of the material via excavation reports, Journals and online sources; (2) the appropriateness of the material in terms of

collecting data relating to the ritual, subsistence and social complexity data; and (3) the necessity to achieve a representative sample from each region that could be subject to statistical analysis. Based on the outlined primary criteria, circa 100 sites were score on a 0 to 5 scale; based on (1) the accessibility of site (site-phase) information including excavation reports, peer-reviewed Journals, published books and online resources which were score on a 0 to 2 scale (0 = poor accessibility, 1 = medium accessibility, 2 = good accessibility) and (2) the presence of ritual, subsistence and social organisation data which were scored in terms of absence or presence (0/1) (e.g., Appendix 2). By employing this method of scoring to the sample of site-phases, it was possible to catalogue the sites from each region that were well documented and that would provide archaeological evidence relating to to ritual, subsistence and social complexity.

A set of region-specific secondary factors was employed to achieve a representative sample. For the selection of the south-west Asian site-phases, four secondary selection criteria were employed; which were to include: (1) a representative sample of site-phases from each period (Epipalaeolithic to Pottery Neolithic); (2) a sample of PPNB *megasites* as these represent well excavated site-phases with a comparatively large populations; (3) a set of sites with continuity of site-phases (from Epipalaeolithic to Neolithic); and (4) a representative sample of previously excavated, newly excavated and re-analysed sites. For the selection of the north-west European site-phases, five secondary selection criteria were employed to attain a demonstrative sample which would comprise of: (1) a representative sample of site-phases from each period; (2) a sample of megalithic sites as these sites represent well excavated sites with ritual activity; (3) a sample of sites from the *INSTAR Cultivating Societies Project* (Whitehouse *et al.* 2010) as one of my supervisors (Professor Bogaard) was directly involved in the analysis of material from this set of sites; (4) sites with a continuity of site-phases (Mesolithic to Neolithic); and (5) a representative samples of previously excavated, newly excavated and re-analysed sites. An example of the site selection process is given in appendix 2 which presents the

scoring of the sample of initially targeted Irish sites that resulted in the selection of the Irish sites that were used in this research. In the example, 11 sites are marked with an additional *inst* indicating that the 11 sites were part of the *INSTAR Cultivating Societies Project*. In the example given in appendix 2, a selection of 34 Irish sites representing both the Mesolithic and the Neolithic cultural complexes were reduced to 16 sites based on the primary and secondary selection criteria outline in this section. In total, data from 74 previously excavated and documented archaeological sites representing 111 site-phases formed the archaeological component of this research project: 44 archaeological sites (64 site-phases) from the Early Epipalaeolithic to the Pottery Neolithic from south-west Asia, and 30 archaeological sites (42 site-phases) from the early Mesolithic to the late Neolithic in north-western Europe (Tables 3.13 and 3.14).

Table 3:13 south-west Asian site-phases

Site–phase no.	site	Phase
1.	Abu Hureyra I	Late Epipalaeolithic
2.	Abu Hureyra II	PPNB
3.	Ain Ghazal I	PPNB
4.	Ain Ghazal II	PPNB
5.	Ain Ghazal III	PPNC
6.	Ain Ghazal IV	PN
7.	Ain Mallaha (cave)	Late Epipalaeolithic
8.	Ain Rahub	PN
9.	Asikli höyük - Musular	PPNB
10.	Atlit Yam	PPNC
11.	Basta	PPNB
12.	Beidha I	Middle Epipalaeolithic
13.	Beidha II	PPNB
14.	Buncuklu	PPNB
15.	Cafer Höyük	PPNB
16.	Çatalhöyük I	PPNB
17.	Çatalhöyük II	PN
18.	Cayonu I	PPNA
19.	Cayonu II	PPNB
20.	Dhra	PPNA
21.	Dja'de	PPNB
22.	Ein Gev I	Early Epipalaeolithic
23.	Gilgal I	PPNA
24.	Gobekli Tepe I	PPNA
25.	Gobekli Tepe II	PPNB
26.	Hallan Cemi	PPNA
27.	Hatoula I	Epipalaeolithic
28.	Hatoula II	PPNA
29.	Hayonim Cave I (cave)	Late Epipalaeolithic
30.	Hayonim Cave II (cave)	Late Epipalaeolithic
31.	Hayonim Terrace	Late Epipalaeolithic
32.	Hilazon Tachtit (cave)	Middle Epipalaeolithic
33.	Iraq Ed-Dubb	PPNA
34.	Jebel Abu Thwwab	PN
35.	Jerf el Ahmar	PPNA
36.	Jericho I	PPNA

Site–phase no.	site	Phase
37.	Jericho II	PPNB
38.	Kfar Hahoresh	PPNB
39.	Kharaneh IV	Late Epipalaeolithic
40.	Khirbet Hammam	PPNB
41.	Kortik	PPNA
42.	Mureybit I	Late Epipalaeolithic
43.	Mureybit II	Late Epipalaeolithic
44.	Mureybit III	PPNA
45.	Mureybit IV	PPNB
46.	Netiv Hagdud	PPNA
47.	Nevali Cori	PPNB
48.	Neve David	Middle Epipalaeolithic
49.	Ohalo II	Early Epipalaeolithic
50.	Shu'eib I	PPNB
51.	Shu'eib II	PPNC
52.	Shu'eib III	PN
53.	Tell 'Abr	PPNA
54.	Tell Aswad II	PPNB
55.	Tell el-Kerkh I	PPNB
56.	Tell el-Kerkh II	PN
57.	Tell Halula	PPNB
58.	Tell Qaramel	PPNA
59.	Tell Ramad I	PPNA
60.	Tell Ramad II	PPNB
61.	Tell Ramad III	PN
62.	Wadi Faynan (WF16)	PPNA
63.	Wadi Hammeh 27	Late Epipalaeolithic
64.	Yiftahel	PPNB

Table 3:14 North-west European site-phases

Site–phase no.	site	Phase	Sub- Phase
1	Bjørnsholm	Mesolithic	Late Mesolithic
2	Bjørnsholm	Neolithic	Early Neolithic
3	Grøbygard	Neolithic	Middle Neolithic
4	Norsminde	Mesolithic	Late Mesolithic
5	Norsminde	Neolithic	Early Neolithic
6	Stranvägen	Mesolithic	Late Mesolithic
7	Tågerup	Mesolithic	Middle Mesolithic
8	Tågerup	Mesolithic	Late Mesolithic
9	Vedbaek	Mesolithic	Middle Mesolithic
10	Vedbaek	Mesolithic	Late Mesolithic
11	Mosegården	Neolithic	Early Neolithic
12	Karlsfält	Neolithic	Middle Neolithic
13	Sarup I	Neolithic	Early Neolithic
14	Sarup II	Neolithic	Middle Neolithic
15	Sarup III	Neolithic	Middle Neolithic
16	Lindebjerg	Neolithic	Middle Neolithic
17	Tybrind Vig	Mesolithic	Late Mesolithic
18	Skateholm II	Mesolithic	Late Mesolithic
19	Skateholm I	Mesolithic	Late Mesolithic
20	Tustrup	Neolithic	Middle Neolithic
21	Ferslev	Neolithic	Middle Neolithic

Site–phase no.	site	Phase	Sub- Phase
22	Clowanstown 1	Mesolithic	Late Mesolithic
23	Clowanstown 1 (Peat Layer F11/F22)	Neolithic	Early Neolithic
24	Clowanstown 1	Neolithic	Early Neolithic
25	Gortore	Mesolithic	Late Mesolithic
26	Gortore	Neolithic	Early Neolithic
27	Lough Boora	Mesolithic	Early Mesolithic
28	Mount Sandel	Mesolithic	Early Mesolithic
29	New Ferry	Mesolithic	Late Mesolithic
30	Ballynagilly	Neolithic	Early Neolithic
31	Ashley Park	Neolithic	Middle Neolithic
32	Tankardstown	Neolithic	Early Neolithic
33	Poulnabrone	Neolithic	Middle Neolithic
34	Lough Gur	Neolithic	Late Neolithic
35	Ceide Fields System	Neolithic	Early Neolithic
36	Carrowmore	Neolithic	Early Neolithic
37	Lyles Hill	Neolithic	Late Neolithic
38	Gransha (site 11 & 12)	Neolithic	Early Neolithic
39	Ballintaggart	Neolithic	Early Neolithic
40	Brú Na Bóinne Complex	Neolithic	Early Neolithic
41	Brú Na Bóinne Complex	Neolithic	Middle Neolithic
42	Brú Na Bóinne Complex	Neolithic	Late Neolithic

3.5.3 Categorising and recording the archaeological data

A major part of the archaeological database construction was to parallel the eHRAF (material correlate) database, so that integrated analysis could be carried out. To achieve a complete record of the archaeological data from each region and to gather data that could be integrated with the ethnographic database, data were collected on a site-phase basis using *Microsoft Access* databases and using the same seven categories as were used to record the eHRAF data:

1. General information
2. Subsistence information
3. General ritual characteristics
4. Mortuary practices
5. Social complexity
6. Sharing avoidance
7. Community, ritual and monumental architecture

   Section 3.4 and codebook (Appendix 1)

The data gathering procedure for the archaeological site-phases is outlined in the codebook (Appendix 1). General site information recorded included site location, region, site-phase, radiocarbon dates for the site phase, archaeological period, estimated population, taphonomic conditions, and bone preservation (based on the criteria set out by Jans *et al.* (2002) (See below and Appendix 1). As with the ethnographic (eHRAF) cultures, the archaeological site-phases were categorised according to three population measures (1) populations less the 150 people, (2) populations between 150 and 500 people; and (3) populations between 500 and 5,000 people (for discussion of the methodological approach used, see section 3.6). In addition, the period(s) of excavation and publication(s) for each site-phase were recorded. Subsistence strategy was recorded on a site-phase basis in relation to a number of criteria. The subsistence strategy in relation to hunting, gathering, fishing and agriculture, was recorded in terms of their

absence or presence (0/1) (See below and Appendix 1). The intensity of crop cultivation and animal management were both recorded on a 0-2 scale (See below and appendix 1). Using this approach I could assess the subsistence strategy, intensity of agricultural practices and resource management at each site-phase. Archaeological evidence relating to ritual activity and mortuary practices was recorded on a site-phase basis (See below and Appendix 1). Ritual material culture was recorded in terms of general ritual activity and specific mortuary data. As in the eHRAF database, mortuary material culture was used to examine both ritual activity and aspects of social inequality visible in the burial record. A number of variables relating to social complexity and equality were recorded on a site-phase basis in the *access* databases. For example, categories of social complexity included the absence or presence of resource monopolisation, exchange networks and communal buildings (See below and Appendix 1). A number of categories such as domestic architecture, resource monopolisation and burial evidence such as special burial treatment and grave goods were used to assess social inequality. Sharing avoidance or theft control was recorded using absence or presence of communal or private food storage and evidence of communal or private cooking (See below and Appendix 1). As in the eHRAF database, a section of the archaeological databases was used to record the evidence of community, ritual and monumental architecture connected with each culture (See below and Appendix 1), using scores of absence or presence.

General information

1. Name of archaeological site (site-phase)*: Name given in the published literature.
2. Geographic region: This is the continent that the site-phase is located on
3. Geographic sub-region: This includes as much regions/local information as possible.
4. Archaeological period*: Calibrated Years BP and Calibrated Years BC.

5. Absolute dating*: Date given in published material following radiocarbon or AMS dating of each site-phase.

6. Site phase cultural horizon*: Cultural horizon that the site-phase has been assigned to following dating and material culture evidence, e.g. Late Mesolithic.

7. Estimated area of settlement *: The estimated dated occupation/settlement area excavated, surveyed and reported upon in the literature/available sources (rather than just the excavated trenches) in meters squared (m^2) or hectares (ha). With 1 m^2 equal to 0.0001 hectares.

8. Time of excavation of material(s) used*: The period of (1) excavation and/or (2) different period of excavations in calendar years.

9. Preservation conditions (description)*: Record the description of the site-phase given in the literature in terms of its composition: (1) the soil type ranging from sand to clay; (2) Inclusions in the soil e.g. stones and charcoal: (3) the colour of the soil; (4) the recorded acidity or basicity using ph. level.

10. Bone preservation conditions (description) *: bone preservation based on the percentage of collagen remaining. This category is based on the original collagen in bone which accounts for 30% of bone composition. It is recorded in terms of three categories, following Jans *et al.* (2002):

    a) Poor preservation: <30% of original collagen remaining
    b) Moderate preservation: 30-60% of original collagen remaining
    c) Good preservation: > 60% of original collagen remaining

    (Jans *et al.* 2002)

11. Estimated average population: (1, 2, 3) disused in section 3.6

12. Degree of sedentism: (0, 1, 2).

* recorded only for archaeological site-phases

(Appendix 1: Codebook)

Subsistence information

1. Hunting: (0 = absent, 1 = present)
2. Gathering: (0/1)
3. Fishing: (0/1)
4. Animal husbandry: (0/1)
5. Animal domestication: (0,1,2)
6. Cultivation/agriculture: (0/1)
7. Crop cultivation intensity: (0,1,2)
8. Evidence of settled forager activity: (0/1)
9. Evidence of nomadic pastoralism: (0/1)
10. Food storage strategy: (0, 1, 2, 3)

(Appendix 1: Codebook)

General ritual characteristics

1. Evidence of ritual standardisation: (0 = absent, 1 = present)
2. Level of ritual standardisation: (0, 1, 2)
3. Evidence of ritual practitioner (s) : (0/1)
4. Evidence of the standardisation of mortuary practices: (0/1)
5. Evidence of ritual domestic space: (0/1)
6. Evidence of communal ritual buildings (not monuments): (0/1)
7. Evidence of communal ritual monuments/monuments in the landscape: (0/1)
8. Evidence of large statues (and totems): (0/1)
9. Evidence of anthropomorphic figurines: (0/1)
10. Evidence of zoomorphic figurines: (0/1)
11. Evidence of association between food with ritual: (0/1)
12. Evidence of feasting: (0/1)

(Appendix 1: Codebook)

Mortuary practices

1. Evidence of the standardisation of mortuary practices: (0=Absent 1=Present)
2. Evidence of cemetery burial/interment: (0 /1)
3. Evidence of non-cemetery burial/interment: (0 /1)
4. Evidence of intramural burial/interment: (0 /1)
5. Evidence of extramural burial/interment: (0 /1)
6. Evidence of burial in ritual building(s): (0 /1)
7. Evidence of monumental burial/interment: (0 /1)
8. Evidence of burial/interment in domestic context: (0 /1)
9. Evidence of single individual burial/interment: (0 /1)
10. Evidence of group burial/interment: (0 /1)
11. Evidence of flexed burial/interment: (0 /1)
12. Evidence of extended burial/interment: (0 /1)
13. Evidence of inhumation: (0 /1)
14. Evidence of cremation: (0 /1)
15. Evidence of secondary burial practice: (0 /1)
16. Evidence of grave disturbance: (0 /1)
17. Evidence of grave goods: (0 /1)
18. Evidence of skulls manipulation: associated with mortuary practices: (0 /1) Including:
    - evidence of skulls caching: (0 /1)
    - evidence of plastered skulls: (0 /1)
    - evidence of painting skulls: (0 /1)
    - evidence of post-mortem decapitation: (0 /1)
19. Evidence of burial associated with animals: (0 /1)
20. Evidence of special burial treatment: (0 /1)

(Appendix 1: Codebook)

Social complexity/inequality

1. Evidence of social inequality: (0=absent 1=present)
2. Degree of sedentism: (0 /1)
3. Subsistence strategy variables: (0 /1)
4. Evidence of resource monopolisation: (0 /1)
5. Evidence of permanent settlement: (0 /1)
6. Evidence of settled forager activity: (0 /1)
7. Evidence of nomadic pastoralism: (0 /1)
8. Evidence of temporary settlement: (0 /1)
9. Evidence of large(r) domestic dwellings: (0 /1)
10. Evidence of feasting: (0 /1)
11. Evidence of craft specialisation: (0 /1)
12. Evidence of pottery: (0 /1)
13. Evidence of exchange networks: (0 /1)
14. Storage of cultural knowledge: (0 /1)
15. Evidence of interpersonal violence: (0 /1)
16. Evidence of single individual burial: (0 /1)
17. Evidence of grave goods: (0 /1)
18. Evidence of special burial treatment: (0 /1)
19. Evidence of cemeteries: (0 /1)

(Appendix 1: Codebook)

Sharing avoidance/theft control

1. Evidence of communal food storage: (0 = absent, 1 = present)
2. Evidence of domestic/private food storage: (0/1)
3. Evidence of communal cooking area: (0/1)
4. Evidence of domestic/private cooking area: (0/1)

(Appendix 1: Codebook)

Community, ritual and monumental architecture

1. Evidence of communal building(s): (0=absent 1=present)
2. Evidence of communal ritual structures: (0 /1)
3. Evidence of communal ritual monuments/monuments in the landscape: (0 /1)
4. Evidence of large statues (and totems): (0 /1)

(Appendix 1: Codebook)

3.6 Estimating population size from archaeological material

Following a pilot study, to test their effectiveness, it was decided to categorise the ethnographic (eHRAF) cultures and archaeological site-phases according to three broad population categories; (1) populations less the 150 people, (2) populations between 150 and 500 people; and (3) populations between 500 and 5,000 people (Section 3.3.1).

As I was dealing with a large cross-cultural sample, it was necessary to find methods of population estimation that would facilitate the categorisation of population size that could be employed cross-culturally. For the eHRAF samples in this research, the population sizes were supplied for each culture via the eHRAF database. Since estimates of population size were not always available for the archaeological site-phases, it was important to find a standard method to estimate the population size.

A number of methods have been presented for the purpose of estimating population sizes in both hunter-gatherer and agriculturalist populations based on information available in the archaeological record (Howells 1960; Naroll 1962; Cook and Heizer 1965: 1968; Turner and Lonfgren 1966; Jamieson 1971; Asch 1975; Hassan 1978; Schacht 1980; 1981; Buikstra 1981; Schact 1981; Bocquet-Appel and Masset 1982; Ubelaker 1974; Buikstra and Konigsberg 1985; Konigsberg and Frankenberg 1992; Hoppa and Vaupel 2002; Bocquet-Appel and Naji 2006; Chamberlain 2006; Shennan and Edinborough

2007; Bocquet-Appel 2008; Isaakidou and Tomkins 2008; Whitelaw 2011). The size of a population that once occupied an individual archaeological site or a region can be determined through the analysis of numerous types of archaeological settlement data including artifact dispersal, food refuse dispersal, potential food yield, burials, ethno-historical data and settlement area (Colton 1932; 1949; Hack 1942; Naroll 1962; Cook and Heizer 1965: 1968; Turner and Lonfgren 1966; Plog 1975; Kohler 1978; Hassan 1981; Kolb 1985; Hosfield 1999; 2005; Scarre 2001; Ashton and Lewis 2002 and Gallivann 2002). For example, estimation of population size based on mortuary data is often utilized at archaeological sites (Howells 1960; Jamieson 1971; Asch 1976; Buikstra *et al.* 1981; Schact 1981; Bocquet-Appel and Masset 1982; Ubelaker 1974; Buikstra and Konigsberg 1985; Konigsberg and Frankenberg 1992; Hoppa and Vaupel 2002; Bocquet-Appel and Naji 2006; Bocquet-Appel 2008; Chamberlain 2006). The methods are often based on determining the total number of burials, the years represented by the burials (or the period of occupation) and the average age at death. However, issues with this method of population estimation method include the preservation of the remains, the determination of the duration of occupation represented by the burials and the (in)ability to identify population fluctuations (Asch 1976; Hassan 1981; Me-Bar and Valdez 2004; Shennan and Edinborough 2007; Chamberlain 2006).

3.6.1 Estimating hunter-gatherer population size from archaeological evidence

The size of a hunter-gatherer group is a function of the optimal size required for a stable organisational unit based on daily face to face relations, which is advantageous for cooperation in hunting, locating food and defence (Calhoun 1970). Calhoun (1970) estimates that 12 adults represent the minimum stable unit which would amount to a group size of 27 persons. A number of estimates of the population size and density of hunter-gatherer populations have been made based on the calculation of resource yield versus the estimated level of consumption, resulting in a person per unit area estimation of a population; these include Kroeber (1953), Steward (1955), Baumhoff (1962),

Harrison *et al* (1964), Lee (1969), Burch (1972), Casteel (1972), Turnbull (1972) and Yessner (1977). For example, Kroeber (1953) estimated a population density of 0.05 persons/Km^2 for *Ojibwa*, north-eastern Native American groups, using the formula: *Population density (PD) = f(R, E) ÷ L*: where *R* is resource potential/optimal yield, *E* is food extractive potential or yield from the most abundant food source and *L* is the level of consumption [using Clarke and Haswell's (1964) estimate of the average calorie intake for a hunter-gatherer as 2,200 calories/person/day]. Casteel (1972; 1973; 1976; 1979) presents a number of estimations based on factors including the net productivity of terrestrial biomes, the rate of extraction, the trophic levels of consumption and the rate of consumption/person/year. For example, Casteel (1972; 1973; 1976; 1979) estimates the population size of hunter-gather groups for a year (P max) in a region as:

$$\text{P max} = \sum_{i=1}^{n} (\text{Zi Nj}) + \text{F} + \text{S}$$

Where *Zi* is the percentage of the annual cycle spent in in a given ecosystem, *Nj* is the trophic level, *F* is the terrestrial resource and *S* is energy of food items. However, the estimates produced by Casteel rely on data such as *the percentage of the annual cycle spent in in a given ecosystem*, a statistic which is often difficult to discern in archaeological contexts.

In examples where a number of the criteria that can be potentially used for population estimation may not be present, it is suggested that population size estimations based on the mathematical relationship between the area of a campsite and the population size of hunter-gatherer groups can be employed (Cook 1972; Hassan 1981). Cook (1972) suggests that, for hunter-gatherer groups specifically, the mathematical relationship between population and area can be accurately estimated via the formula: $P = 2.9379\ A^{.37}$ where $A^{.37}$ is the area of the campsite in m^2 raised to the power of 0.37. Cook's equation has been applied to a number of prehistoric hunter-gatherer groups. For example, using

this equation Hassan (1981) refined the population size estimation for 44 north-west European Mesolithic sites [originally estimated by Newell (1973)]. As the area of the site is available in the excavation and published sources for all of the Mesolithic/Epipalaeolithic site-phases, the formula $P = 2.9379\ A^{.37}$ was used in this research to estimate the population size for each of the pre-Neolithic site-phases.

3.6.2 Estimating agricultural population size from archaeological evidence

It is generally accepted that the population increased greatly as the agricultural transition progressed in both south-west Asia and Europe (Ammerman and Cavalli-Sforza 1984; Goring-Morris 2002; Bentley *et al*. 2003; Gkiasta *et al.* 2003; Richards 2003; Whittle 2003; Bellwood 2005). Agricultural groups generally consist of large local units and very large regional aggregates, with local units of population sizes ranging from 50-200 persons. In agricultural societies there is often a hierarchy of settlements including hamlet, village and large (more urban) centres with population sizes ranging from 50 people in the hamlet to thousands of people in the associated larger centres (Barclay 1971; Johnson 1972; Sanders 1972; Marcus 1976). The population size that can be supported by an agricultural economy is based on a variety of factors including: the area or arable land, the system of land management, the technology employed, the net yield of agricultural products, the consumption rates of individuals in the group, as well as a mixture of environmental and socio-cultural factors (Hassan 1981; Kosse 1990; 1994; Johnson and Earle 2000; Kuijt 2000; Binford 2001; Kuijt and Goring-Morris 2002; Whittle 2003; Bellwood 2005; Isaakidou and Tomkims 2008; Bogaard and Isaakidou 2010; Whitelaw 2011). Environmental factors include climate and the sustainability of the land being utilised, whereas socio-cultural factors include the availability of labour, the resource management system, the food productions strategy and the storage strategy (*Ibid*). A number of researchers have presented formulae for estimating the size of agricultural populations, including Allan (1945; 1967), Conklin (1959), Carneiro (1960), Cowgill (1962), Gourou (1966), Rappaport (1968), Zubrow (1971) and Cook (1972),

Hassan 1981, Zorn (1994) and Isaakidou and Tomkins (2008). For example, Carneiro (1960) advocates estimating the population size of agricultural groups using the formula:

$$\text{Population size } (P) = \frac{(TY)x^2}{R+Y} \div A$$

Where *T* is the total area of arable land, *Y* is the productive lifespan of the plot, *R* is the length of fallow period in years and *A* is the area require per capita (acres/person). However, this method (similar to many methods) requires a substantial amount of information which is not always present in archaeological contexts. One of the most frequently employed methods is to estimate population size on the basis of house floor or living floor area (Naroll 1962; LeBlanc 1971; Casselberry 1974; Wiessner 1974; Rosenan 1978; Vita-Finzi 1978 Kramer 1982; Kolb 1985; Rosen 1986; Brown 1987; Dohm 1990; Zorn 1994 Porčić 2011; Whitelaw 2011). For example, Whitelaw (2011) uses a combination of the density of settlement, the average house size (circa 90 m^2), the overall site sizes 2.5 ha, and estimation of 5 individuals in a nuclear family to estimate a population of 200 persons/ha for the final Neolithic site-phases at Knossos. However, basing population calculations on dwelling information has a number of problems as this method requires an accurate assessment of the settlement's plan, the size of the average family and the number of families that occupy a single dwelling (Hassan 1981; Zorn 1994).

An alternative for estimating population size where limited site information is available is to utilize the mathematical relationship between population size and site area. Following the examination of a number of modern and ancient agriculturalist sites in south-west Asia, Kramer (1980) presents the equation $P = 146\sqrt{A}$: where $\sqrt{A}$ is the square root of the area (A) of the site-phase in hectares. This formula is mainly (but not exclusively) applicable to settled agricultural populations, and when tested using a sample 26 rural settlements in south-west Asia where settlement and population data had been recorded from 1940 to 1979, it confirmed previous population size estimates (which had been

based on different types of settlement information depending on each specific site). As the area of the site is available in the excavation and published sources for all of the Neolithic site-phases used in this research, the formula $P = 146 \sqrt{A}$ was used to calculate the Neolithic population sizes.

Therefore, to maintain uniformity in the population size estimation method across all 111 site-phases, the two formulae based on the area of site-phase were used; for the Mesolithic and Epipalaeolithic, hunter-gatherer site-phases $P = 2.9379\ A^{.37}$ and for the Neolithic site-phases $P = 146 \sqrt{A}$ respectively. This approach was employed as the area of the site is available in the literature for all of the archaeological site-phases used. The formulae were tested using the recorded ethnographic information. For example, the eHRAF informs us that the Trobriander islanders (from the eastern coast of New Guinea) live in hamlets which are grouped together to form discrete villages circa 2.5 to 3 ha with populations ranging from 200 to 500 people. The Trobrianders are sedentary agriculturalists focusing on yam harvesting. Using the population figure and area information provided by the eHRAF we could examine the accuracy of the formula $P = 146 \sqrt{A}$ [where P is the average population size and A is the area in hectares (ha); in this case using 2.5 ha]

$P = 146 \sqrt{2.5}$

$P = 146 \text{ X } 1.58113883$

$P = 231$

From this calculation we can see that the formula provides us with an estimation of population size of 231 people which reflects the figures provided by the eHRAF record. Similarly, the eHRAF informs us that the Tukano (located in the north-western Amazon region) are a hunter-gatherer group that live in a single, multi-family dwelling called a *MALOCA* or longhouse with a surrounding area of circa 0.50 to 1.5 ha, with populations ranging from 20 to 100 people. The Tukano are essentially semi-settled hunter-gatherers

who move location every four to five years. The Tukano subsistence strategy focuses on fishing, hunting, collecting, and garden horticulture. Using the population range figures and the settlement area estimate of 0.5 ha (which converts to 5000m^2) provided by the eHRAF we can check the accuracy of the formula $P = 2.9379\ A^{.37}$where *A* is the area of the site-phase in metres squared (m2).

$P = 2.9379\ A^{.37}$

$P = 2.9379X\ 5000^{\ .37}$

P = 2.9379 X 23.3678578234113774

P = 69

From this calculation it is evident that the formula provides an estimation of population size that reflects the figures provided by the eHRAF record.

To achieve a cross-cultural method of population estimation, two formulae based on the area of site-phase were used. This estimation of population is directly connected to the mathematical relationship between population size and site-phase/settlement area to estimate population size (as an estimate of community size)—with area taken to be the dated occupation/settlement area excavated, surveyed and reported upon in the literature/ available sources, not just the areas of the excavation trenches. Population is considered as the number of people at a given site-phase rather than an extended community which would have been difficult to determine over 111 site-phases. Therefore, the population size estimated at each site-phase is what was considered as the community. There are limitations with this approach as it does not enable me to consider the entire, extended community and it is dependent on the area of the site-phase. In spite of the limitations, this population estimation method was used as it represents an accessible calculation in relation to each site-phase (and the eHRAF cultures) and provides a method for comparing many site-phases across a region or between regions. As mentioned above, the

two formulae for estimating population were checked in relation to (1) the population size estimates provided by the literature for each of the archaeological site-phases and (2) the recorded ethnographic information regarding population estimates in a given area supplied via the eHRAF database (as outlined in chapter 3 section 3.6). The main potential limitations of population estimation in the research are outlined and discussed in Chapter 8 section 8.1.1.

3.7 Methods of data analysis

There are two interrelated aspects to the data recording and analysis strategy used in this research: database construction and statistical analysis.

3.7.1 Databases

Three databases were used to record and manage the ethnographic and archaeological material in this research. Firstly, a *Microsoft Access* database was used to record a set material correlates relating to ritual activity, social complexity and subsistence strategy from the 34 selected eHRAF cultures. Secondly, *Access* databases were used to record information from the 111 selected archaeological site-phases representing each region (section 3.4.2). In addition, an *Access* database was used to integrate the archaeological and the ethnographic data. The purpose of the databases was to generate data that could be utilised to test hypotheses statistically.

3.7.2 Designing a statistical framework for this thesis

To achieve a statistical framework for this research it was necessary to examine what aspects of the Modes of Religiosity theory could be employed to identify the imagistic and/or doctrinal mode in archaeological contexts. A number of previously tested assertions directly associated with the Modes of Religiosity theory (Whitehouse 2004; Atkinson and Whitehouse 2011) were used in this context.

3.7.3 Identifying the Independent and dependent variables

As explained in (Chapter 2, section 2.4), Whitehouse (2004) asserts that central to the modes theory is the relationship between *psychological features* (ritual frequency and

level of arousal and a set of cognitive mechanisms/devices related to the processing of ritual activity in the human mind) and a collection of *sociopolitical features*. For the set of psychological features, Whitehouse (2004) states that "there is no independent variable driving the rest, only a set of a conditions that some patterns of human activity manage to satisfy" (Whitehouse 2004, 75). Concerning the relationship between the *psychological features* and the *sociopolitical features,* it is asserted that "the activation of these psychological conditions provides the underlying cause of the distributed (population-level) effects depicted as the sociopolitical features of religion" (Whitehouse 2004, 75). Thus, it is asserted that there is a causal relationship between psychological conditions (effects of ritual activity) and the population-level, sociopolitical features (Whitehouse 2004). In stating both the centrality of ritual practices (centring on the underlying relationship between psychological conditions associated with ritual practice) and the population-level, sociopolitical characteristics, Whitehouse (2004) clearly defines the effects attributed to ritual activity as the independent variable and the population-level, sociopolitical characteristics as the dependent variable(s). For the purpose of the analysis and hypothesis testing in this thesis, the independent variable and dependent variables were defined as the material culture relating to ritual activity (independent variable), and the material culture relating to subsistence and social complexity as the (dependent variables), respectively.

3.7.4 Identifying the modes of religiosity via ritual variables using archaeological material

Fundamental to the Modes theory is the difference between the imagistic and doctrinal modes based on ritual frequency and level of dysphoric arousal (Whitehouse 2004). The *known* eHRAF cultures in this thesis were classified by Atkinson and Whitehouse (2011) based primarily on ritual frequency and dysphoric arousal levels. Ideally, the archaeological site-phases could be classified as imagistic or doctrinal based on the same criteria. However, as explained in Chapter 2, section 2.4.2, ritual frequency and dysphoric arousal level are problematic in archaeological contexts. To overcome this problem this

research used a set of ritual material correlate variables from the *known* set of eHRAF cultures to observe whether or not there is any commonality in (1) ritual material culture between the *known* eHRAF dataset and the *unknown* dataset of 111 site-phases; and (2) whether similar trends are apparent in the statistical analysis of the three datasets using the ritual variables. The purpose of this approach was to examine to what extent the archaeological ritual material culture could be used to predict/identify the mode of religiosity in the context of the agricultural transition in two distinct regions.

8.7.1. 3.7.4.1 Identifying the modes of religiosity via subsistence variables using archaeological material

As explained in Chapter 2, section 2.4.1, Atkinson and Whitehouse (2011) examined the relationship between agricultural intensity and the doctrinal mode. Their study was predicated on the assertion by Whitehouse (2004) that (1) highly arousing rituals should be less prevalent in societies that rely more on agriculture; and (2) dysphorically arousing rituals should be more prevalent in cultures that rely more on foraging and less on agriculture (because increased likelihood of food scarcity requires sharing resources and is thus susceptible to free-riding). Using hierarchical regression analysis, Atkinson and Whitehouse (2011) demonstrated that agricultural intensity is a significant cross-cultural predictor of dysphoric arousal i.e. mode of religiosity. Their result is particularly pertinent to this study as we are examining material culture directly associated with the agricultural transition. It is crucial to this study to explore to what extent agricultural (subsistence) variables can be used to predict mode of religiosity in the recorded archaeological cases.

8.7.2. 3.7.4.2 Identifying the modes of religiosity via covariance between ritual and socio-cultural variables using archaeological material

As outlined in Chapter 2, section 2.4.1, Whitehouse (2004) and Atkinson and Whitehouse (2011) identify a connection between ritual activity (frequency and arousal) and a number of society-level variables. It is asserted that the two modes constitute *attractor positions*

around which other socio-cultural variables cluster. They state clearly that ritual and society-level variables co-vary. Thus, it is proposed that, within the framework of the Modes theory, aspects of ritual activity, subsistence practices and social complexity should cluster predictably with respect to each mode of religiosity (Whitehouse 2004; Atkinson and Whitehouse 2011). This thesis examines to what extent the evidence (if any) of a covariance between socio-cultural variables can be utilised to identify cultures engaging in imagistic or doctrinal mode rituals in the recorded archaeological cases.

8.7.3. 3.7.4.3 Identifying the modes of religiosity via population size using archaeological material

Whitehouse (2004) suggests that types of ritual activity or religious framework are directly related to group size and human cognitive architecture. To examine the connection between population size and ritual activity, subsistence practices and social complexity, the ethnographic (eHRAF) cultures and the archaeological site-phases (categorised in terms of three population size measures: less the 150 people, between 150 and 500 people and between 500 – 5,000 people) were subject to statistical analysis. This approach was taken to enable us to examine to what extent (if any) population size is a good indicator of mode of religiosity.

3.8 Hypothesis testing

As stated in Chapter 1, sections 1.1, this DPhil research explores one particular hypothesis—namely, that the solidarity-generating effect of religious, ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in south-west Asia and north-western Europe. To test this hypothesis is was necessary to examine and quantify the extent to which the variables identified following principal component analysis (PCA) of the site-phases from each region provide us with evidence of a shift from an imagistic to a doctrinal mode of religiosity. PCA presents a statistical method to explore the relationship of individual eHRAF cultures or archaeological site-phases to

each other in terms of a specific set of identified variables (sections 3.9.2). For testing the hypothesis, generalised linear models (GLMs) (explained in sections 3.9.3) were employed (1) to examine which set of variables (ritual, subsistence and social complexity) reflect the best predictor of mode of religiosity and (2) to determine the percentage probability of each archaeological site-phase being indicative of an imagistic or doctrinal culture.

3.9 Statistical analysis

Due to the mixed numerical and categorical composition of the data, standard descriptive statistical methods such as measures of central tendency could not be used on the data set. Furthermore, to compare the *unknown* archaeological and *known* eHRAF sample, it was determined that a chi square (goodness of fit) test could not be utilised as the data were not entirely categorical. It was decided that three specific types of statistical analysis would be employed: multidimensional scaling (MDS), principal component analysis (PCA) and generalised linear modelling (GLM). It was decided that the datasets would be analysed separately using MDS and PCA (eHRAF, south-west Asian archaeology and European archaeology) as this approach would provide a more representative picture of the grouping and separation of the cases and the variables responsible for the separation in each dataset. The combined eHRAF and archaeological database was used to perform the GLM analysis (explained in section 3.9.3). The statistical analyses in this research were carried out in a specific order and are presented in this sequence in the following section. First, multidimensional scaling (MDS) provides a general picture of how the cases group and separate in relation to the recorded ritual, subsistence and social complexity variables. Secondly, principal component analysis (PCA) was used (1) to identify the specific set of ritual, subsistence and social complexity variables that were responsible for the separation and coalescing of cultures or site-phases and (2) to examine further the grouping and separation of the site-phases/eHRAF cultures based on the identified ritual, subsistence and social complexity variables. Lastly, generalised linear

modelling (GLM) was used (1) to examine which set of ritual, subsistence and social complexity variables (identified PCA) represents the best predictor of mode of religiosity in the absence of ritual frequency and arousal data and (2) to generate the percentage probability of each archaeological site-phase reflecting a culture engaged in an imagistic or doctrinal mode of religiosity.

3.9.1 Multidimensional scaling (MDS)

Multidimensional scaling (MDS) is a dimension reduction method that produces coordinates in dimensional space that best characterises the structure of a full distance/dissimilarity matrix (Miclaus 2015). Using a Gower similarity coefficient, MDS presents us with a method to analyse data that combines numerical and categorical data or multiattributed data (Gower 1978; Baxter 1994). For combined numerical and categorical data, the weight between two individuals is 1 if both individuals possess the same attribute—the Gower similarity compares two cases *i* and *j* and coefficient is defined as:

$$S_{ij} = \frac{\sum_K \left(W_{ijk} S_{ijk} \right)}{\sum_k \left(W_{ijk} \right)}$$

Where *Sij* is the similarity between two individual cases; where *Sijk* is the influence of the *k'th* variable, *wijk* is the weight of the *k'th* variable (0 or 1) (Gower 1972, Doran and Hodson 1975; Baxter 1994). Statistical analysis using the Gower similarity coefficient has been utilized in archaeological research to examine multiattributed data. For example, Ottoway (1983) used a Gower similarity coefficient approach to examine and chronologically classify a sample of prehistoric Cypriot weapons. Similarly, Palumbo (1987) used the Gower similarity coefficient to examine the relationship between mortuary practices and social structure at Early Bronze Age Jericho. In this DPhil research, MDS was used to examine the multivariate distance in terms of the similarity or dissimilarity by constructing a dissimilarity matrix of the data by employing a Gower similarity coefficient, using the *R-statistics package* (R development core team 2005).

MDS was employed to examine grouping patterns relating to a set of ritual activity, subsistence and social complexity variables from both the ethnographic cultures categorised as either doctrinal or imagistic (Atkinson and Whitehouse 2011) and the sample of the south-west Asian and north-west European archaeological site-phases. The variables from the ethnographic and archaeological datasets, respectively, were used to produce two-dimensional and three-dimensional dissimilarity matrices. The two-dimensional plots present the multivariate distances of the ethnographic cultures or individual archaeological site-phases on the first two principal components and the three-dimensional plot present the multivariate distances of individual archaeological site-phases or ethnographic cultures on the first three principal components. In addition, the eigenvalues which describe the percentage variability in the data are given for the three-dimensional plots. The eigenvalues show the percentage of information maintained when you reduce the data to three variable axes; when the MDS reduces the data to something that can be interpreted and represented on a plot (Davidson 1983).

MDS analysis was performed on ritual, subsistence, social complexity and a combination of all variables. For the ethnographic samples, MDS made it possible to assess to the extent to which the two modes of religiosity are distinguished in terms of material correlates reflecting ritual practices, subsistence practices and social complexity. To examine the archaeological material, MDS analysis provided a method to test whether or not archaeological site-phases from the same archaeological period group together predictably in relation to sets of ritual activity, subsistence practices and social complexity variables. Additionally, MDS was used to assess the degree of closeness of individual archaeological site phases or ethnographic cultures relating to the three population size categories used in this research (section 3.5). The specific variables causing separation and coalescence in the MDS analyses were examined further using principal component analysis.

3.9.2 Principal Component Analysis (PCA)

Principal component analysis is a multivariate technique that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components (Hotelling 1933; Jackson 1991; Jolliffe 2002; Saporta and Niang 2009; Abdi and Williams 2010). PCA makes it possible to display the pattern of similarity of the observations and of the variables as points in plots (Jolliffe 2002; Saporta and Niang 2009; Abdi and Williams 2010). The fundamental concept common to all principal component methods is "to describe a data set (*X* with *I* individuals and *K* variables) using a small number (S < K) of uncorrelated variables while retaining as much information as possible" (Husson *et al*. 2010, 1). In PCA, the first component accounts for the maximal amount of the total variance. Each succeeding component accounts for progressively smaller amounts of variance (*ibid*). The second component extracted will have two important characteristics (Esbensen and Geladi 1987; Ringner 2008). By definition, this second component will account for a maximal amount of variance in the data set that was not accounted for by the first component. Under typical conditions, this means that the second component will be correlated with some of the observed variables that did not display strong correlations with the first component (*Ibid*). Thus, the second characteristic of the second component is that it will be uncorrelated with the first component. The remaining component(s) that are identified in the analysis display the same two characteristics: (1) each component accounts for a maximal amount of variance in the observed variables that was not accounted for by the preceding component(s) and (2) each component is uncorrelated with all of the preceding components (*Ibid*). The correlation between a component and a variable estimates the information they share. In the PCA framework, this correlation is called a loading. The application of PCA to a dataset facilitates the extraction/identification of the dominant patterns in the matrix in terms of a complementary set of score and loading plots (Esbensen and Geladi 1987; Ringner 2008).

Although a large number of components may be extracted in this way, only the first few components will be important enough to be retained for interpretation. For the PCA used in this research project, correlation circles and factor maps were used to display the variables and the individual archaeological site phases or ethnographic (eHRAF) cultures in relation to the first two principal components. PCA presents a statistical method to explore the relationship of individual eHRAF cultures and archaeological site-phases to each other in terms of a specific set of identified set of variables. As the recorded ethnographic and archaeological information reflects categorical data (e.g., 0 or 1) and ordinal data (Likert scale), the variables were converted to normal quantile variables to give an attractable distribution (normal distribution), enabling standard PCA analysis to be performed. This is done by using the *FactoMineR* r-software package, which deals with both continuous and categorical data, which allocates normal quantiles to ordered data (e.g., recorded on a Likert scale).

PCA yields a correlation circle (variable factor map) and an individual factor map. The correlation circle presents the five most important variables that account for the variance in the data set relation to the first two principal components. The correlation circle presents a projection of the initial variables in the factor space (Abdi and Williams 2010). The variables are represented as vectors from the origin or centre and are surrounded by a unit circle. Each variable is a point whose coordinates are given by the loadings on the principal components. The variables are plotted as points in the component space in the correlation circle using their loadings as coordinates. The length of the vector gives an appreciation of how much that variable contributes to the first two principal components. The closer a variable is to the circle of correlations, the better we can reconstruct this variable from the first two components (and the more important it is to interpret these components); the closer to the centre of the plot a variable is, the less important it is for explaining the variance in the sample (Baxter 1994; Abdi and Williams 2010). The cosine of the angle (r) between any pair of variables is a measure of the correlation. On the

correlation circle when two variables are far from the centre then they can display one of three features:

1. the variables form an acute angle to each other: they are considered decidedly positively correlated (r close to 1);
2. the variables are orthogonal (90^0 degrees) to each other: they are considered not correlated (r close to 0)
3. the variables are on the opposite side of the centre of the correlation circle (180^0 degrees), forming an obtuse angle: they are considered extremely negatively correlated (r close to -1) (*ibid*).

For example, the cosine of a 90^0 angle is 0, so, two variables at 90^0 are said to be not correlated. If the angle between two variables is 60^0, then the cosine would be 0.5 and these are deemed to be positively correlated. A correlation of 1 indicates that one variable is entirely deducible from the other (Corsten and Gabriel 1976; Baxter 1994; Abdi and Williams 2010). The individual factor map presents the data (coloured, for example in this research, according to archaeological site-phase or mode of religiosity) plotted in relation to the first two principal components. The factor map demonstrates how individual cases (ethnographic cultures or archaeological site-phases) cluster with respect to the five variables that account for the maximum variance in the data set. The variability for each dimension is expressed in percentage on each axis (*ibid*). To achieve a comprehensive result, PCA was carried out for ritual, subsistence, social complexity and the entire set of variables for each database using mode of religiosity (for ethnographic cultures) and archaeological cultural horizons as the identifying factors—e.g., site-phases coloured in terms of archaeological cultural horizons.

3.9.3 Generalised Linear Modelling (GLM)

Generalised linear modelling (GLM) is a multilevel binary regression statistical technique that provides a model that best accounts for the variance observed in the sample

(McCullagh and Nelder 1989; Dobson 2002; Field 2005; Agresti 2007; Howell 2009). GLMs are mathematical extensions of linear models that allow for non-linearity and non-constant variance structures in the data (McCullagh and Nelder 1989; Hastie and Tibshirani 1990; Dobson 2002). They are based on an assumed relationship (link functions) between the mean of the response variable and the linear combination of the explanatory variables (McCullagh and Nelder 1989; Dobson 2002; Guisan *et al.* 2002). GLMs attempt to accommodate asymmetric variance or heterogeneity in the data by allowing for a range of distributional types; enabling us to work with many mean–variance relationships (McCullagh and Nelder 1989; Dobson 2002; Field 2005; Agresti 2007; Venables and Dichmont 2004). They provide a multivariate statistical method for the modelling of data that represents a number of probability distributions including: Gaussian, inverse Gaussian, normal binomial, negative binomial, Poisson and gamma distributions (Baxter 1994; Guisan *et al.* 2002; Venables and Dichmont 2004). GLMs are a particularly applicable statistical predictor models to analyse archaeological and ethnographic data which, more often, are not represented by classical Gaussian distributions. GLMs are fit to data by the method of maximum likelihood, providing the percentage probability that an *unknown* sample can be classed in terms of a particular *known* category (McCulloch 1997; Guisan *et al.* 2002).

In the context of this DPhil research, GLM offered a statistical method to test predictions regarding the similar causal history of the *known* eHRAF and the *unknown* archaeological data, providing a means of classifying each of the archaeological site-phases in terms of a percentage probability of being indicative of a particular mode of religiosity. GLMs were applied to the data recorded for this DPhil as:

1) GLMs can be employed to use a number of distributions for the response variable (McCullagh and Nelder 1989; Guisan *et al.* 2002);

2) they accommodate more general qualitative and semi-quantitative (ordinal) response variables based on a series of binary regressions (Davis and Goetz 1990; Guisan and Harrell 2000);
3) they are applied to data by the method of maximum probability, providing not only estimates of the regression coefficients but, also, estimated asymptotic standard errors of the coefficients, resulting in the generation of a percentage probability classification (McCullagh and Nelder 1989; Guisan *et al.* 2002); and
4) they are the most effective way of doing discriminant analysis when you have two classes (Hand *et al.* 1998).

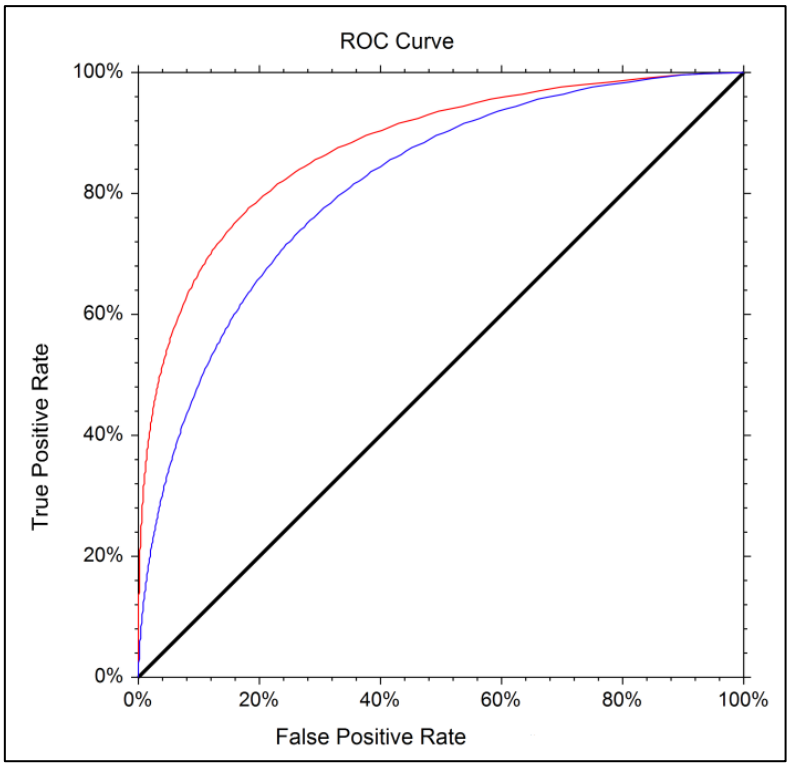
For archaeological and ethnographic data which, often, are represented by binomial distributions, the response matrix in the GLM can be either a vector or a matrix with two columns. Given the mixed categorical and ordinal nature of the data recorded in this DPhil research, a response matrix approach was used. For the data recorded, the response is a matrix where the first column is the number of *successes* or positive results and the second column is the number of *failures* or negative results (Guisan *et al.* 2002). This thesis utilized a specific set of the eHRAF cultures which were defined as doctrinal or imagistic by Atkinson and Whitehouse (2011) as a threshold to make a binary function; the sample of ethnographic cultures was divided into imagistic or doctrinal (0 or 1) and a GLM (binary regression) was applied to it. Once the cases had been divided into this binary relationship, the variables identified using PCA were used to apply a multilevel binary regression via the GLM. First, the GLM was applied to the *known* ethnographic sample [classified by Atkinson and Whitehouse (2011)] to test the appropriateness of the applied GLM, to examine how successful the model was at correctly categorising the *known* imagistic and doctrinal cultures. Secondly, the GLM was applied to the *unknown* archaeological data. In this response matrix approach the function *cbind* in the *R-statistics* package (R Development CoreTeam 2005) was used to create a matrix by binding the column vectors containing the binary numbers (0 and 1) assigned to the *known* cases

(imagistic 0 and doctrinal 1). Thus, GLM provided a means of (1) testing the model using the variables received via the principal component analysis on a *known* (previously categorised) eHRAF sample; (2) using the *known* ethnographic sample to classify each archaeological site-phase as either imagistic or doctrinal based on the variables received via the principal component analysis; and (3) generating the percentage probability of an *unknown* archaeological site-phase being doctrinal or imagistic. A generalised linear model was generated for the four databases described in section 3.6.1 of this chapter.

8.7.4. 3.9.3.1 Testing the GLMs via Receiver Operating Characteristic (ROC) curves

The GLMs were tested by plotting a Receiver Operating Characteristic (ROC) curve. The ROC curve is a method for evaluating the performance of a prediction system (in this case the GLM) (Bewick 2004; Johnson 2004; Beerenwinkel *et al* 2005). An ROC curve is a two-dimensional depiction of the performance of the classifier. The ROC curve is a graph of the proportion of positive responses in the sample plotted against the proportion of false responses—i.e. false rate (F). An ROC curve makes it possible to assess the accuracy of the received predictions by plotting the true positive rate against the false positive rate (Metz 1978; Beerenwinkel *et al.* 2005) (Figure 3.1 a). Unlike regular parametric statistical tests, ROC analysis does not assume that the distributions are Gaussian and have equal variance (Green and Swets 1966; Christian *et al.* 2006). A number of points in ROC space are important to note. The origin point (0, 0) represents a situation of no positive or false (negative) classifications being assigned; such a classifier commits no false positive errors but also gains no true positives (Metz 1978; Bewick 2004; Johnson 2004; Fawcett 2005; Beerenwinkel *et al.* 2005; Hartle *et al.* 2006; Sujun *et al.* 2006). In terms of initial visual inspection, the closer the ROC curve follows the left-hand border and then the top border of the ROC space (making a right angle), the more accurate the test—that is—the more appropriate the model is for generating true predictions (Figure 3.1a and b) (Metz 1978; Bewick 2004; Johnson 2004; Fawcett 2005;

Beerenwinkel *et al.* 2005; Hartle *et al.* 2006; Sujun *et al*. 2006). In a perfect test, the ROC curve would start at the origin (0, 0), go vertically up the y-axis to the (0, 1) coordinate and then horizontally across to the (1, 1) coordinate (Bewick 2004; Johnson 2004; Fawcett 2005; Beerenwinkel *et al.* 2005; Hartle *et al.* 2006; Sujun *et al.* 2006). The closer the ROC curve tends towards a 45-degree diagonal line, the less accurate the test (Figure 3.1a and b). A diagonal line (going from 0, 0 to 1, 1) represents the random assigning of classes. For example, if a classifier randomly predicts the positive class half the time, it can be expected to get half the positives and half the negatives correct; this results in the point (0.5, 0.5) in ROC space (Figure 3.1 b) (Metz 1978; Bewick 2004; Johnson 2004; Fawcett 2005; Beerenwinkel *et al.* 2005; Hartle *et al.* 2006; Sujun *et al.* 2006).



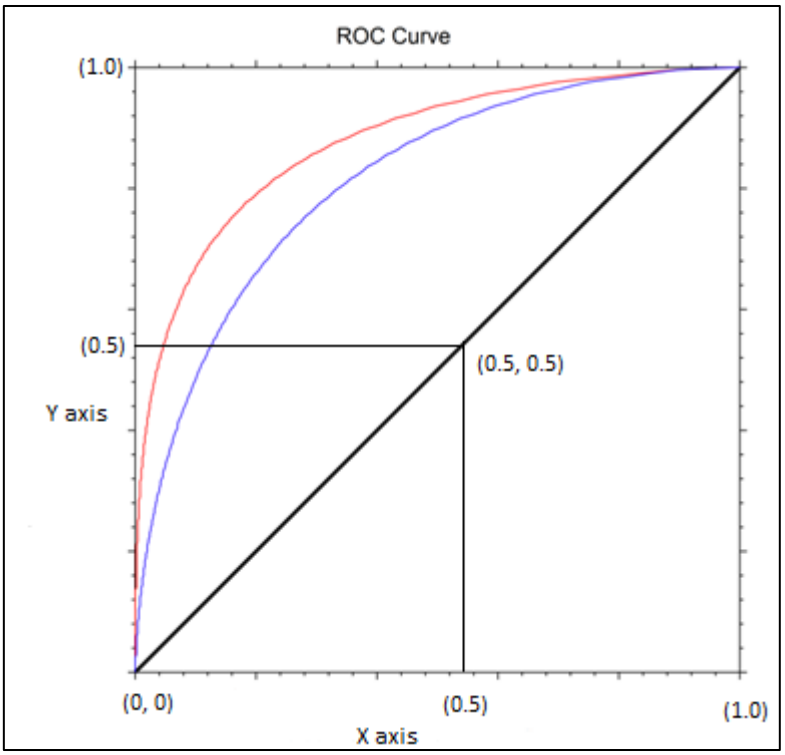


Figure 3:1 a and b contrasting ROC curves (after Fawcett 2006 and Sing *et al.* 2004)

Apart from visually assessing the GLM via an ROC curve, a common method to examine the appropriateness of the GLM applied is to calculate the area under the ROC curve (AUC) (Hanley and McNeil, 1982; Bradley, 1997; Mason Graham 2002; Roomp *et al.*

2006). The AUC value is always between 0 and 1.0 (or 0 to 100% of cases classified correctly). In sum, the larger or higher percentage the AUC is, the better the prediction system (in this case the GLM) (Hanley and McNeil, 1982; Mason Graham 2002; Sujun *et al.* 2006). The perfect predictor model will result in an AUC of 1 (or 100% of cases classified correctly), while a model producing random classifications will produce an AUC of 0.5 (50% of cases classified correctly) or less–showing that by randomly assigning the cases it is getting at least a 50% false positive rate (Hanley and McNeil, 1982; Bradley, 1997; Beerenwinkel *et al.* 2005). A valid predictor model should have an AUC greater than 0.5. (or 50%); with the closer AUC is to 1 (100% of cases classified correctly), the better the predictor model is at classifying the cases correctly (Hanley and McNeil, 1982; Bradley, 1997; Harrell 2001; Mason Graham 2002; Fawcett 2003; Guo *et al.* 2006; Hartle *et al*. 2006; Roomp *et al.* 2006). The combination of recording the true positive versus the false positive rate and calculating the area under the curve makes it possible to use the ROC curve(s) to examine the validity and performance of the GLMs employed in this research. The *ROC* and *ROCR* libraries in *R-statistics* package (R Development CoreTeam 2005) were used to plot the (R.O.C) curves and calculate the AUCs and percentage of cases classified correctly.

The ROC curves provide us with a method to assess the goodness of fit of each GLM. However for the most fit for purpose GLMs, it was decided to further test them by generating half normal Q-Q plots using the method outline by Collett (2003). A half normal Q-Q plot is a plot in which the residuals are arranged in ascending order and plotted against an approximate of their expected values. In addition to the ROC curve, the half normal Q-Q plot provides us with a formal diagnostic assessment of the models *goodness of fit.* The half normal Q-Q plots the ordered absolute values of the Pearson residuals (X-axis) against the corresponding half normal quantiles (Y-axis). A half normal Q-Q plots simulates points in relation to a confidence envelope and a line showing the means of the simulated values. Central to the generation and interpretation of

a half normal Q-Q plot is the construction of a confidence envelope for the plot. This envelope is such that if the fitted model is correct the plotted points are likely to be located within the limits of the confidence envelope; generally a 95% confidence envelope is preferred for testing the simulated points.

Collett (2003) suggest constructing a simulated envelope for a half normal Q-Q plot in the following way:

1. For each of the *n* of observations, additional observations should be simulated from a binomial distribution with parameters *ni* and *pi*, where *ni* is the binomial denominator and *pi* is the estimated response probability for the *i*th observations in the original dataset, i= 1,2,…,n.
2. The model fitted to the original data is the fitted to each of the simulated values of the binomial response variable, where the explanatory variables in the model keep their original value.
3. For each of these fits, the absolute values of the standardised deviance residuals [rDi] are obtained
4. These values are then ordered to give the values [rD](i), where [rD](1),< [rD](2),<… [rD](n), residuals are arranged in ascending order.
5. The mean minimum and maximum of the values of [rD](i), over the number of simulated data sets for i= 1,2….,n, are then computed and plotted on the half normal Q-Q plot of deviance residuals from the original data set.

Using the simulated confidence envelope the half normal Q-Q plot can be (visually) interpreted without having to make assumptions about the distribution of the residuals. Moreover, the generation of outliers or points outside the simulated confidence envelope, indicates that the fitted model is not appropriate. In addition, the closer the points are to the line showing the means of the simulated values, the more appropriate the model. However, Collett points out that even with a fit for purpose model, the residuals used in constructing a half normal Q-Q plot may not be approximately normally distributed.

Thus, a half normal Q-Q plot of the residuals will not necessarily result in a straight line (an ideal line of the means of the simulated values) for the simulated points. Ultimately, A half normal Q-Q plot offers us a critical validation of each generalized linear model using the means of Pearson residuals obtained by simulation under the assumption that the model is correct along with a 95% confidence envelope enabling us to (1) assess if the Pearson residuals from the fitted model (simulated point) are within the 95% confidence interval; (2) examine the model residuals in relation to a mean; and (3) identify outliers.

The statistical analysis combining MDS, PCA and GLM central to this research present us with the opportunity to statistically examine the extent to which the agricultural transition in each region is connected with a shift from an imagistic to an increasingly doctrinal mode of religiosity in the context of an indigenous agricultural transition [south-west Asia] and an imported transition [north-western Europe].

Chapter 4: Exploratory analysis of the eHRAF database

4 Introduction

This chapter presents the analysis of the eHRAF culture using multidimensional scaling (MDS) and principal component analysis (PCA).

4.1 Multidimensional Scaling

This section provides the initial statistical results obtained using multidimensional scaling (MDS) to examine the similarity or dissimilarity of the data. MDS was used to examine the statistical separation of the ethnographic data by constructing dissimilarity matrices based on Gower distances, using the *R-statistics* package. Chapter 3, section 3.9.1 outlines the application of MDS to the datasets in detail. A sample of 34 ethnographic cultures was categorised in terms of either the doctrinal or imagistic mode of religiosity following Atkinson and Whitehouse (2011). Although the separation central to the modes of religiosity theory is based on ritual frequency and dysphoric arousal, it is proposed that that the *material correlates* relating to ritual should achieve a separation of the cultures engaged in the different modes of religiosity (Chapter 3, section 3.3). Furthermore, I assess how far material correlate variables relating not only to ritual practices but also to subsistence practices and social complexity distinguish the two modes of religiosity as predicted in (Chapter 3, section 3.7.2).

The ethnographic database was used to construct a two-dimensional and a three-dimensional dissimilarity matrix to assess the multivariate distance of cultures representing the two different modes of religiosity. As described in Chapter 3, section 3.9.1, the two-dimensional graph shows the multivariate distances of individual ethnographic cultures based on the first two principal components; the three-dimensional graph presents the multivariate distances of individual ethnographic cultures based on the

first three principal components. In the presentation of results below, individual cultures of interest are identified in the two-dimensional plot. The eigenvalues are given for the three-dimension plots; showing the percentage of information maintained when you reduce the data to three variable axes; when the MDS reduces the data to something that can be interpreted and represented on a plot. MDS analysis was performed on the ritual, subsistence, social complexity, as well as the entire set of material correlate variables recorded from the eHRAF samples. The specific variables causing separation and coalescence will be investigated in the principal component analysis, section 4.3.

4.1.1 Multidimensional scaling based on the ritual variables, coded by mode of religiosity

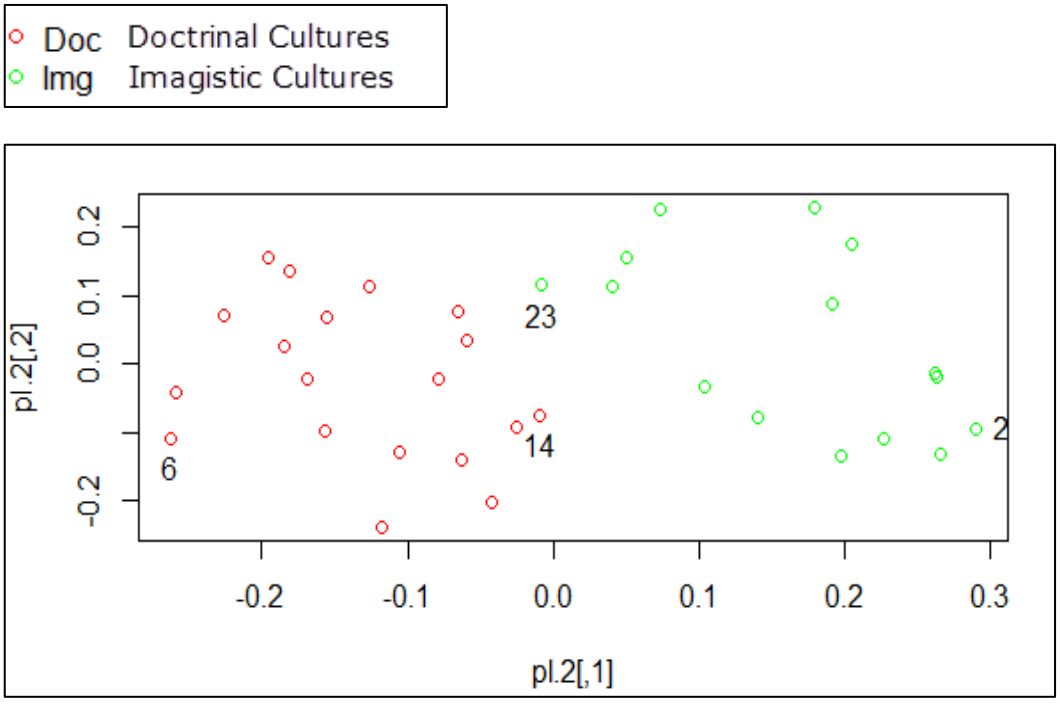


Figure 4:1: 2-d plot base on the ritual variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Trobrianders (14), Dogon (23) and Andamans (26).

:

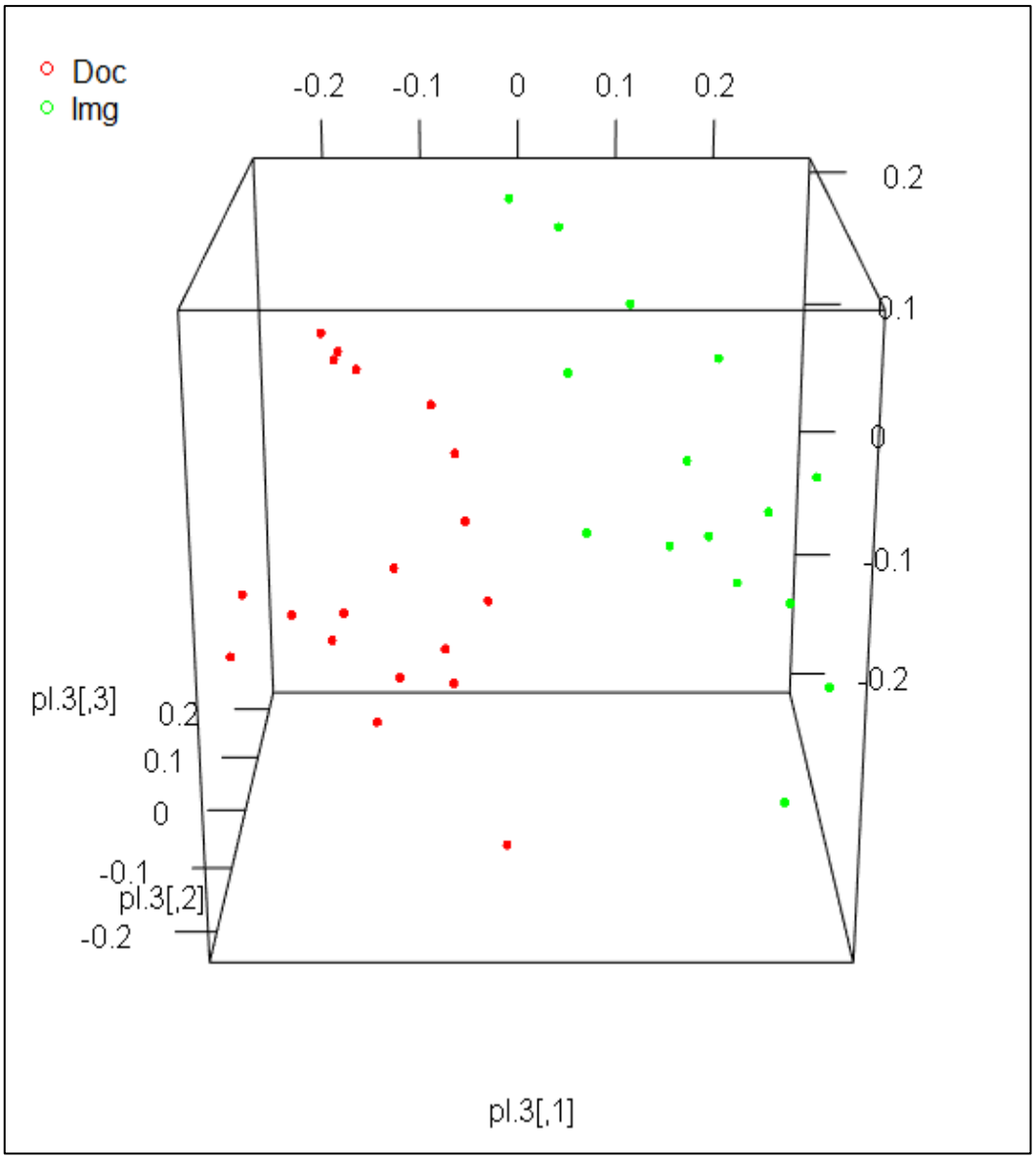


Figure 4:2: 3-dimensional plot based on ritual variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

Figures 4.1 and 4.2 show the results of the MDS statistical analysis for the ethnographic dataset based on the ritual variables. In Figure 4.1 we can observe a number of patterns. The imagistic cultures (green) are distributed around the middle and the right-hand side of the plot. The doctrinal examples (red) are located on the left-hand side. In this two-dimensional plot we can see relatively distinct imagistic and doctrinal clusters. In the three dimensional plot (Figure 4.2) we can observe that the imagistic cultures (green) are distributed in the middle to right-hand section of the plots. The doctrinal cultures (red) are located on the left-hand side of the three-dimensional plot. The doctrinal cultures cluster

more distinctively than the imagistic cultures on the right-hand side, but there are examples of doctrinal cultures that are closer to imagistic cultures, in the middle of the plot. For the most part, the imagistic cultures (green) are distributed in the right-hand section and the doctrinal cultures (red) are distributed on left-hand side of both plots. The greatest statistical separation is between the Andaman (imagistic culture no. 26) and the Central Thai (doctrinal culture no. 6). Although there is no overlap between imagistic and doctrinal cultures in the two-dimensional or three-dimensional plots, in the middle of both plots a number of imagistic and doctrinal cultures are closer to each other. Examples of the cultures in close proximity in this middle section include the Dogon (imagistic culture no. 23) and the Trobrianders (doctrinal culture no. 14). The Dogon sample represents a group of West African agriculturalists that practices Islam [world religion] but incorporate aspects of their indigenous religious beliefs and practices. The Trobrianders are an island population from the Trobriand or Kiriwina Islands in the Solomon Sea. The Trobrianders mainly engage in fishing and garden cultivation. Their religious beliefs centre on magic and sorcery, reflecting an indigenous rather than a world religion. The statistical results indicate that the known imagistic and doctrinal cultures cluster separately when the cultures are examined based on the recorded ritual material correlates. The degree of separation of doctrinal and imagistic cultures following MDS analysis extends the distinction proposed by Atkinson and Whitehouse (2011) by showing that a distinction between the two groups can be demonstrated on the basis of ritual material correlates, without including frequency/degree of dysphoria. The eigenvalue calculated for the three-dimension plots is 0.899851, indicating that 90% of the variability in the data is accounted for by reducing the data to three variable axes using MDS. The specific ritual variables causing separation and coalescence will be investigated in the principal component analysis section (3.4.1) of this chapter.

4.1.2 Multidimensional scaling based on the subsistence variables, coded by mode of religiosity

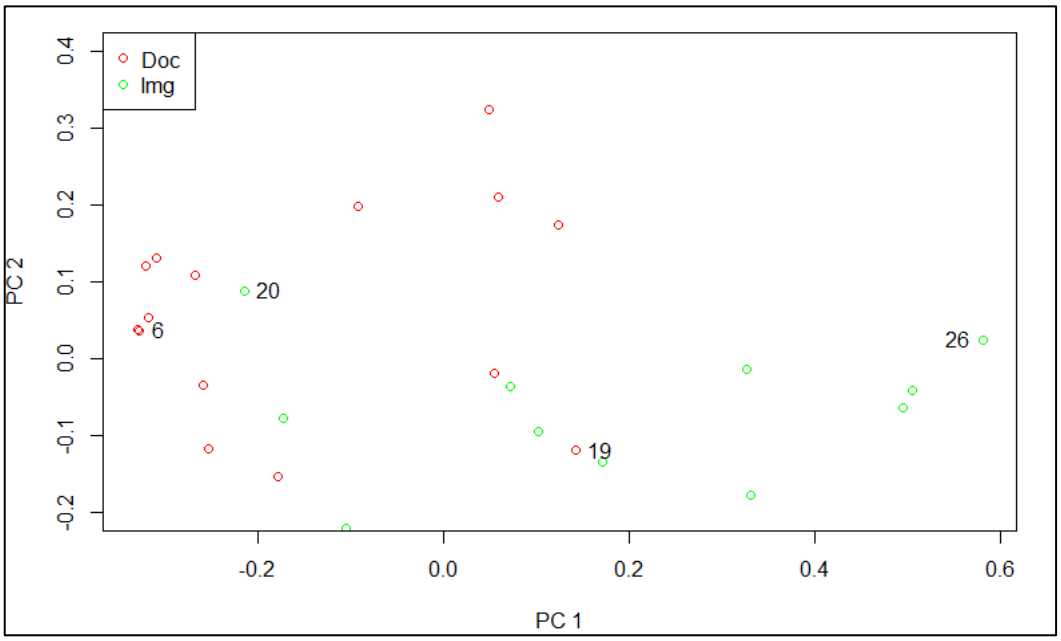


Figure 4:3: Figure 3: 2-d plot base on the subsistence variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Guaraní (19), Banyoro, (20) and Andamans (26).

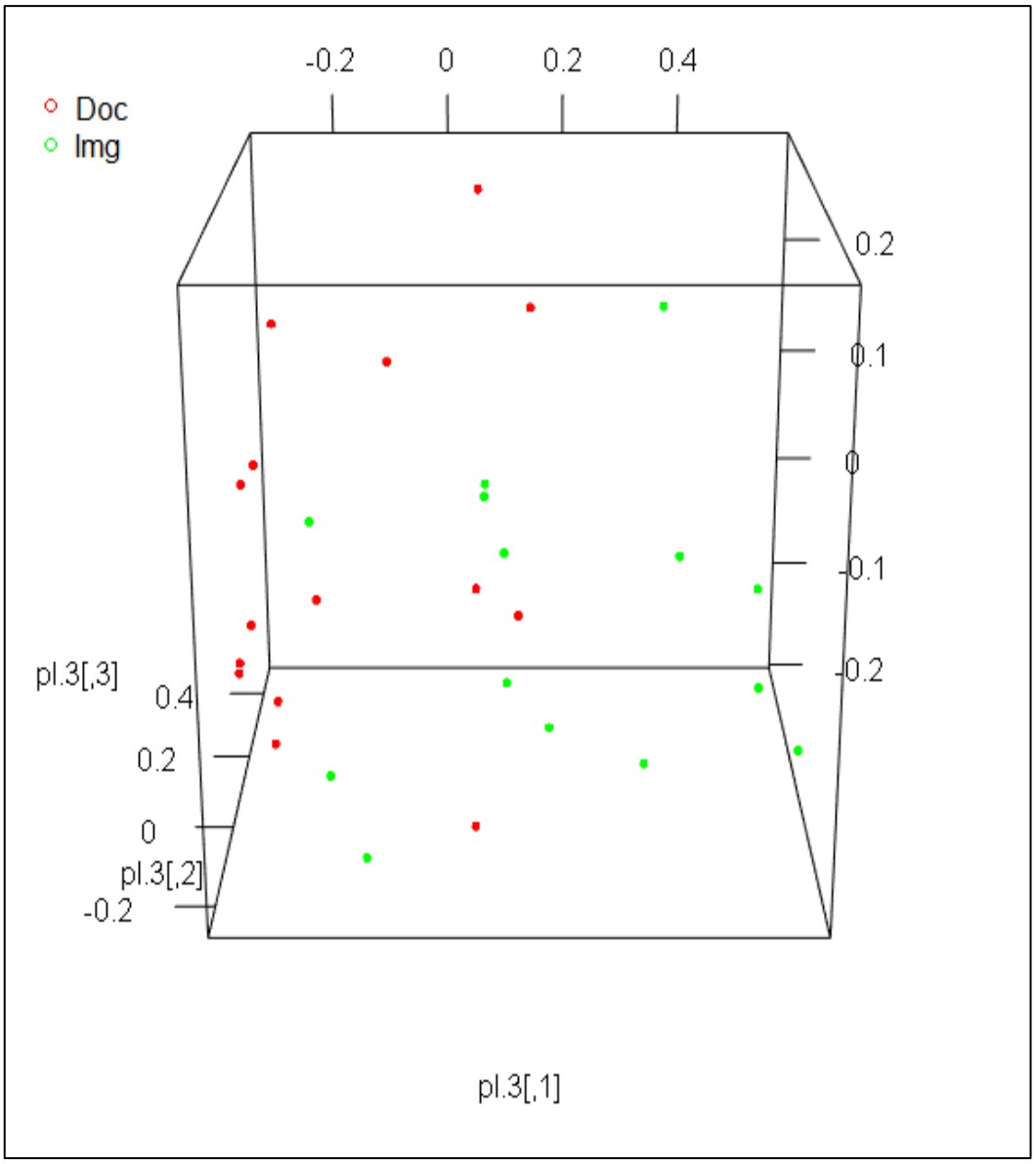


Figure 4:4a: 3-dimensional plot based on the subsistence variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

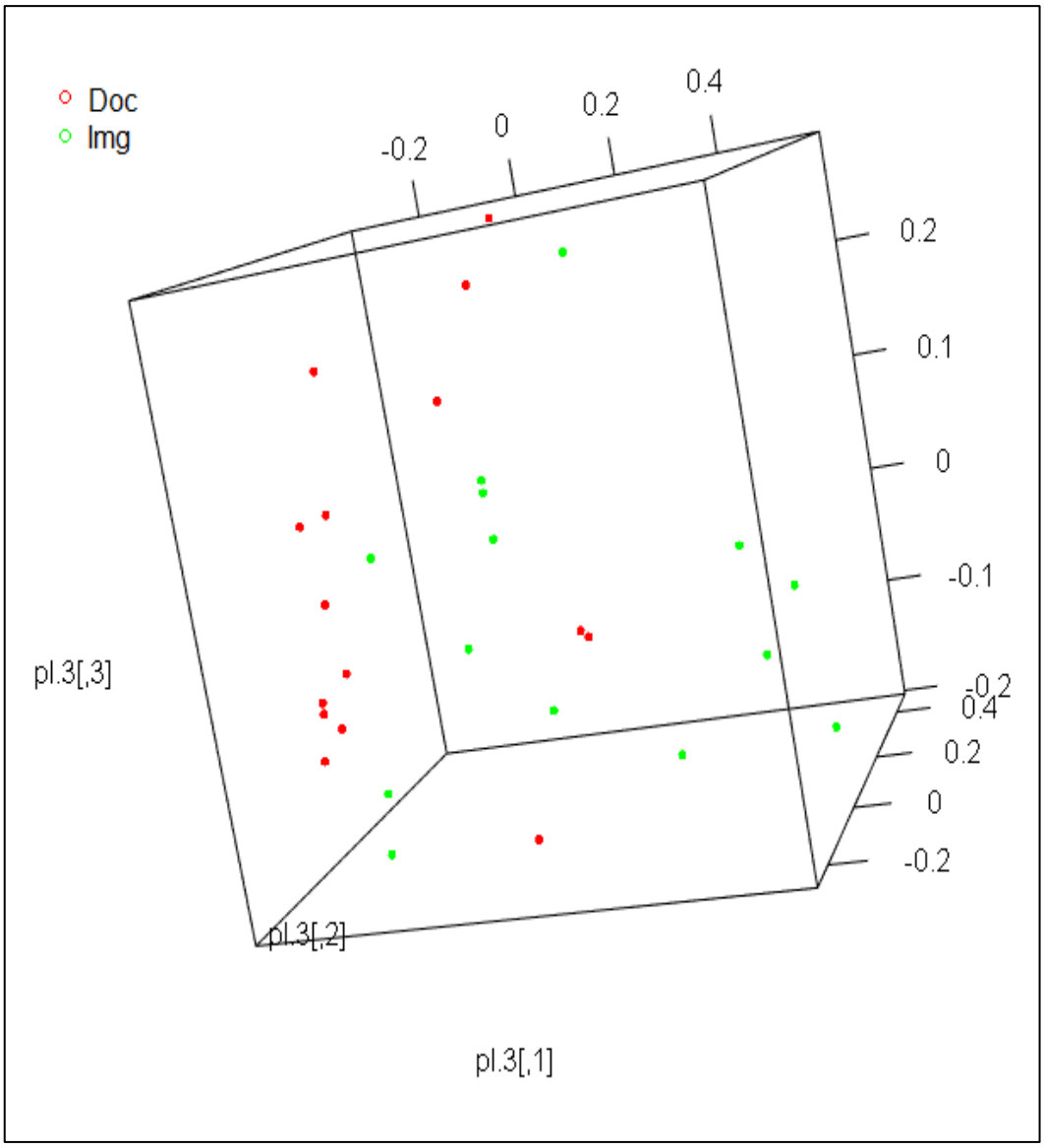


Figure 4.4b: 3-dimensional plot based on the subsistence variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

Figures 4.3, 4.4a and 4.4b show the results of the MDS statistical analysis for the ethnographic data based on the subsistence material correlate variables, coded in terms of either doctrinal or imagistic mode of religiosity. In Figure 4.3 we can observe a number of patterns. The imagistic cultures (green) are, mainly, distributed around the middle and the right-hand side of the plot. However, there are examples of imagistic cultures in close proximity to the doctrinal cultures on the left-hand side. The doctrinal examples (red) cluster on the left-hand side, but there are also examples of doctrinal cultures concentrated in the middle of the plot, near some imagistic cultures. Similarly, in the three-dimensional plots (Figures 4.4a and 4.4b) we can observe that the imagistic cultures

(green) are distributed in the middle to right-hand section of the plots, with three definite examples of imagistic cultures which cluster adjacent to the doctrinal cultures. Figure 4.4b is a three-dimensional plot rotated on its axis to examine whether or not rotation yields additional information. The concentration of doctrinal cultures on the left-hand side of the three-dimensional plots is more distinct than the imagistic cultures on the right-hand side, but there are still examples of doctrinal cultures in the middle of the plot that are in close proximity to a number of imagistic cultures. The degree of closeness and overlap in the three-dimensional plots reflects the fact that some imagistic and doctrinal cultures from the eHRAF sample have aspects of subsistence strategy in common. For instance, a number of the imagistic cultures from the eHRAF sample engage in some form of low-level crop or animal management involving, at the very least, domesticated non-staples; while some doctrinal cultures supplement their diet with hunting and gathering. The MDS statistical analysis shows that the greatest separation is again between the Central Thai (doctrinal culture no. 6) and the Andaman (imagistic culture no. 26), as in the analyses presented above based on the ritual material correlates only. Examples of the cultures displaying a degree of closeness or overlap in the middle section are imagistic cultures no. 19 and 20. Culture no. 19 is identified as the Guaraní from lowland South America. They are classed as a doctrinal culture based on their ritual activity; however, their mixed subsistence strategy includes hunting as the prime method of adding meat to their diet and foraging to supplement garden cultivation. In this example, we can see how a subsistence strategy that includes hunting and gathering is causing the Guaraní culture to cluster in close proximity to the imagistic cultures. The Banyoro culture from Western Uganda, Africa (Imagistic culture no. 20) is classified as an imagistic culture based on their ritual activities. However, their subsistence strategy/economy is focused on agriculture, with the majority of Banyoro being considered sedentary farmers. The observed overlap between doctrinal and imagistic cultures reflects the fact that a number of cultures from the eHRAF sample practice both hunting/gathering and some form of agriculture. The eigenvalue calculated for the three-

dimension plots is 0.9207992, indicating that 92% of the variability in the data is accounted for by reducing the data to three variable axes using MDS. The specific aspects of subsistence behaviour causing separation and coalescence will be investigated in the principal component analysis section (4.3.2) of this chapter.

4.1.3 Multidimensional scaling based on the social complexity variables, coded by mode of religiosity

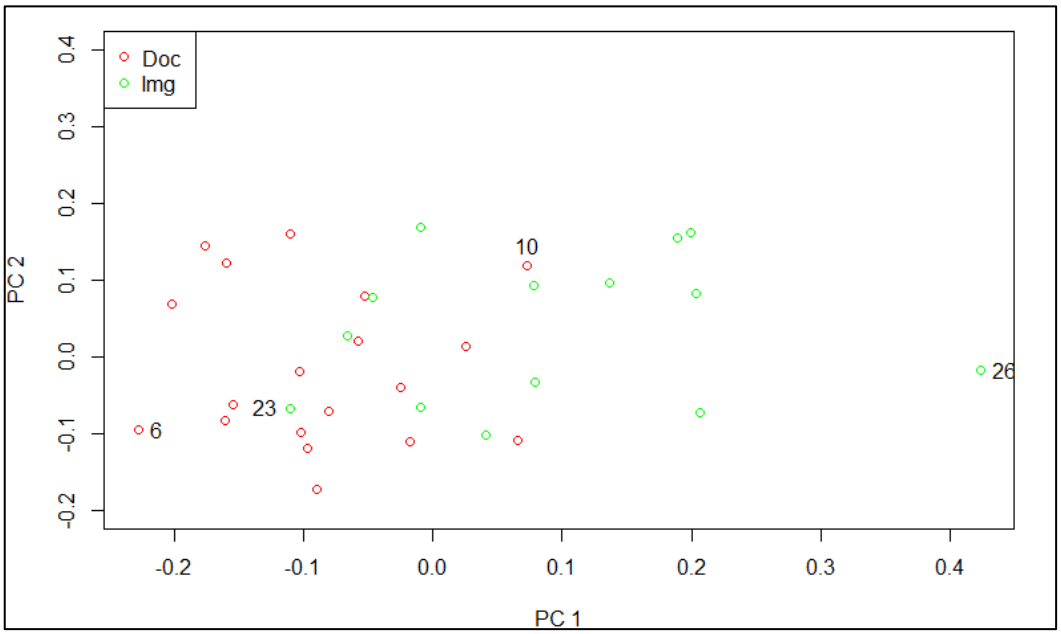


Figure 4:5: 2-d plot base on the social complexity variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Seminole Native American (10), Dogon (23) and Andamans (26).

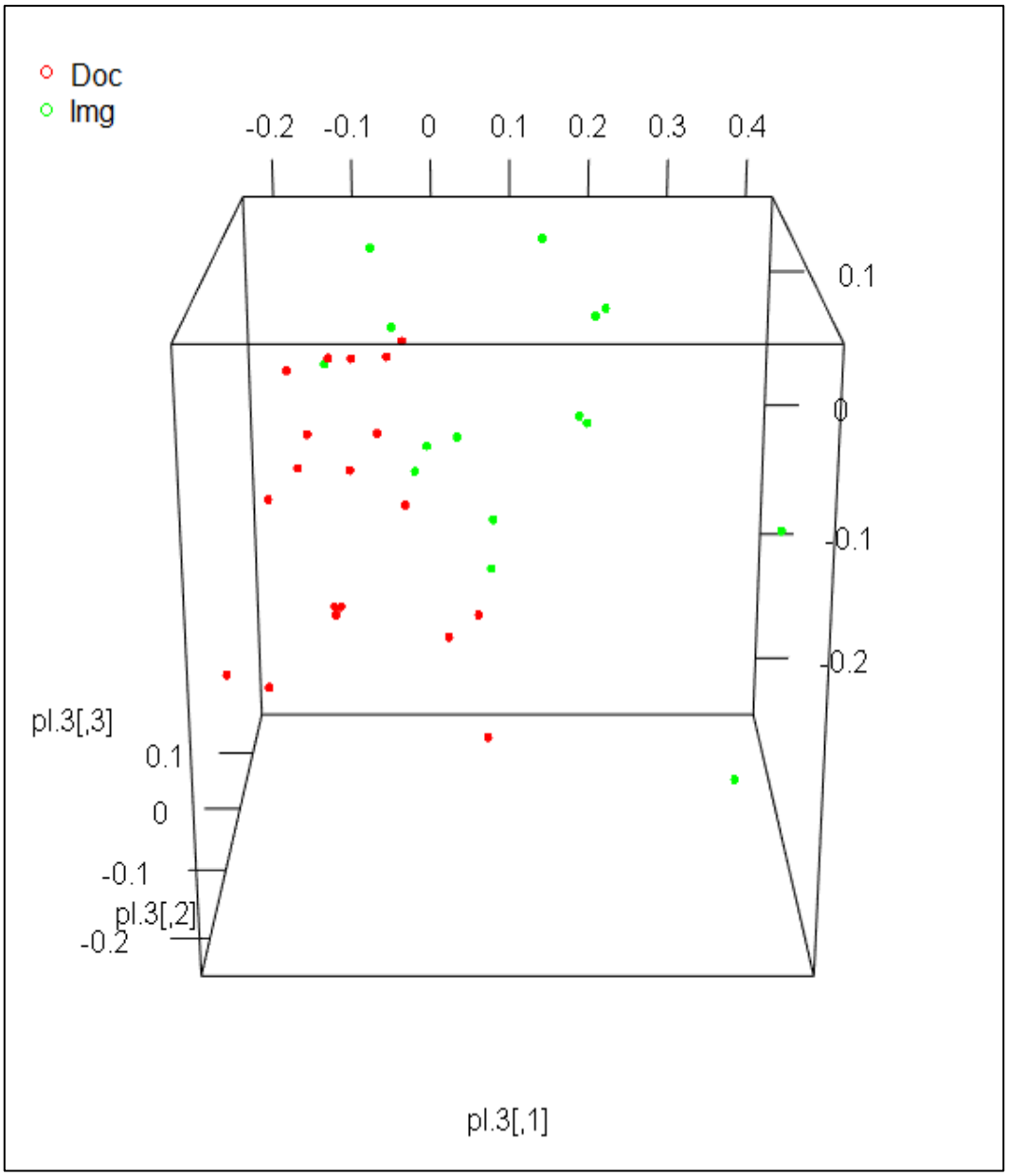


Figure 4:6a: 3-dimensional plot based on the social complexity variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

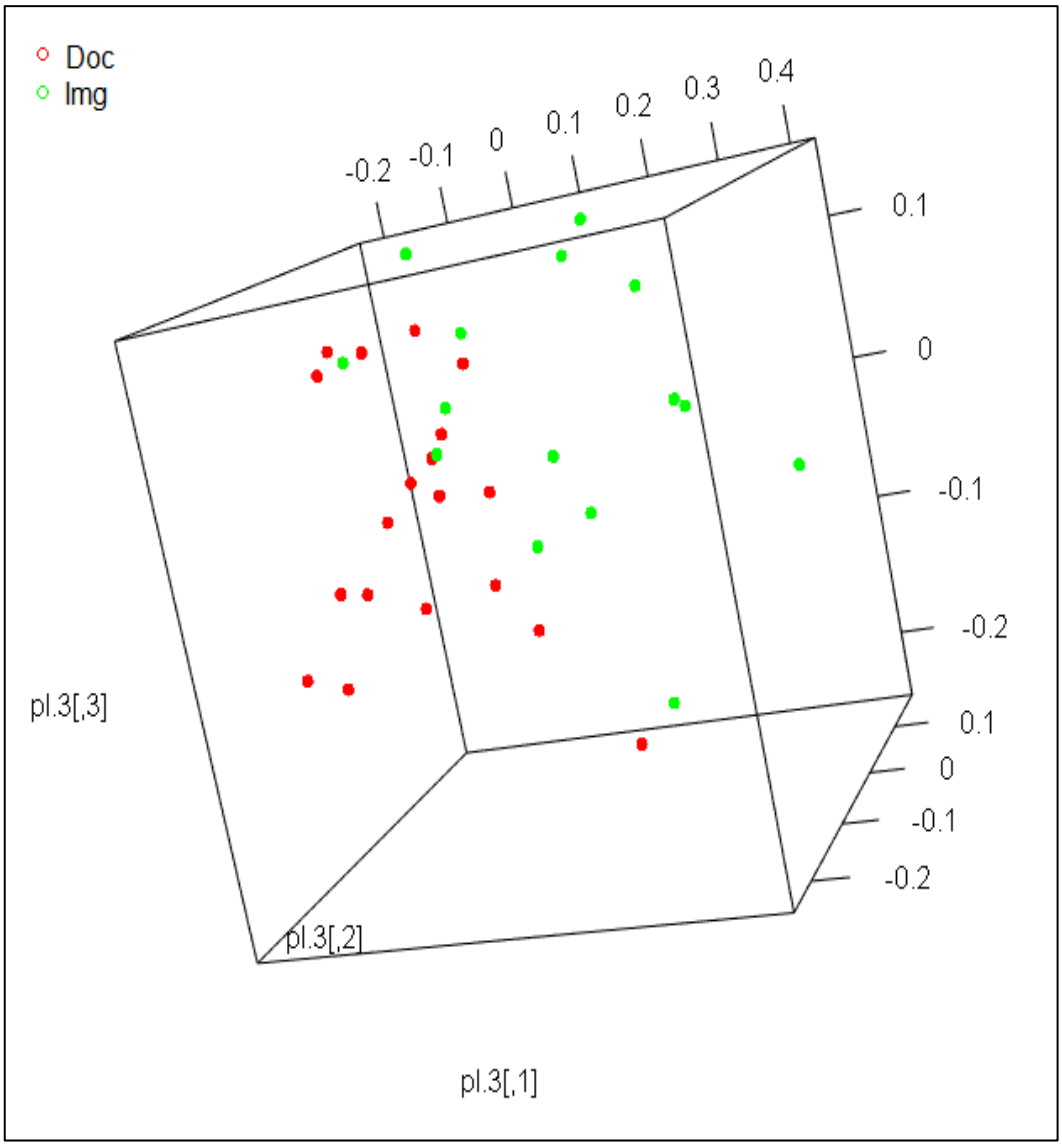


Figure 4.6b: 3-dimensional plot based on the social complexity variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

Figures 4.5, 4.6a and 4.6b show the results of the MDS statistical analysis for the ethnographic data relating to the social complexity variables, coded in terms of mode of religiosity. In Figure 4.6 we can see that a number of the imagistic cultures (green) are located in the middle of the two-dimensional plot, close to the doctrinal cultures (red). The three-dimensional plots (Figures 4.6a and 4.6b) show that there is some overlapping between doctrinal and Imagistic cultures in the left hand side of the plot. However, there are examples of imagistic cultures that are located on the right side of the plot and doctrinal cultures that cluster on the left-hand side. Here again, the MDS analysis shows that the greatest separation is between the Central Thai (doctrinal culture no. 6) and the

Andaman (imagistic culture no. 26). A clear example of a culture displaying overlap is the Dogon (imagistic culture no. 23) which is located on the left-hand side in close proximity to a number of doctrinal cultures. The Dogon are West African agriculturalists that live in villages with populations of up to 500 people. The Dogon mix indigenous religious beliefs and practices with aspects of Islam [world religion]. It is factors such as the Dogon reflecting a sedentary group, engaging in agriculture which practice Islam that is causing them to cluster with a number of the doctrinal cultures, when examined in relation to the social complexity variables. The statistical result reflects the fact that some imagistic and doctrinal cultures from the eHRAF sample have aspects of social complexity in common; the application of principal component analysis in the next section is used to examine the variables that are causing the statistical closeness. The eigenvalue calculated via for the three-dimension plot is 0.8524381 which indicates that 86% of the variability in the data is accounted for by reducing the data to three variable axes using MDS. It is evident that there is a greater degree of statistical closeness or overlap in the sample when the cultures are analysed solely in relation to the social complexity material correlate variables rather than the MDS analysis using ritual variables. There appears to be a similar level of overlap when the cultures are analysed using the subsistence variables.

4.1.4 Multidimensional scaling based on all variable, coded by mode of religiosity

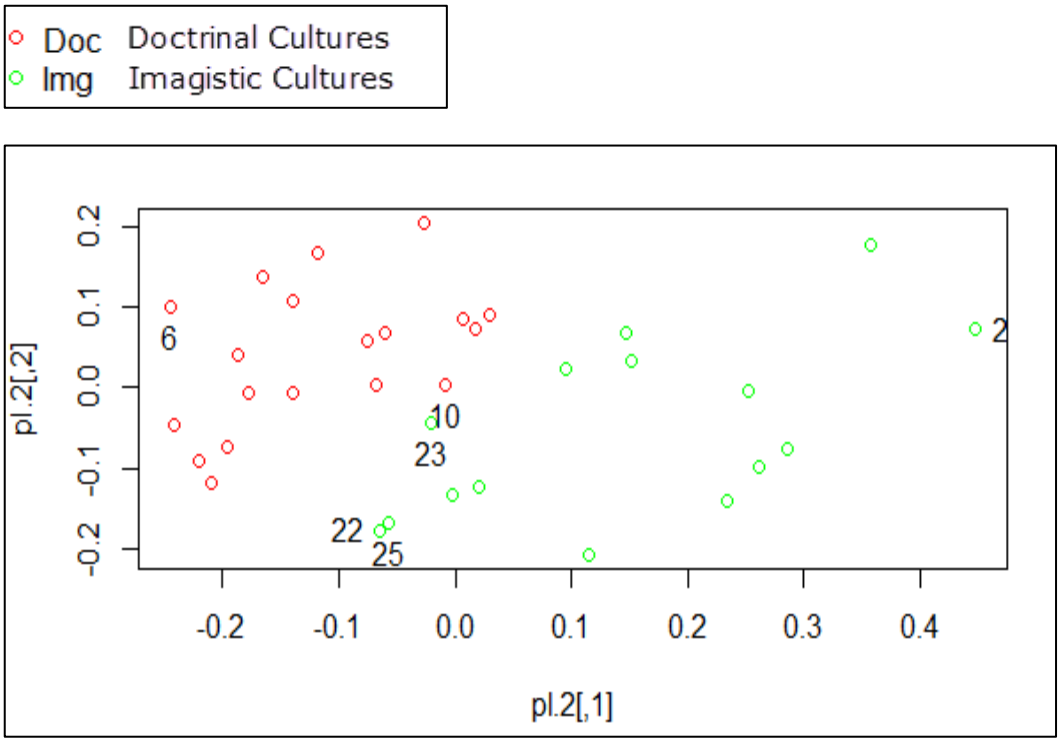


Figure 4:7: 2-d plot based on all variables for ethnographic eHRAF cultures coloured in terms of mode of religiosity categorisation, showing selected cultures: Central Thai (6), Seminole Native American (10), Hausa, (22), Dogon (23), Wolof (25) and Andamans (26).

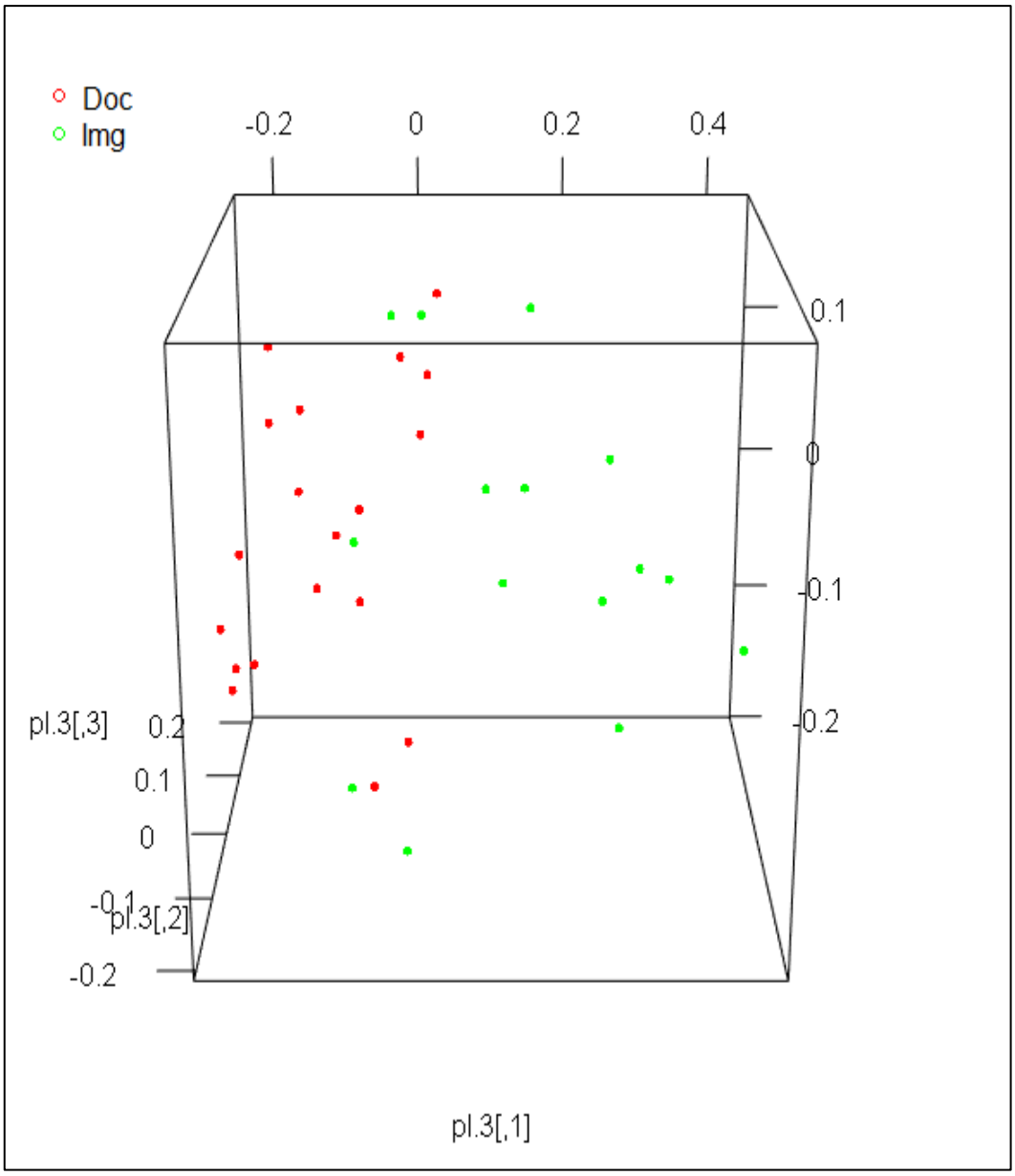


Figure 4:8: 3-dimensional plot based on all variables for ethnographic eHRAF cultures coded in terms of mode of religiosity

Figures 4.7 and 4.8 show the results of the MDS statistical analysis for the ethnographic data relating to all variables (ritual activity, subsistence strategy and social complexity), coded in terms of either doctrinal or imagistic mode of religiosity. From Figures 4.7 and 4.8 we can observe a number of patterns. The imagistic cultures (green) are distributed around the middle and the right-hand side of the plot. The doctrinal examples (red) cluster on the left-hand side. The doctrinal cultures appear to cluster more closely than the imagistic cultures, which indicate that they have a number of variables in common. The MDS statistical analysis shows that the greatest separation is, again, between the

Andaman (imagistic culture no. 26) and the Central Thai (doctrinal culture no. 6). The Central Thai culture is a predominantly Buddhist [world religion] population, living in villages with populations of between 300 and 3,000 and with an economy based on wet rice cultivation. The Andaman sample represents a mobile, seasonal hunting and foraging group with a population of less than 150 people; maintaining indigenous religious (Animistic) beliefs and practices. In the middle of the plot a number of imagistic and doctrinal cultures display some degree of closeness. Examples of cultures in this middle section are the Hausa, Dogon and Wolof (imagistic cultures no. 22, 23, and 25) respectively and Seminole, Native Americans (doctrinal culture no. 10):

1. Hausa, West Africa: a mainly Muslim [world religion] population, living in villages of 150-500 people. For the most part, their economy is based on agriculture. The Hausa are classed as imagistic based on a number of rituals that they preform; however, they do practice a form of Islam. Thus, their imagistic classification is based on the incorporation of imagistic rituals into their (predominantly) Islamic belief system.
2. Dogon, West Africa: agriculturalists that live in villages with populations of up to 500 people. The Dogon mix indigenous religious beliefs and practices with aspects of Islam [world religion].
3. Wolof, West Africa: agriculturalists that live in villages with a population of 50 to 150 people, on average. The Wolof are described as Muslims [world religion] who include aspects of indigenous religious practices.
4. Seminole Native Americans, Florida: this sample reflects a pre 20th century sample of hunter-gather/agriculturalists. The Seminole population live in permanent settlements and engage in horticulture and crop growing. Their indigenous religious beliefs focus on the seasonal events such as corn festival ceremonies during the season of harvest.

It is evident that imagistic and doctrinal cultures in this sample reflect a diverse set of ritual practices, subsistence practices and levels of social complexity, causing, for example, doctrinal cultures such as the Seminole to cluster in close proximity to the imagistic cultures. The eigenvalue calculated via *R-statistics* for the three-dimensional plot was 0.8720445, which indicates that 88% of the information from the ethnographic data was reduced to variables in three dimensions with only a loss of 12% of information. The specific variables causing separation and coalescence will be investigated in the principal component analysis section (4.3.4) of this chapter.

4.1.5 General MDS summary

Following MDS analysis on the basis of material correlates (in the absence of ritual frequency and dysphoric level information) from a dataset of doctrinal or imagistic cultures (as categorised by Atkinson and Whitehouse 2011) it has been shown that:

1. doctrinal and imagistic cultures show the greatest statistical separation when analysed using ritual variables only;
2. doctrinal and imagistic cultures show the greatest degree of closeness when analysed using subsistence variables only;
3. in terms of overlap, imagistic cultures such as the Dogon provide an example of a culture which, when analysed in terms of all and the ritual variables, shows some overlap with doctrinal cultures, due to the fact that the Dogon Are sedentary agriculturalists practising indigenous ritual activities in parallel with of Islam [world religion]; and
4. whether analysed in terms of subsistence, ritual, social complexity variables or a combination of all variables, the greatest separation is between the Andaman (imagistic culture no. 26) and the Central Thai (doctrinal culture no. 6). This result presents a distinctive separation between a small-scale (<150 people), translocationry seasonal hunting and foraging group that maintains indigenous

religious beliefs/practices and a Buddhist [world religion], large-scale, sedentary population with an economy based on agriculture.

4.2 Multidimensional Scaling coded by population size

This section provides the results of the use of MDS analysis to assess the degree of closeness of the ethnographic data relating to ritual activity, subsistence strategy, social complexity and the combination of all variables, categorised in terms of their population size. As discussed in Chapter 3 section 3.3.1, a number of papers have examined and commented on empirical evidence concerning the relationship between group size limits and aspects of subsistence practices, social organisation and ritual practices (Forge 1972; Flannery 1972; Wright and Johnson 1975; Wright 1977; Johnson 1978; Kosse 1989; Whitehouse 2004; Atkinson and Whitehouse 2011). To examine the connection between population size and ritual activity, subsistence practices and social complexity, the ethnographic (eHRAF) cultures were categorised and colour coded in terms of three population measures: (1) populations less the 150 individuals, (2) populations between 150 and 500 individuals; and (3) populations between 500 and 5,000 individuals.

4.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size

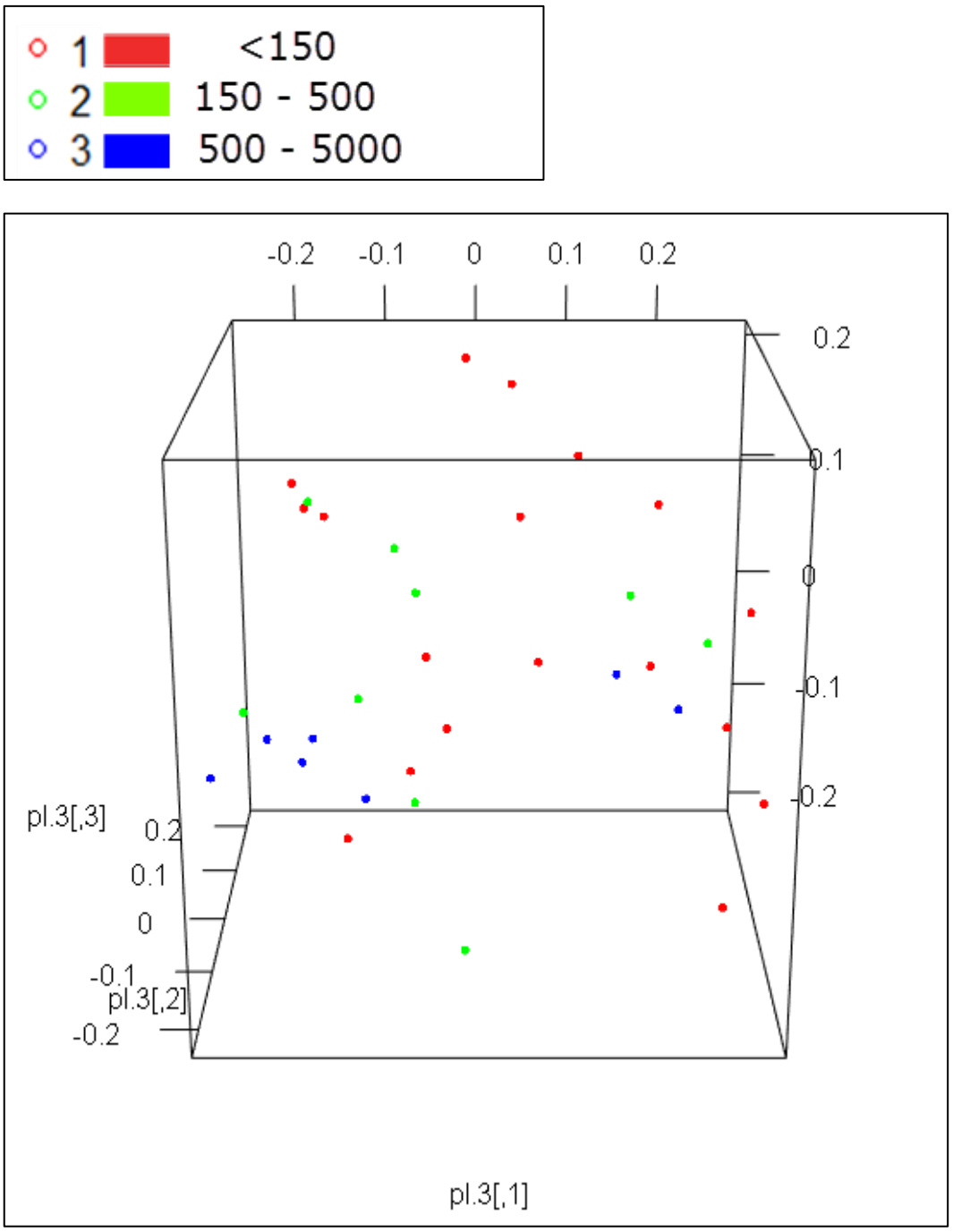


Figure 4:9: 3-dimensional plot based on the ritual variables for ethnographic eHRAF cultures, coded in terms of population size

Figure 4.9 shows the results of the MDS statistical analysis for the ethnographic data based on the ritual material correlate variables, coded in terms of population size. In Figure 4.9 the three population sizes do not show a great degree of separation. For the

most part, the three population sizes seem to disperse evenly throughout the plots. However, with the exception of two cultures, the population group of 500-5,000 individuals (blue) occur toward the lower left section of the three-dimensional plot. This may be an indication that there is a relationship between ritual and group size particularly in the context of larger sizes as suggested by Whitehouse (2004) and Atkinson and Whitehouse (2011).

4.2.2 Multidimensional scaling analysis based on the subsistence variables, coded by population size

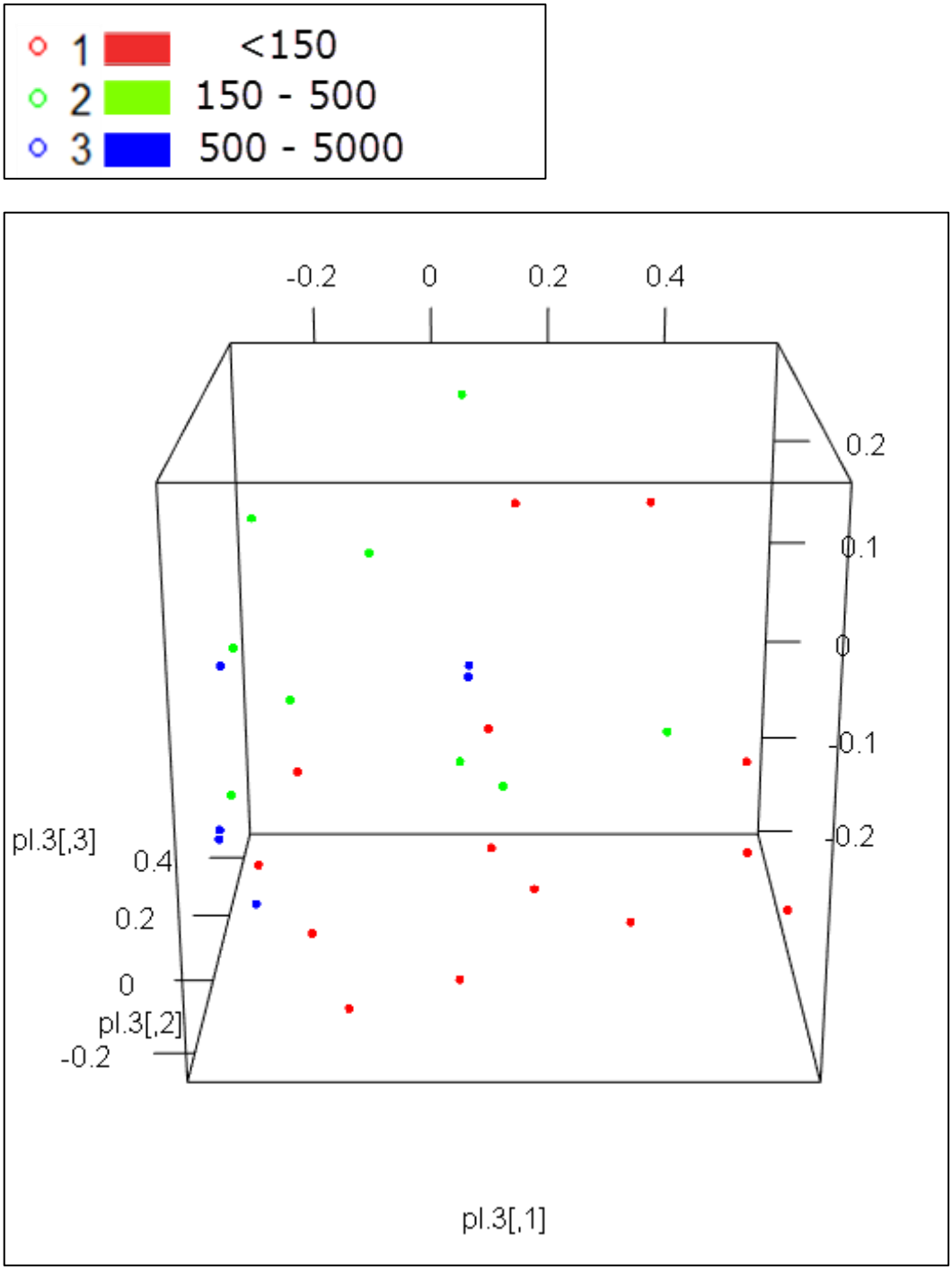


Figure 4:10: 3-dimensional plot based on the subsistence variables for ethnographic eHRAF cultures, in terms of population size

Figure 4.10 shows the results of the MDS statistical analysis for the ethnographic dataset based on the subsistence material correlate variables—coded in terms of population size. We can observe that, when analysed in terms of the subsistence variables, the plot results in a degree of distinction between the three population sizes. The population group of less than 150 people (red) mainly group in the lower section of the plot. There are two examples of cases of groups with less than 150 people (red) in the upper section of the plot—which can be considered as outliers, to an extent. The population group of 150-500 people (green) is more distributed throughout the middle to upper left section of the plot. For the population group of 500-5,000 people (blue) four examples are located in the lower to middle left hand side of the plot and two examples are located in the middle section of the plot. To an extent we can observe a separation between the group of 150-500 people (green) and 150 people (red). There are examples of closeness between cultures from each category in the middle of the plot. We can suggest that MDS analysis on the basis of subsistence variables shows a degree of separation in terms of population size groups than MDS based on the of ritual variables alone.

4.2.3 Multidimensional scaling analysis based on the social complexity variables, coded by population size

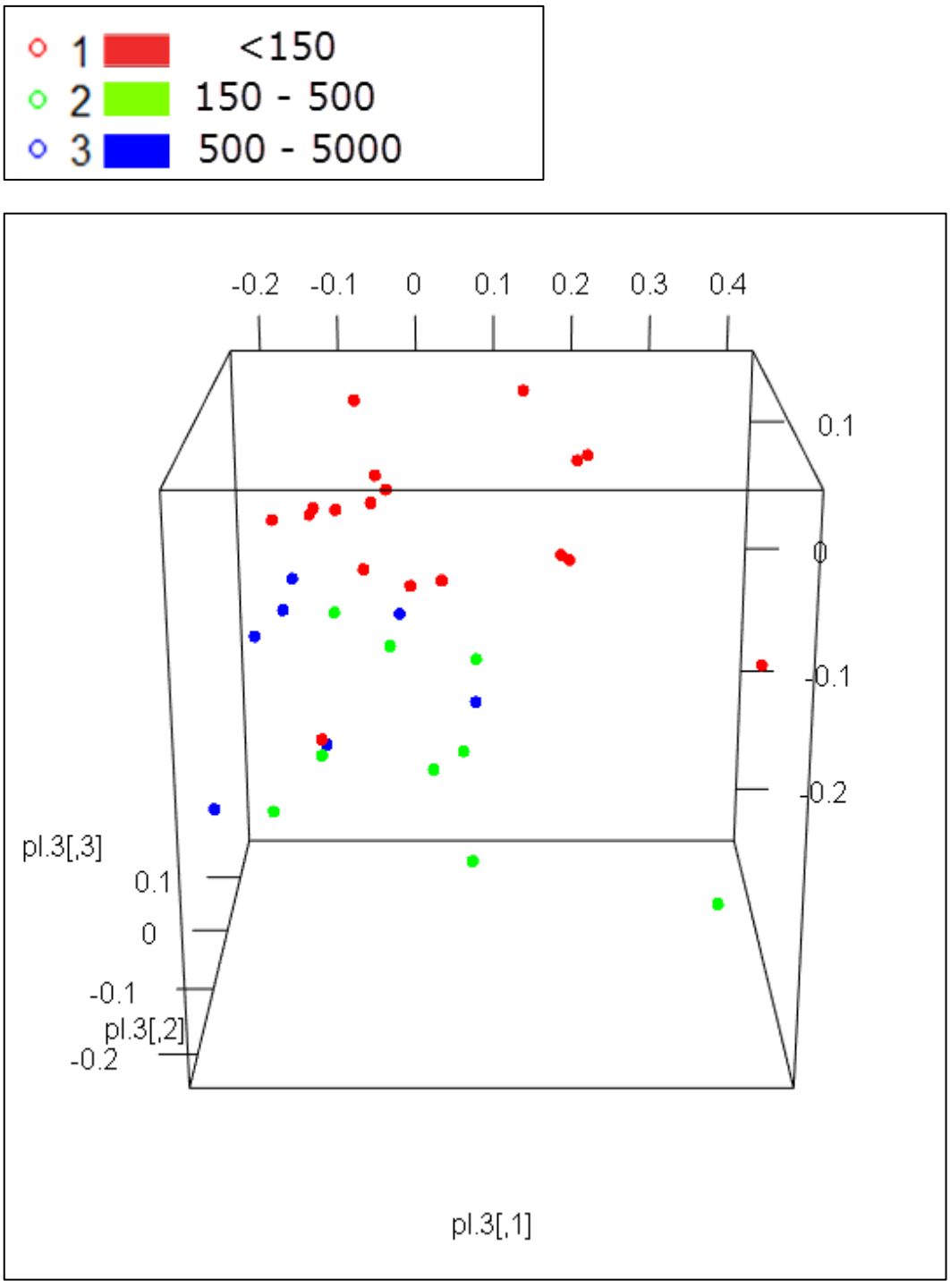


Figure 4:11: 3-dimensional plot based on the social complexity variables for ethnographic eHRAF cultures, in terms of population size

Figure 4.11 presents the results of the MDS statistical analysis for the ethnographic data relating to the social complexity variables, coded in terms of population size. From the

plot we can assert that cultures reflecting the three population sizes show a degree of separation. The cultures represented by the population size of less than 150 people (red) cluster relatively distinctly in the upper section of the plot, with one example on the middle right hand side. There is degree of coalescence between the other two populations size categories; however, the greatest distance is observed between cultures reflecting the population size of less than 150 individuals and the cultures of 150 – 500 individuals. Based on the clustering observed for the examples that reflect populations less the 150 people (red) (located mainly in the upper left hand section of the plot), we can suggest that there may be a connection between the level of social complexity and the group size of less than 150 people. At the very least, the MDS result is indicating that that a number of shared social complexity variables are responsible for the clustering of the examples in this population size category.

4.2.4 Multidimensional scaling analysis based on all variables, coded by population size

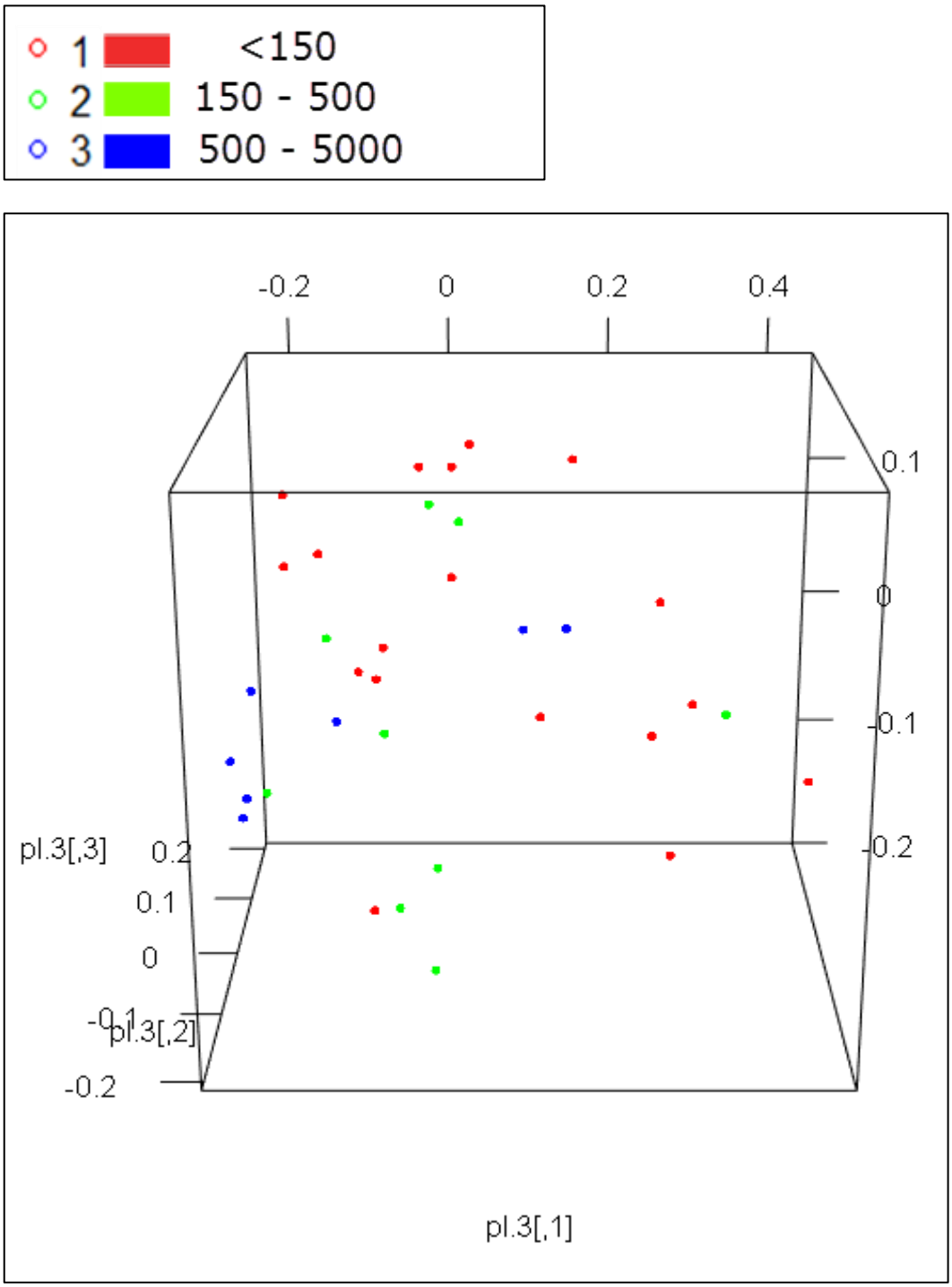


Figure 4:12: 3-dimensional plot based on all variables for ethnographic eHRAF cultures, coded in terms of population size

Figure 4.12 presents the results of the MDS statistical analysis for the ethnographic data relating to all variables (ritual, subsistence and social complexity), coded in terms of population size. Figure 4.12 demonstrates that the three population sizes do not show a

great degree of separation. For the most part, cultures representing the three population sizes seem to be dispersed randomly throughout the plot, though there is a partial tendency for the largest population size (blue) to occur at the far left-hand side.

4.2.5 General MDS summary in relation to population size

In terms of how the population sizes relate to the eHRAF sample, for the imagistic cultures, 73% of cultures represent population sizes with less than 150 people, 13% represent population sizes of 150 to 500 individuals and 13% represent population sizes of 500 - 5,000 people. For the doctrinal cultures, 37% of cultures represent population sizes with less than 150 people, 37% represent population sizes of 150 to 500 individuals and 26% represent population sizes of 500 - 5,000 individuals. The three population sizes appear more randomly distributed when using the combination of all variables. The cultures reflecting populations less than 150 individuals appear to cluster when using the subsistence and social complexity variables respectively. The populations ranging from 500 - 5,000 individuals cluster together more distinctly when analysed using the ritual variables compared to the plots based on the social complexity variables. This suggests that a degree of ritual uniformity associated with the doctrinal mode is a factor in the context of large group sizes, as proposed by Whitehouse (2004). The results seem to tentatively verify some of the proposed relationships between group size and subsistence, ritual and social complexity proposed by a number of authors. For example, we can see a link between the lower population size and the imagistic cultures which reflect primarily hunter-gatherer groups. The cultures reflecting the largest population size cluster distinctly when examined using the ritual variables, which suggests a connection between ritual activity and the larger (mainly doctrinal) populations. However, this examination of the role of group size represents an initial test using a small sample.

Following the analysis of the eHRAF cultures coded by population size the question must be asked: why did the subsistence variables become a more important distinguishing factor between the eHRAF cultures, compared to MDS coded by the mode of religiosity

classification? It appears that, while both ritual practice and levels of social complexity relate to group size, subsistence and population represent the more *direct* relationship. The implication is that subsistence practice constrains population size more directly than religious practice. If religious mode represents a means of coping with a particular group size, one could hypothesise that subsistence practice determines group size, which in turn is managed through religious practice—this point will be discussed further in Chapter 8, section 8.7

4.3 Principal Component Analysis

As describe in Chapter 3, section 3.9.2, PCA provides a statistical method to explore the relationship of individual eHRAF cultures to each other in terms of the recorded variables. PCA yields a correlation circle (variable factor map) and an individual factor map. The correlation circle (e.g., Fig. 4.13) presents the five most important variables that account for the variance in the data set in relation to the first two principal components. The factor map (e.g., Fig. 4.14) enables the visualization of how individual cultures cluster in relation to the five variables that account for the variance in the dataset. To achieve a comprehensive result, PCA was performed for the ritual, subsistence and social complexity variables, as well as, a combination of all variables.

4.3.1 Principal component analysis (PCA) based on the ritual variables

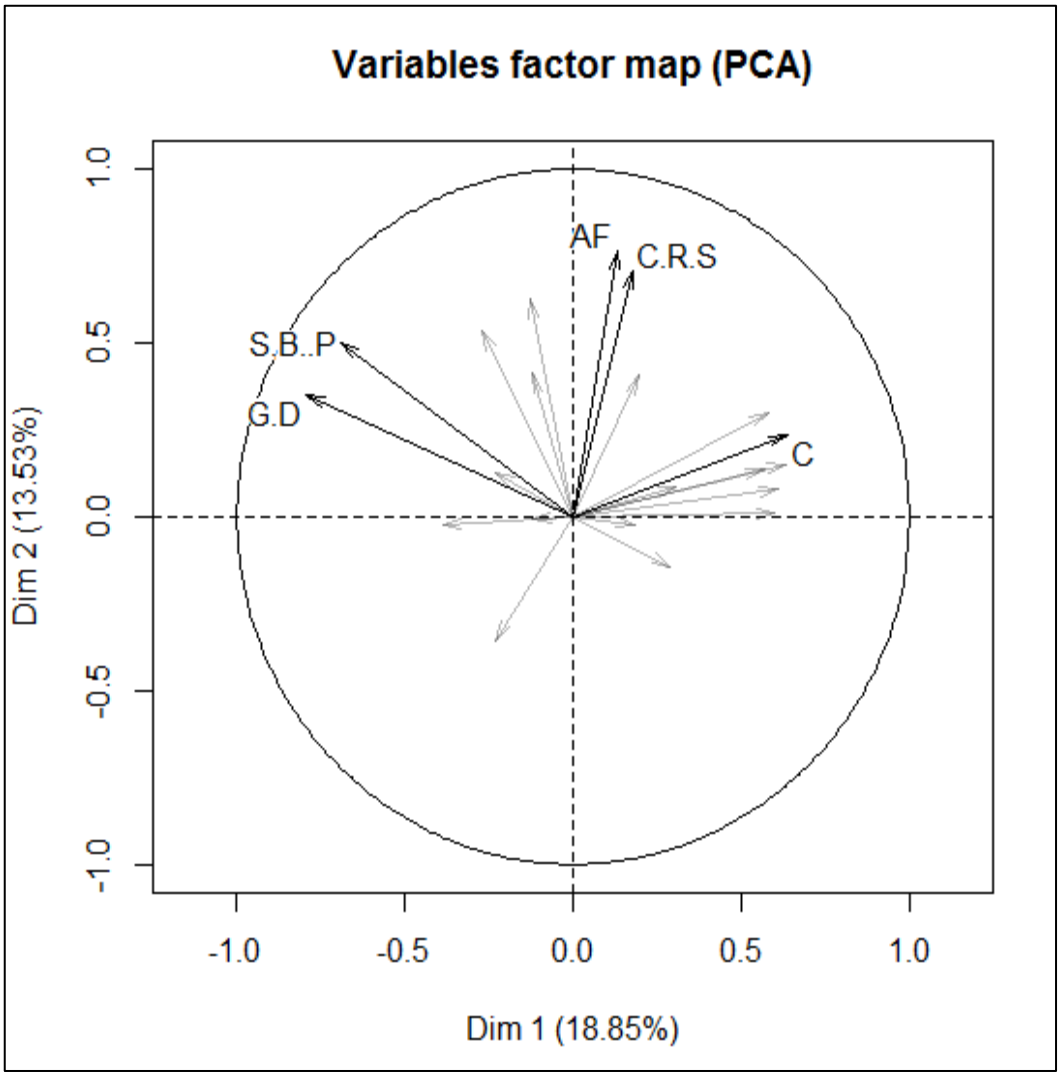


Figure 4:13: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on the ritual variables: Secondary Burial Practices (SBP), Grave Disturbance (GD), Anthropomorphic Figurines (AF), Communal Ritual Structures (CRS) and Cemeteries (C)

Figure 4.13 presents the correlation circle received following the PCA based on the ritual variables. The squared loadings give the proportion of the variance of the variables explained by the components. The correlation circle shows the five most important variables that account for the variance in the dataset in relation to the first two principal components. The variables are represented as vectors from the origin/centre. The length of the vector gives an indication of how much that variable can be constructed from the first two principal components and the cosine of the angle between any pair of variables is a measure of the correlation or co-occurrence.

The first variable extracted via the PCA is secondary burial practices (SBP), which are recorded in terms of absence or presence on the database. The results suggest that secondary burial practices accounts for the maximal amount of total variance in the observed database. The second variable extracted by the PCA is grave disturbance (GD), which is recorded in terms of absence or presence. The third variable extracted via the PCA is anthropomorphic figurines (AF), recorded in terms of absence or presence. The fourth variable extracted by the PCA is communal ritual structures, recorded in terms of absence or presence (CRS). The fifth variable extracted by the PCA is cemeteries (C), recorded as either absent or present. The vectors representing the secondary burial practices and grave disturbance variables in the upper left-hand quadrant are far from the centre. An acute angle (angle less than 90^0) between these two variables suggests that the cosine of the angle is close to 1 (r close to 1). This result indicates that secondary burial practices and grave disturbance variables are highly positively correlated and co-occur in many populations. To further examine the relationship between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the variables. The PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a perfect positive correlation, 0 is no correlation, and −1 represents a perfect negative correlation. For the secondary burial practices (S.B.P) and grave disturbance (G.D) variables, the correlation was estimated to be 0.6154758 with 95% confidence bounds (0.4398, 0.8897), showing that these variables are highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 4.307e-12 [4.307e * 10^ (-12)]; thus the null hypothesis that the secondary burial practices (S.B.P) and grave disturbance (G.D) variables are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between these two variables.

The anthropomorphic figurines and communal ritual structures variables are far from the centre and form an acute angle (less than 20^0) which suggests that these two variables are

decidedly positively correlated with the cosine of the angle (r) being close to 1. This received positive correlation results suggest a high level of co-occurrence between the presence of both anthropomorphic figurines and communal ritual structures. Additionally, the Pearson product-moment correlation coefficient (PPMCC) between these variables was calculated. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the anthropomorphic figurines (A.F) and the communal ritual; structures (C.R.S) variables, the correlation was estimated to be 0.6892557 with 95% confidence bounds (0.3135, 0.7733), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 2.457e-13 [2.457* 10^ (-13)]; thus the null hypothesis that the anthropomorphic figurines (A.F) and the communal ritual; structures (C.R.S) variables are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables.

The secondary burial practices and the grave disturbance variables are, almost, at 90^0 to the anthropomorphic figurines and communal ritual structures variables, respectively. The almost orthogonal relationship indicates that these variables show little correlation. Given this statistical result it is evident that, in the majority of instances, there is no co-occurrence between these variables. In a substantial number of samples from the eHRAF cross cultural sample, cultures participating in secondary burial practices and grave disturbance do not utilise anthropomorphic figurines and/or communal ritual structures. The cemeteries variable is located in the upper right-hand quadrant of the correlation circle. The angle between the cemeteries variable and both the anthropomorphic figurines and communal ritual structure variables is less than 90^0. The angle does not exceed 90^0; therefore, demonstrating a weak but positive correlation among these three variables (r close to 1); this indicates that, in a limited number of cases, there is a co-occurrence

between the presences of these variables. The correlation circle shows an obtuse angle (> 90◦) between cemeteries and secondary burial practices and the grave disturbance variables. As this angle is greater than 90^0 we can assert that these variables are negatively correlated this indicates that there is no co-occurrence among these variables. Thus, cultures possessing cemeteries never practice either secondary burial practices or grave disturbance.

From the correlation circle we can state that:

1. secondary burial practices and grave disturbance are highly positively correlated;
2. anthropomorphic figurines are highly positively correlated with the presence of communal ritual structures;
3. secondary burial practices are not correlated with anthropomorphic figurines and communal ritual structures;
4. grave disturbance is not correlated with anthropomorphic figurines and communal ritual structures;
5. cemeteries show a positive but weakly correlation with the presence anthropomorphic figurines and communal ritual structures; and
6. the presence of cemeteries is negatively correlated with secondary burial practices and grave disturbance, respectively.

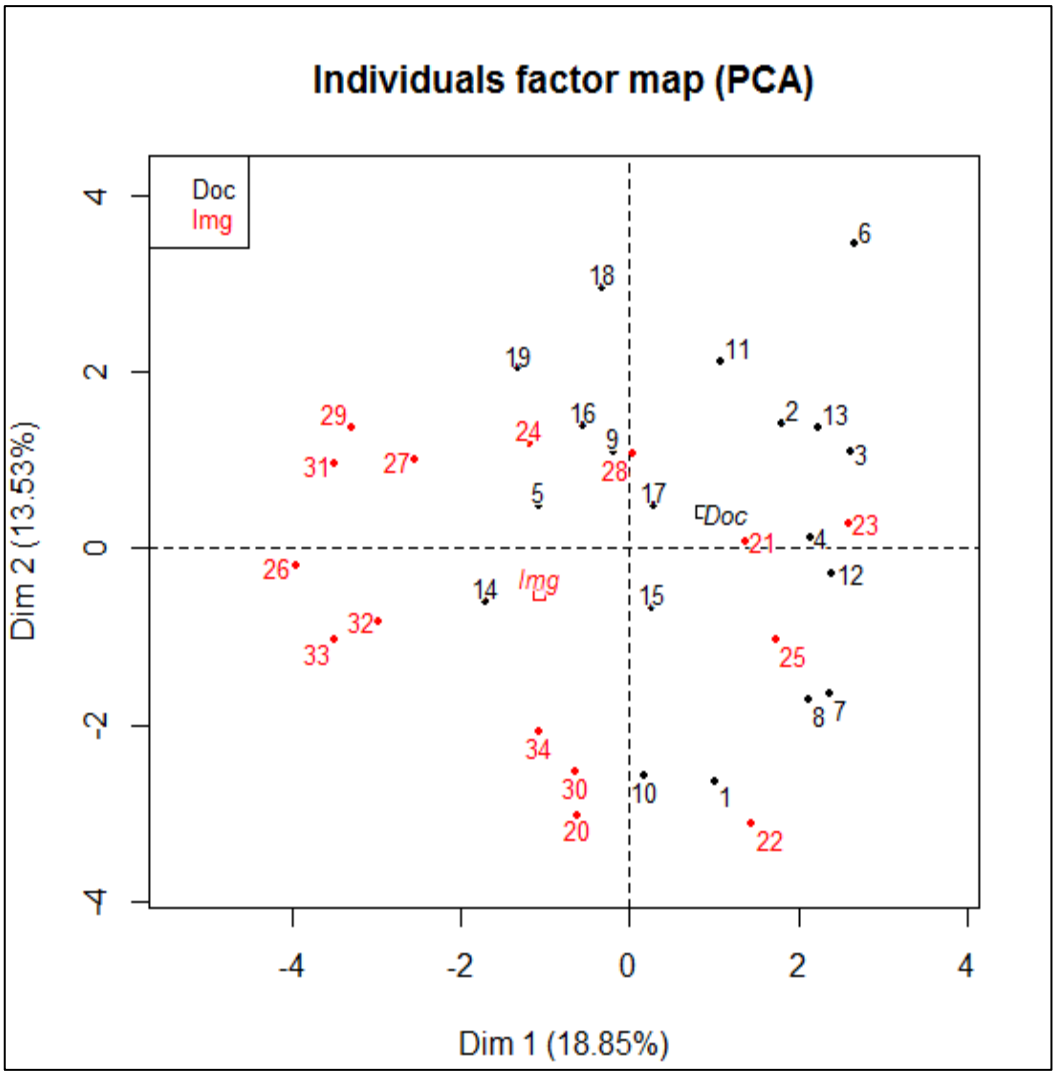


Figure 4:13: Individual Factor map showing cultures clustering based on the ritual variables following PCA analysis with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square.

Figure 4.14 presents the cultures plotted on a PCA factor map. The factor map shows how the five identified variables cause the cultures to cluster or separate in relation to the first two principal components following PCA based on the identified ritual variables. The ethnographic cultures classed as either doctrinal or imagistic are coloured according to their mode classification. The statistical centre of the imagistic or doctrinal clusters is represented by a square on the factor map; the centre represents the transformed multivariate centre or mean expressed in terms of the factor map. The imagistic and doctrinal cultures appear to be fairly evenly dispersed throughout the factor map. However, a doctrinal cluster (black) is apparent in the mid to upper right section of the

plot, while the imagistic cultures (red) cluster in the middle to left side of the plot. Around the centre of the plot there is some overlap between the imagistic and doctrinal cultures; examples include the Trobriand Islanders (doctrinal culture no. 14) and the Lozi (imagistic culture no. 21). For the most part, the Trobrianders are Christians, attending regular Sunday Church services. However, in parallel to their Christian beliefs, they believe in spirits who reside in the bush who cause illness and death and they maintain indigenous mortuary practices including secondary burial practices. In this example we can clearly assert that instances of non-Christian ritual practices such as grave disturbance cause the Trobriand Islanders to cluster in close proximity to a number of imagistic cultures. It is notable that the Trobrianders also overlapped with imagistic cultures when preforming MDS for the ritual variables (section 4.1.1). To an extent, the Lozi (imagistic) appear to be monotheistic but they retain a number of beliefs about spirits and other supernatural beings. The Lozi have communal ritual buildings and a standardised ritual framework. In relation to the separation of doctrinal and imagistic cultures, the Lozi do not engage in any secondary burial practices, which, in combination with their regularised religious frame work, is responsible for the observed overlap with the doctrinal cultures. The Central Thai (doctrinal culture no. 6) appears as an extreme case. The Central Thai culture appeared as an outlier or extreme case when MDS was performed for each set of variables (section 4.1).

In sum, it is apparent that the PCA to a degree parallels the MDS analysis as we are seeing similar examples of separation and coalescence when we run MDS and PCA based on the ritual variables. The PCA results strongly suggest that factors such as secondary burial practices are causing the examples of the doctrinal Trobriander culture to cluster near the imagistic centre. Similarly, evidence of ritual buildings and the standardisation of ritual practices are responsible for the Lozi culture (imagistic) clustering in close proximity to a number of doctrinal cultures. The factor map confirms that the imagistic

and the doctrinal cultures can largely be distinguished by the five identified ritual variables.

4.3.2 Principal component analysis (PCA) based on the subsistence variables

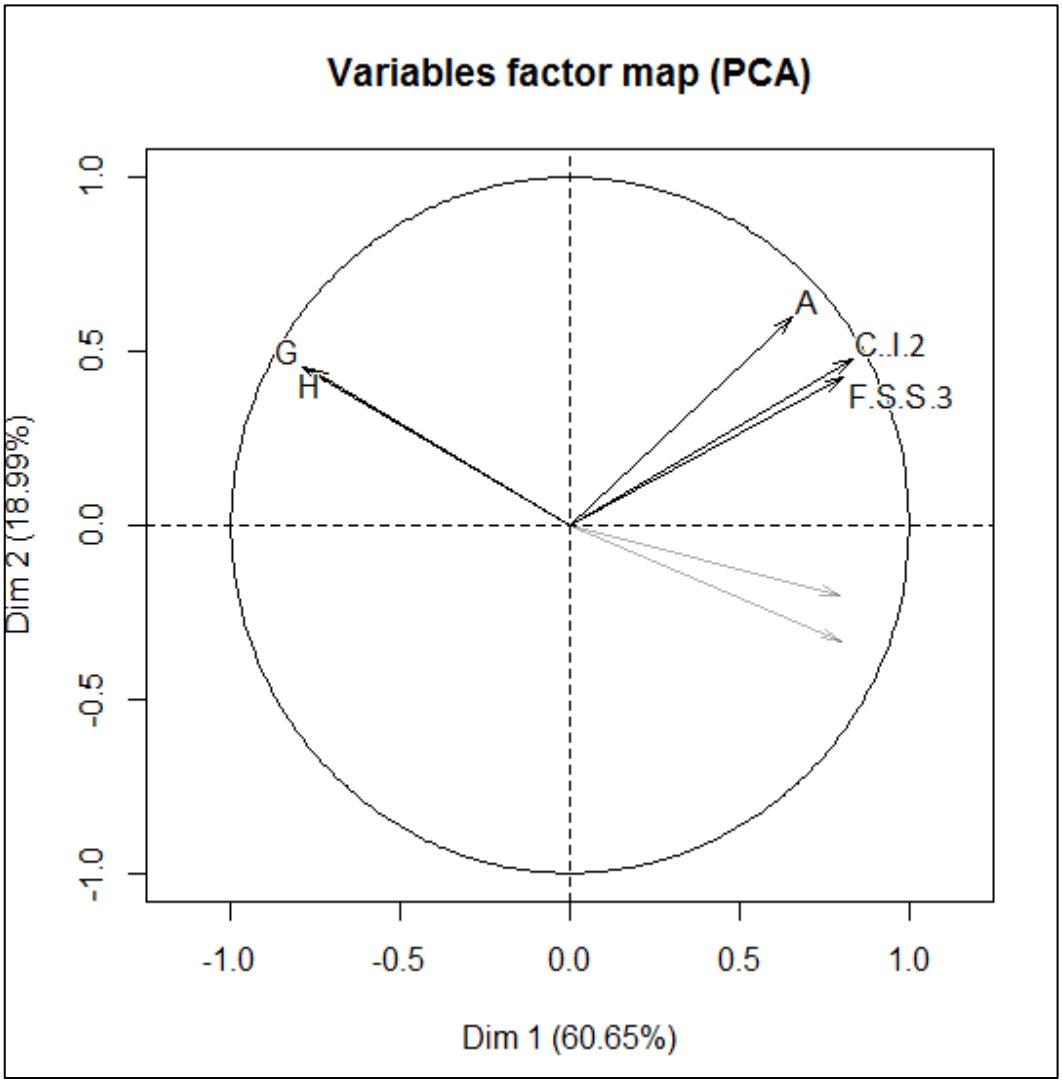


Figure 4:14: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on the subsistence variables: Hunting (H), Gathering (G), Crop Intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS.3) and Agriculture (A)

Figure 4.15 presents the correlation circle received following the PCA based on the subsistence variables. The first variable extracted by the PCA is hunting (H), which is recorded in terms of absence or presence on the database. The results suggest that hunting accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is gathering (G); instances of gathering are recorded in terms of absence or presence on the database. The third variable extracted by the PCA is

crop intensity at level 2 (CI.2) (high crop intensity). This result indicates a separation of the cultures based on their level of crop intensity—particularly, the cultures engaged in intensive cultivation/agriculture; which is measured on a Likert scale from 0 to 2 (0 = no evidence of cultivation, 1= cultivation of non- staples/non-domesticates, 2 = intensive cultivation/agriculture with domesticates). The fourth variable extracted by the PCA is food storage strategy at level 3 (FSS.3) (long-term food storage strategy). This result indicates a separation of the cultures based on their level of food storage strategy; which is measured on a Likert scale from 0 to 3 (0 = No storage strategy, 1 = daily, 2 = monthly, 3 = seasonal/yearly). The fifth variable extracted by the PCA is agriculture (A), which is recorded in terms of absence or presence on the database.

On the correlation circle the hunting and gathering variables are incredibly close together indicting that these two variables are highly correlated with the cosine of the angle (r) being equal to 1. The correlation of r =1 suggests an extremely high level of co-occurrence in the site-phases analysed; i.e. cultures that engage in hunting almost always participate in gathering and vice versa. To further examine the relationship between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the hunting and gathering variables, the correlation was estimated to be 0.9672852 with 95% confidence bounds (0.8026 0.9478), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 6.701* 10^ (-13)]; thus the null hypothesis that the hunting and gathering are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between these variables at a substantial number of the site phases analysed.

The vectors representing the high crop intensity and long-term food storage strategy variables are far from the centre. These variables appear highly positively correlated. An acute angle (angle less than 10^0) between these two variables suggests that the cosine of the angle is close to 1 (r close to 1). This result indicates that high crop intensity and long-term food storage strategy are highly positively correlated, suggesting that in a majority of cultures the level of crop intensity is directly related to the long-term food storage strategy and vice versa. Additionally, the Pearson product-moment correlation coefficient (PPMCC) between these variables was calculated. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For these two variables, the correlation was estimated to be 0.8888889 with 95% confidence bounds (0.7874, 0.9434), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 26.701* 10^ (-12)]; thus the null hypothesis that the crop intensity at 2 (C.I.2) and food storage strategy at 3 (F.S.S) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables.

The agriculture variable, the high crop intensity and long-term food storage strategy variables are far from the centre. An acute angle (angle less than 90^0) between the vectors representing these variables suggests that the cosine of the angle would be close to 1 (r close to 1). This result indicates that the agriculture, high crop intensity and long-term food storage strategy are decidedly positively correlated; suggesting that in a number of cultures, the level of crop intensity and or agriculture is directly related to the long-term food storage strategy and vice versa. The correlation circle shows an angle of almost 90◦ between hunting and gathering variables and the agriculture variable; indicating that these variables are not correlated. This indicates that there is very little co-occurrence between the presence of these variables—cultures employing hunting and gathering rarely engage

in agriculture. An obtuse angles (> 90◦) between hunting and gathering variables and the high crop intensity and long-term food storage strategy variables indicates that these variables are extremely negatively correlated (r close to -1). Given this statistical result it is evident that in a number of circumstances, there is no co-occurrence between the these variables; in a sizable number of cases from the cross cultural sample, cultures engaging in hunting and gathering do not have a high degree of crop Intensity or utilise long-term food storage strategies.

From the correlation circle we can state that:

1. hunting and gathering variables are entirely deducible from each other; significantly correlated
2. high crop intensity and long-term food storage strategy are highly positively correlated;
3. agriculture, high crop intensity and long-term food storage strategy are highly positively correlated;
4. high crop intensity and long-term food storage strategy are strongly correlated; and
5. hunting and gathering are negatively correlated with high crop intensity and long-term food storage strategy.

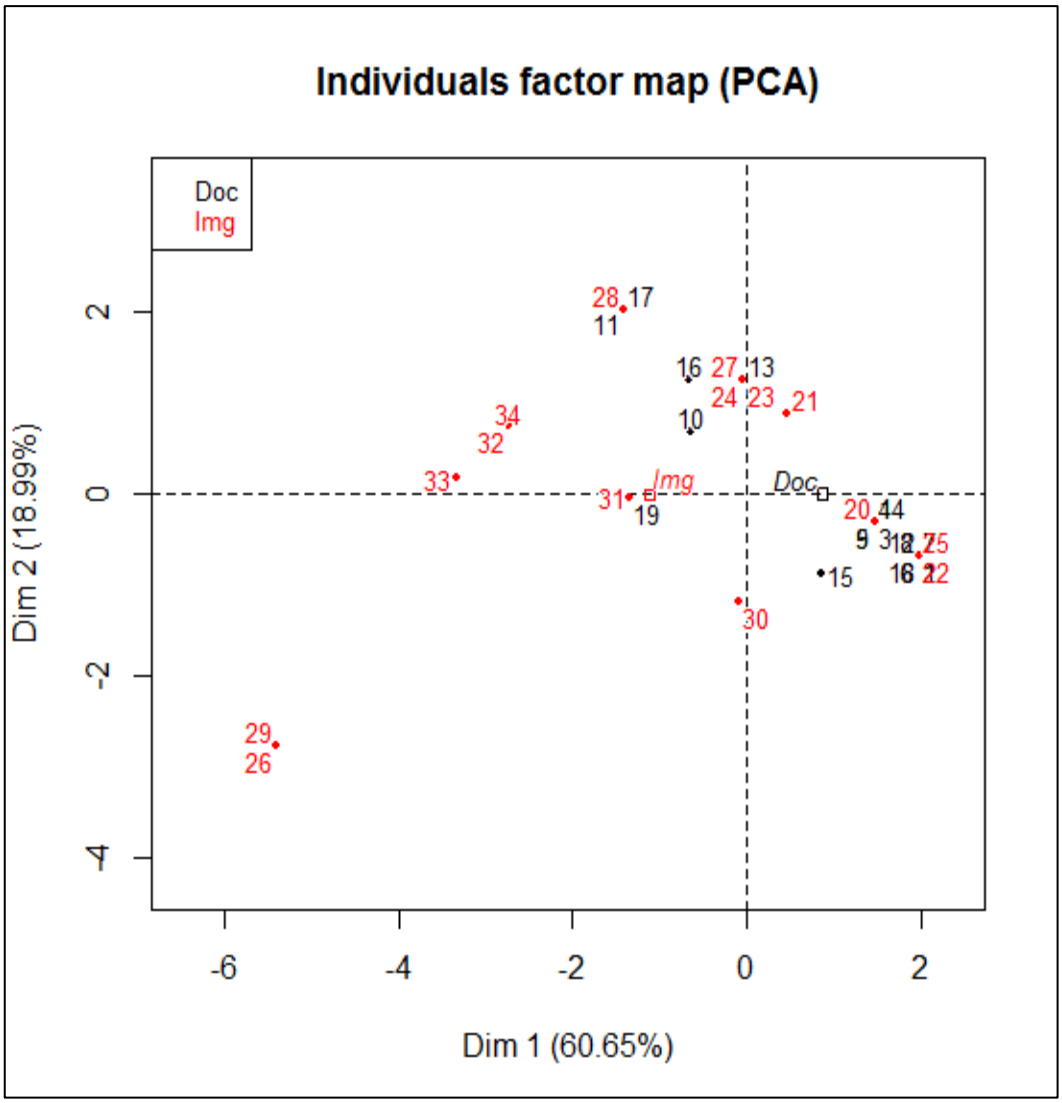


Figure 4:15: Individual Factor map showing cultures clustering based on the subsistence variables following PCA analysis with the Imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square.

Figure 4.16 presents the cultures plotted on a PCA factor map. The factor map shows how the five identified variables cause the cultures to cluster or separate in relation to the first two principal components following PCA based on the subsistence material correlate variables. The ethnographic cultures classed as either doctrinal or imagistic are coloured according to their mode classification. In terms of the discernible clusters, the doctrinal cultures appear to cluster on the right-hand side of the factor map while the imagistic cultures are located on the left-hand side. The cluster of doctrinal cultures (on the extreme right) is comprised of sedentary groups that rely exclusively of high intensity agriculture as their economic/subsistence model. For example, culture no. 9 represents the North

American Indian Iroquois tribe: a sedentary population that live in villages where several hundred acres are often dedicated to fields for growing crops. The imagistic cultures (no. 31-34) that group together near the imagistic centre are composed of mobile or semi-mobile groups that depend on hunting and gathering. For example, culture no 31 is the Jivaro culture from foothills of the Andes near the Ecuadorian-Peruvian border, is a geographically dispersed, semi-sedentary group who engage in hunting, gathering and fishing. Similarly, cultures 32-34 (the Tukano, Yanoama and Bororo) which cluster closely in the upper left-hand side quadrant of the factor map represent semi-sedentary groups that engage in a variety of hunting/fishing and gathering activities. The most interesting cultures are, for example, the Guaraní (culture no. 19), a doctrinal culture that appears adjacent to the imagistic culture centre. Similarly, the Banyoro (imagistic culture no. 20) is located in the lower right-hand quadrant near the doctrinal culture centre. Both these cultures also showed overlap in the MDS analysis based on subsistence variables (section 4.1.2). Culture no. 19 is the Guaraní from lowland South America. They are classed as a doctrinal culture based on their ritual activity. However, their subsistence strategy includes foraging wild resources, small-scale garden cultivation on individual family plots and hunting to provide meat. In this example, we can see how a food procurement system that includes hunting and gathering is causing the Guaraní culture to cluster in close proximity to imagistic cultures. For the Banyoro culture from Western Uganda, Africa (although classed as imagistic based on their ritual activities) agriculture forms the basis of their economy with the majority of the Banyoro being sedentary farmers. From the results, we can see how aspects of subsistence strategy are responsible for the clustering of imagistic and doctrinal cultures, respectively, particularly contrasting groups that rely on hunting and gathering against groups that engage in high intensity agriculture and food surplus generation. The zone of overlap centres on groups that participate in low level or garden cultivation supplemented by hunting and foraging. The factor map demonstrates that the imagistic and the doctrinal cultures can be distinguished by the five identified subsistence variables—particularly, distinguishing between hunter-

gather and groups that engage in high intensity agriculture with a long-term storage strategy.

4.3.3 Principal component analysis (PCA) based on the social complexity variables

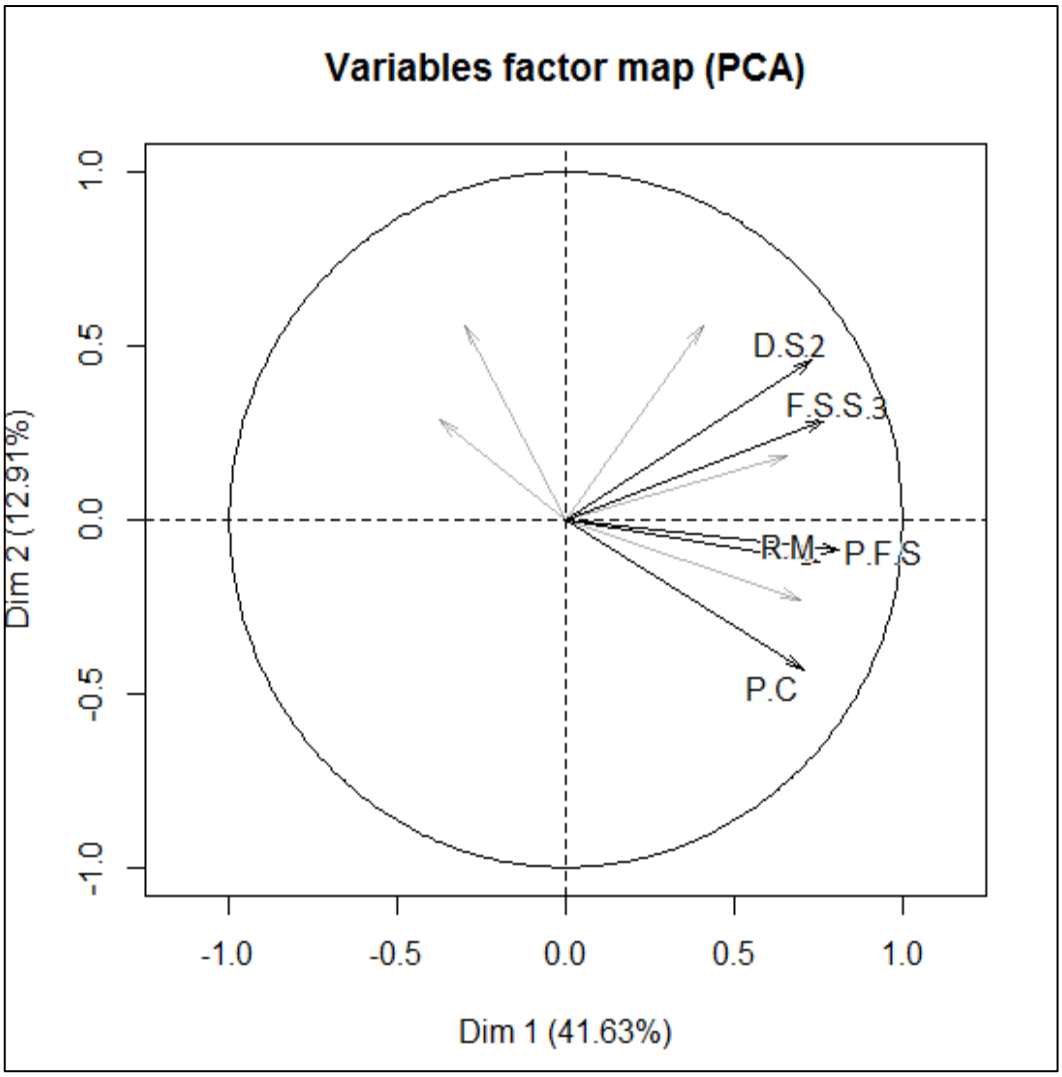


Figure 4:16: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on the social complexity variables: Degree of Sedentism at 2(DS.2), Private Food Storage (PFS), Private Cooking (PC), and Food Storage Strategy at 3 (FSS.3) and Resource Monopolization (RM)

Figure 4.17 presents the correlation circle received following the PCA based on the social complexity variables. The first variable extracted via the PCA is the degree of sedentism at level 2 (DS.2) (high degree of sedentism), measured on a Likert scale from 0 to 2 (0 = no sedentism, 1 = some sedentism, 2= fully sedentary communities). The results suggest that a high degree of sedentism accounts for the maximal amount of total variance in the

observed variables. The second variable extracted by the PCA analysis is private food storage (PFS), recorded in terms of absence or presence. The third variable extracted via the PCA analysis is private cooking (PC), recorded in terms of absence or presence. The fourth variable extracted by the PCA is food storage strategy at level 3 (FSS.3) (long-term food storage strategy). The fifth variable extracted via the PCA is resource monopolization (RM), recorded in terms of absence or presence. The degrees of sedentism and long-term food storage strategy variables are located in the upper right-hand side of the plot. An acute angle (angle less than 90^0) between these two variables suggests that the cosine of the angle is close to 1 (r close to 1). This result indicates that the high degree of sedentism and long-term food storage strategy variables are highly positively correlated; many cultures that have a high degree of sedentism (fully sedentary) engage in a long term food storage strategies and vice versa.

The vectors representing resource monopolization and private food storage variables are highly positively correlated, with the variables almost being superimposed on each other. An acute angle (angle less than 90^0) between these two variables suggests that the cosine of the angle would be close to 1 (r close to 1). This result indicates that resource monopolization and private food storage exhibit a high level of co-occurrence; in a majority of cultures where private food storage is utilised, resource monopolization is evident. To further examine the relationship between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. The correlation was estimated to be 0.7507572 with 95% confidence bounds (0.5789, 0.8587), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 5.597* 10^ (-8)]; thus the null hypothesis that private food storage (PFS) and resource

monopolization (RM) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables; indicating that at a substantial number of the site phases analysed we have a co-occurrence between resource monopolization and food storage.

The Long-term food storage strategy, resource monopolization and private food storage variables are positively correlated with the cosine of the angle (r) being close to 1, suggesting a co-occurrence between these variables. A high degree of sedentism is weak but positively correlated with resource monopolization and private food storage variables. Private cooking located on the lower left-hand quadrant is positively correlated with the other four variables. However, there are distinctions to be made. For instance, private cooking is more positively correlated with resource monopolization and private food storage than it is with the high degree of sedentism and long-term food storage strategy, suggesting a greater degree of co-occurrence between the former two variables. The weakest correlation of all the pairs of vectors is between the high degree of sedentism and private cooking variables but this is still a positive correlation. This result suggests a lower level of co-occurrence between these variables.

From the correlation circle we can state that:

1. private food storage and resource monopolization are highly positively correlated;
2. a high degree of sedentism is highly correlated with a long-term food storage strategy;
3. private cooking is more highly correlated with private food storage and resource monopolization than it is with a high degree of sedentism; and
4. private cooking shows a positive but weak correlation with a high degree of sedentism.

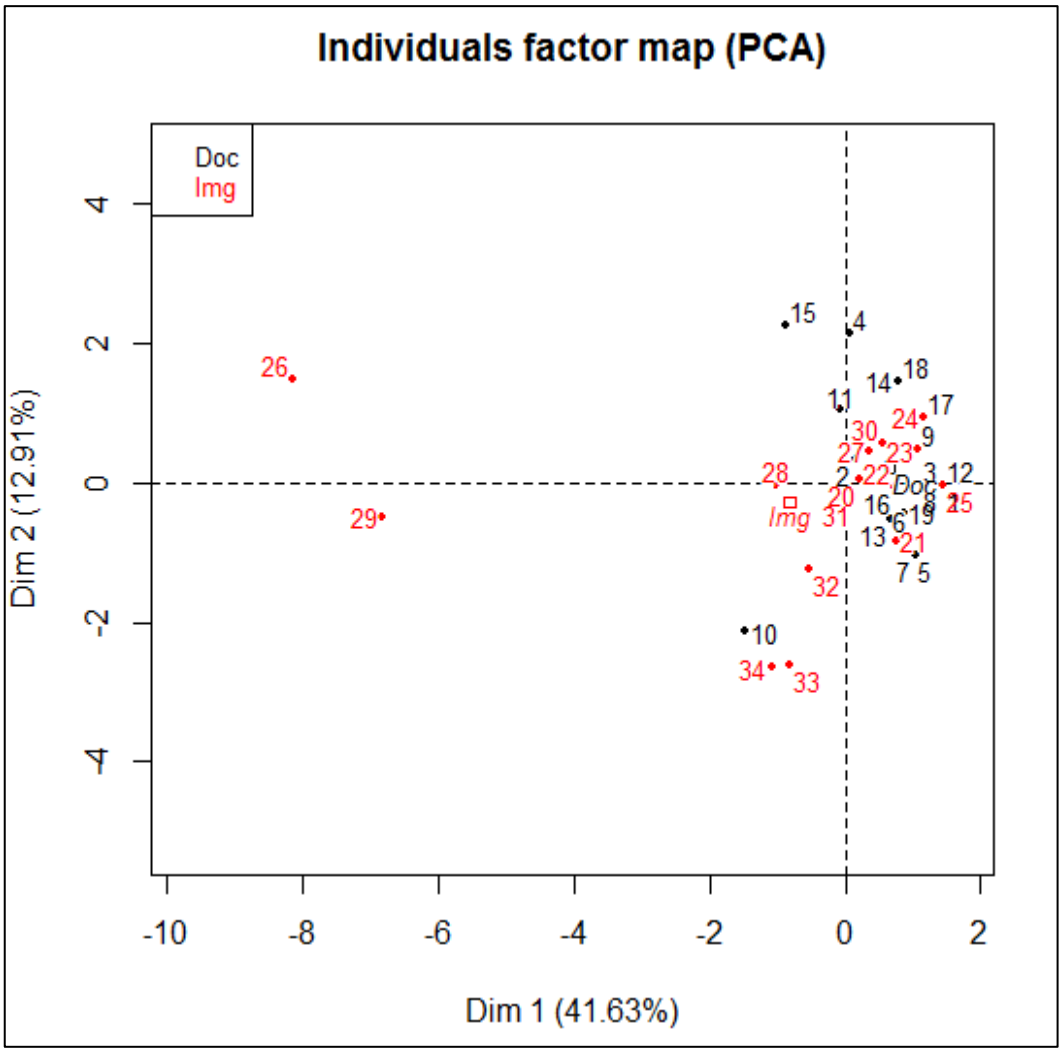


Figure 4:17: Individual Factor map showing cultures clustering based on the social complexity variables following PCA analysis with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square.

Figure 4.18 presents the cultures plotted on a PCA factor map. The factor map shows how the five identified variables cause the cultures to cluster or separate in relation to the first two principal components following PCA based on the social complexity variables. We can observe, somewhat, of a doctrinal cluster (black) in the mid to upper right section of the plot. Similarly, the imagistic cultures (red) cluster in the middle right side of the plot. Generally, there is a great degree of overlap in the sample. However, there are two distinct imagistic cultures that act as extreme cases: culture no. 26 (Andamans) and culture no. 29 (Aranda). The Andaman culture was observed on the extremity of imagistic section of all MDS plots (section 4.1). Similarly, this culture acted as an extreme case when PCA was performed based on the subsistence variables (section 4.2.2). The Aranda

culture was observed as an extreme case when PCA was performed based on subsistence variables. The most interesting culture is the Wolof (imagistic culture no. 25), an imagistic culture located close to the centre of the doctrinal cultures. The Wolof (a large ethnic group) in Senegal, West African are identified as Muslims (world religion), but they maintain a number of indigenous ritual practices. The majority of the Wolof, about 70 to 75 percent, consists of rural villagers; the remainder constitute a significant group in many of the larger urban centres of Senegal. Their subsistence economy is based on agriculture. Also, in the rural villages there is a high degree of disparity centred on private food storage and resource monopolization; for example, in each village only a select a few people own cattle which are often considered more as a sort of wealth reserve than a food resource. From this example, it can be suggested that factors such as resource monopolization and private food storage cause the imagistic cultures such as the Wolof to cluster in close proximity to the doctrinal centre. The Wolof also clustered close to doctrinal cultures when MDS was carried-out using all variables (section 4.1.4).

4.3.4 Principal component analysis (PCA) based on all variables

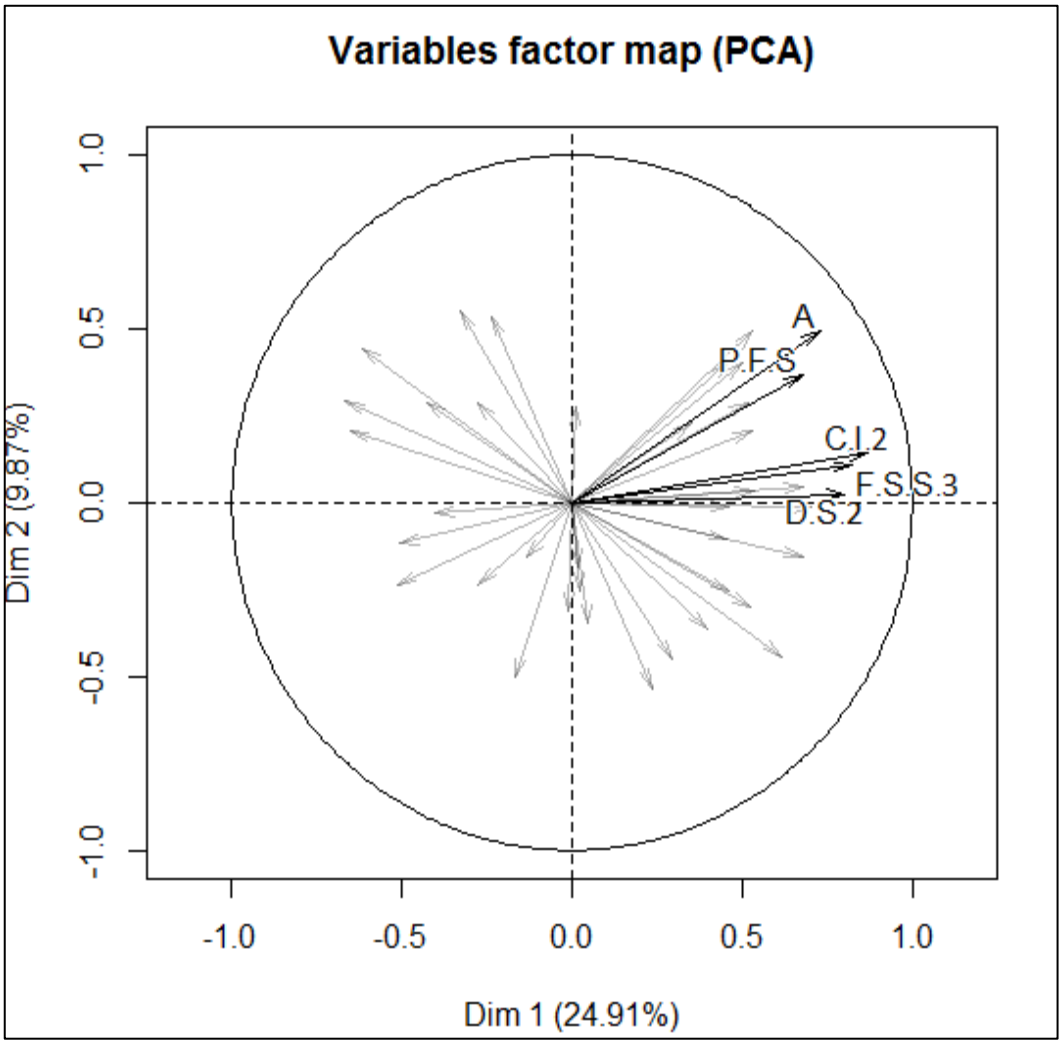


Figure 4:18: Correlation graph showing the first five variables that account for most of the variance in the eHRAF dataset based on all variables: Agriculture (A), Crop Intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS. 3), Private Food Storage (PFS) and Degree of Sedentism at 2 (DS.2)

Figure 4.19 presents the correlation circle produced by the PCA based on all variables. The first variable extracted via the PCA is agriculture (A), which is recorded in terms of absence or presence on the database. The results suggest that agriculture accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is crop intensity at level 2 (CI.2) (high crop intensity); showing a separation of the cultures based on their level of engagement in intensive cultivation/agriculture. The third variable extracted by the PCA is food storage strategy at level 3 (FSS.3) (long-term food storage strategy). The fourth variable extracted by the PCA is private food storage (PFS), recorded in terms of absence or presence. The fifth

variable extracted by the PCA is the degree of sedentism (DS.2) (high degree of sedentism, reflecting fully sedentary communities). The vectors representing the agriculture and private food storage variables are far from the centre. An acute angle (angle less than 90^0) between these two variables suggests that the cosine of the angle would be close to 1 (r close to 1). This result indicates that the agriculture and private food storage variables are highly positively correlated, in that many cultures that engage in agriculture also have private food storage and vice versa. The high crop Intensity and long-term food storage strategy variables are far from the centre and form an acute angle (less than 10^0) which suggests that these two variables are highly positively correlated with the cosine of the angle (r) being close to 1. This result suggests that the level of crop intensity is directly related to the food storage system utilised. For example, cultures that engage in high intensity crop cultivation, also, have a longer term food storage strategy. In addition, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For these two variables, the correlation was estimated to be 0.8972852 with 95% confidence bounds (0.8026, 0.9478), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 6.701* 10^ (-13)]; thus the null hypothesis that the crop intensity at 2 (C.I.2) and food storage strategy at 3 (F.S.S) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables

Similarly, the variables high crop intensity and long-term food storage strategy, respectively, make an acute angle (angle less than 90^0) with the high degree of sedentism. This acute angle demonstrates that these variables are highly positively correlated, the cosine of the angle (r) being close to 1. This observation suggests that in many cases a

high degree of sedentism is linked to high levels of crop intensity and a long-term food storage strategy employed by the culture. This result is not surprising in the ultimate sense as it is expected that these variables would be connected but it does demonstrated the degree to which these variables are correlated in the eHRAF sample used in this research. The agriculture and private food storage variables form an acute angle with the high crop intensity and long-term food storage strategy variables. As this angle is less than 90^0 we can assert that these variables are positively correlated (r close to 1); this indicates that, in a number of cases, there is a positive relationship between these variables. From the correlation circle we can state that:

1. private food storage is strongly correlated with the presence of agriculture, showing a definite co-occurrence;
2. a high crop intensity and long-term food storage strategy are positively correlated; and
3. a high degree of sedentism is more strongly correlated with long-term food storage strategy and high crop intensity than it is with private food storage.

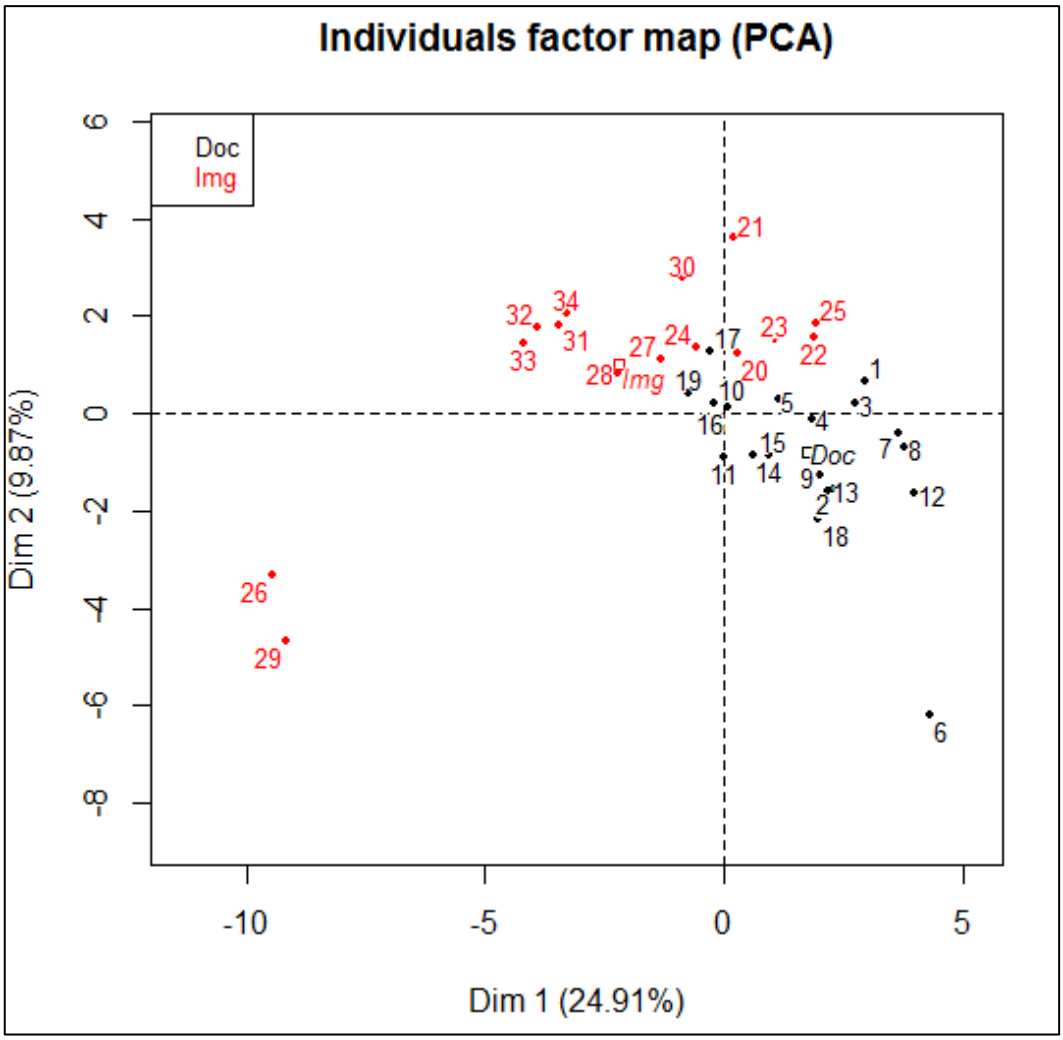


Figure 4:19: Individual factor map showing cultures analysed by PCA on the basis of all variables with the imagistic cultures in red and the doctrinal cultures in black, and the statistical centre of each cluster represented by a square.

Figure 4.20 presents the cultures plotted on a PCA factor map. The factor map presents how the five identified variables cause the cultures to cluster following PCA based on the combination of all the PCA identified variables. For the most part, we can see that there are two distinctive clusters, doctrinal (black) and Imagistic (red). We can observe towards the centre of the two clusters some degree of closeness or overlap between the imagistic and the doctrinal cultures. Three apparent outliers are observed (one doctrinal and two imagistic cultures). The doctrinal outlier is culture no. 6 (Central Thai). The imagistic outliers are no. 26 (Andamans) and culture no. 29 (Aranda) which are more affected by the first component than the second. The Central Thai were recorded on the on the extremity of doctrinal section of the PCA plot based on the ritual variables (section

4.1.1). Similarly, Andamans were observed on the extremity of imagistic sector of the PCA plots based on the subsistence and social complexity variables (sections 4.1.2 and 4.1.3). However, the more questionable cultures are, for example, culture no. 19 or and culture 17 as they are doctrinal cultures that appear close to imagistic cultures. Similarly, the Hausa (culture no. 22) was recorded as an imagistic culture that overlaps with some doctrinal cultures. Culture no. 17 is identified as the Saramaka from the Republic of Suriname on north-eastern Atlantic coast of South America. Classed as a doctrinal culture based on their ritual activity, the Saramaka depend on shifting (swidden) horticulture, hunting, and fishing, supplemented by wild forest products, for subsistence. Culture no. 19, the Guaraní are indigenous to lowland South America. While classed as a doctrinal culture centred on their ritual activity, their subsistence strategy focuses on the cultivation of variety of other foods (including manioc, corn, beans and sweet potato) in individual family garden plots, foraging to supplement the yield from their family plots and hunting to provide meat throughout the year. Culture no. 22 is the Hausa cultural group from West Africa. Although classed as imagistic based on their ritual activities, the Hausa reflect a group that live in villages, towns or cities and rely on agriculture as their main economic activity. Therefore, we can observe how aspects of ritual practices, subsistence strategy and social complexity are causing imagistic and /or doctrinal cultures to cluster in close proximity.

4.3.5 General PCA summary

The use of PCA enables the identification of the specific material correlate variables that account for the variance in the sample. The PCA results show that the greatest separation between the imagistic and doctrinal cultures respectively was achieved when PCA was performed based on the combination of all variables. The ritual variables resulted in a degree of overlap compared to the MDS analysis but there was a distinction recorded between both cultural groups. PCA using the subsistence variables resulted in greater separation between imagistic and doctrinal cultures than was observed using MDS. PCA

based on the social complexity variables resulted in the highest degree of overlap. MDS based on the subsistence strategy variables resulted in the least statistical distinction between the eHRAF cultures, whereas PCA using the subsistence variables resulted in a much greater separation between the imagistic and doctrinal cultures. The reason why the PCA based on the subsistence variables proved to be better at distinguishing between the eHRAF cultures than the MDS analysis reflects the difference between the two types of analyses. MDS separated the imagistic and doctrinal cultures based on *all* 10 subsistence variables for each, whereas PCA is separating the imagistic and doctrinal cultures based on a *specific* set of the five most influential subsistence variables. Thus, we can see when PCA identified the five most influential subsistence strategy variables; as a result a clearer distinction is recorded between the imagistic and doctrinal cultures, compared to MDS analysis. The identified variables form PCA that are used to generate the generalised linear model (GLM) in Chapter 7.

Chapter 5: Exploratory analysis of the South-west Asian archaeological database

5 Introduction

This chapter presents the analysis of the south-west Asian site-phases using multidimensional scaling (MDS) and principal component analysis (PCA).

5.1 Multidimensional Scaling

MDS was used to explore variation among the south-west Asian archaeological site-phases by constructing dissimilarity matrices based on Gower distances, using the *R-statistics* package. This section gives the results of MDS analysis based on the sets of recorded ritual, subsistence and social complexity variables, as well AS, all variables combined. MDS was conducted on a sample of 44 well documented sites (64 site-phases in total) from the Epipalaeolithic to the Pottery Neolithic periods in south-west Asia (Chapter 3, section 3.5.2). The south-west Asian archaeological database was used to construct a two-dimensional and a three-dimensional dissimilarity matrix in order to assess multivariate distances among the site-phases. In chapter 4, the degree to which the ritual, subsistence and social complexity material correlates reflect mode of religiosity was explored for the eHRAF cultures. From the MDS analysis of the eHRAF sample, it is evident that doctrinal and imagistic cultures show the greatest statistical separation when analysed using ritual variables only; they show the greatest degree of overlap when analysed using the subsistence variables only.

5.1.1 Multidimensional scaling based on the ritual variables, coded by culture-historical period

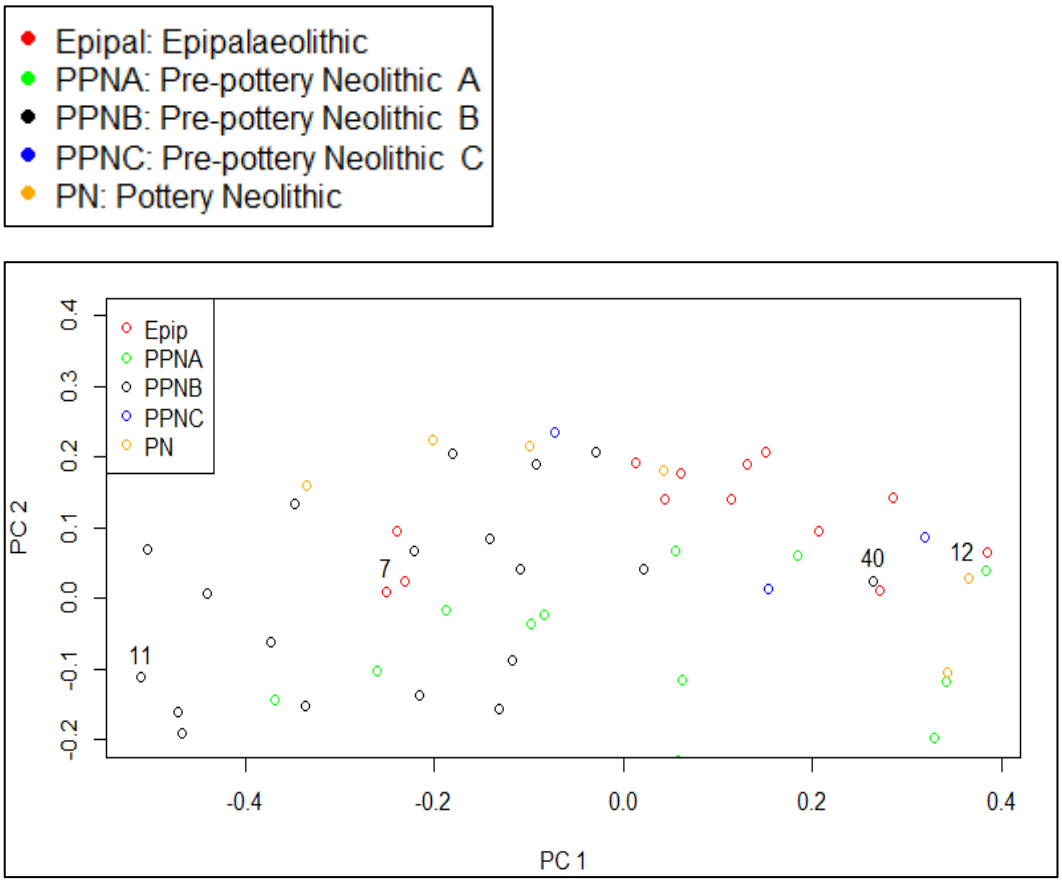


Figure 5:1: 2-d plot based on the ritual variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Epipalaeolithic Ain Mallaha (7), PPNB Basta (11), Epipalaeolithic Beidha I (12), and PPNB Khirbet Hammam (40)

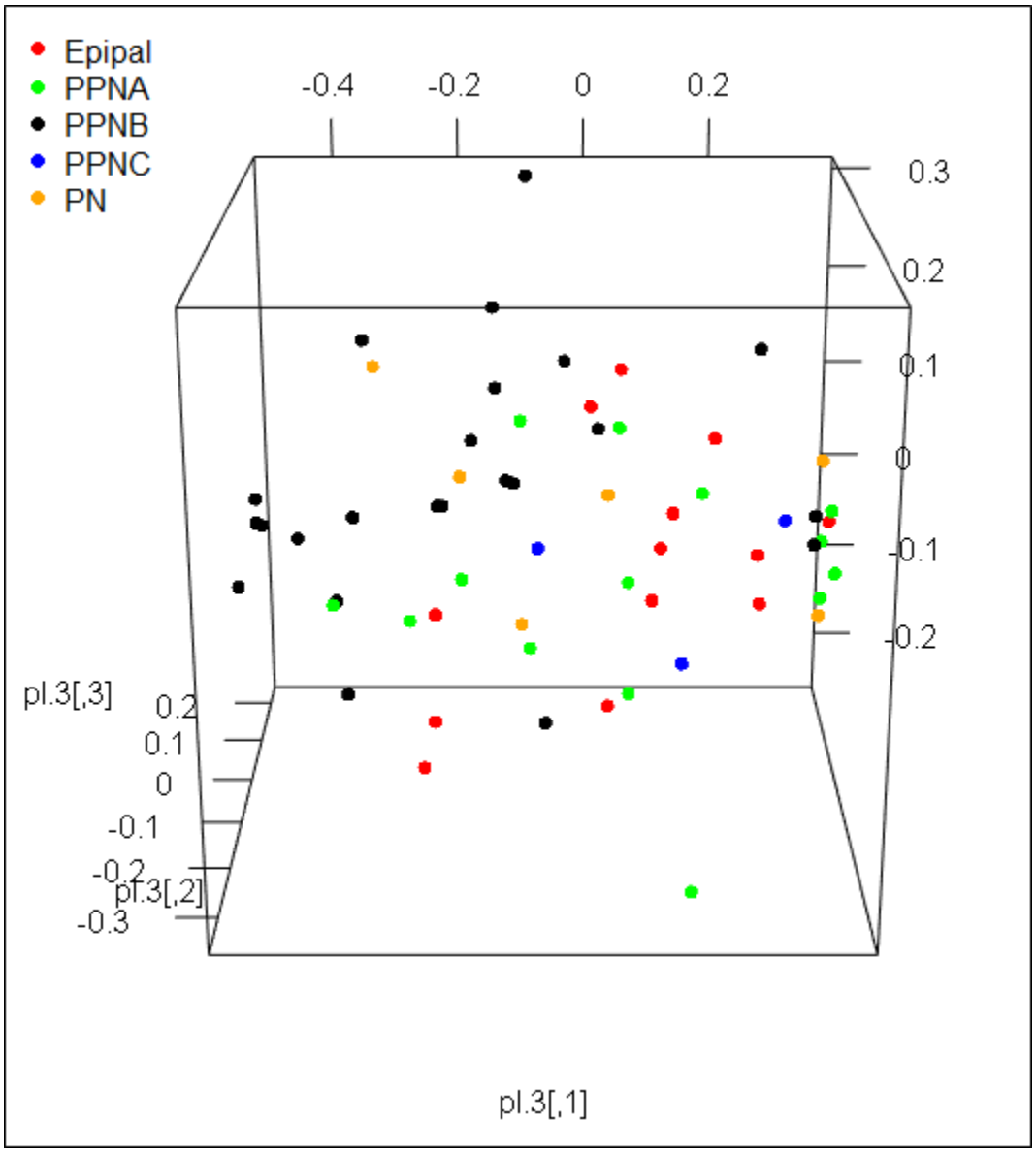


Figure 5:2: 3-d plot based on the ritual variables for south-west Asian archaeological site-phases, coded in terms of cultural phase

Figures 5.1 and 5.2 show the results of the MDS statistical analysis of the south-west Asian archaeological dataset based on the ritual variables, coded in terms of either Epipalaeolithic or one of the four Neolithic cultural phases. The Epipalaeolithic site-phases are distributed around the upper middle to right-hand quadrant of the plots; with three examples in the middle to left section of both plots. The PPNB site-phases are located in the middle to upper left-hand side of the plots. The PPNC site-phases are positioned in the middle to right-hand section of the plots. The PPNA and PN site-phases are dispersed evenly throughout the plots.

In Figure 5.1 we can see that the greatest distance on the plot is identified between Epipalaeolithic Beidha I (site-phase no. 12) and the PPNB phase at Basta (site-phase no. 11). The PPNB phase at Basta has yielded evidence of a ritual system that includes special burial treatment, burial goods, grave disturbance, figurines and communal/ritual buildings (Nissen, *et al.* 1987; Gebel *et al.* 1988; Roehrer-Ertl *et al.* 1988; Starck 1988; Nissen *et al.* 1991; Thaís and Pernika 1997; Dahl Hermansen 1997; Becke 1998; Gebel 1996; 2002; Berner and Schultz 2004; Kinzel 2004). By contrast, Epipalaeolithic Beidha I has none of the ritual material culture identified at PPNB Basta (Kirkbride 1960; 1966a; 1966b; 1966c 1967; 1968a; 1968b; 1984; Mortensen 1970; Hecker 1982; Byrd 1988; 1991; 1994; 2005).

There are examples of overlap between site-phases from different cultural phases in the plot. For instance, Epipalaeolithic Ain Mallaha (site-phase no.7) is located on the left-hand side of the plot adjacent to a number of PPNB site-phases. Epipalaeolithic Ain Mallaha is located in close proximity to the PPNB site-phases as they have a number of aspects of ritual activity in common including: figurines, grave disturbance and special burial treatment (Perrot 1957; 1960; 1975a; 1975b; 1976; Valla 1975; 1977a; 1977b; 1988; Lechevallier and Perot 1973; Bar-Yosef and Valla 1979; Sillen 1984; Stordeur 1988; Valla and Lechevallier 1989; Bocquentin *et al.* 2001; Mithen 2003). The eigenvalue calculated via R-statistics for the three-dimensional plot is 0.9326574, which indicates that 93% of the site-phase information from the south-west Asian archaeological database was reduced to variables in 3 dimensions with only a loss of 7% of information. The MDS analysis based on ritual variables presents us with the greatest separation between a PPNB and an Epipalaeolithic site-phase on the 2-d plot. On the 3-d plot we can see a degree of separation between the Epipalaeolithic site-phases on the middle to right hand side and the PPNB site-phases on the middle to left hand side; this separation indicates a broad trend of difference relating to ritual material culture. The particular

ritual variables causing separation and coalescence will be investigated in the principal component analysis (PCA) section of this chapter (section 5.3).

5.1.2 Multidimensional scaling based on the subsistence variables, coded by culture-historical period

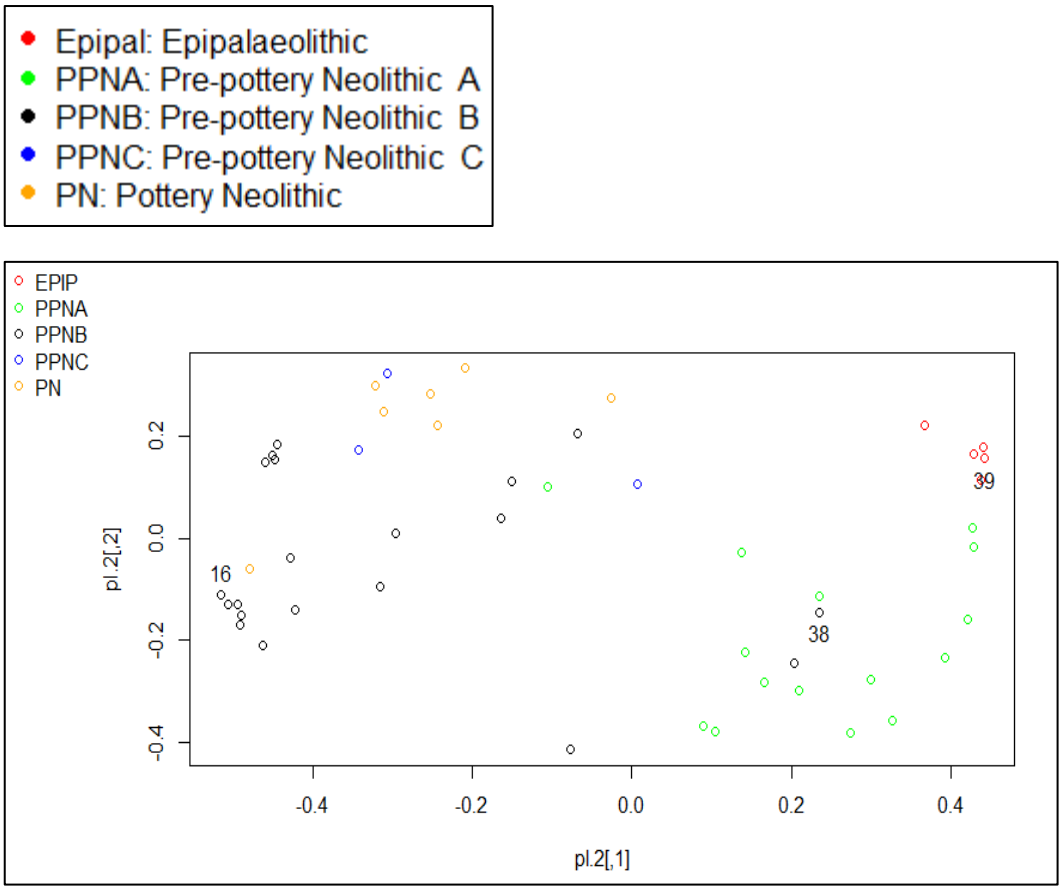


Figure 5:3: 2-d plot based on the subsistence variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: PPNB Catalhöyük I (16), PPNB Kfar Hahoresh (38) and Epipalaeolithic Kharaneh IV (39)

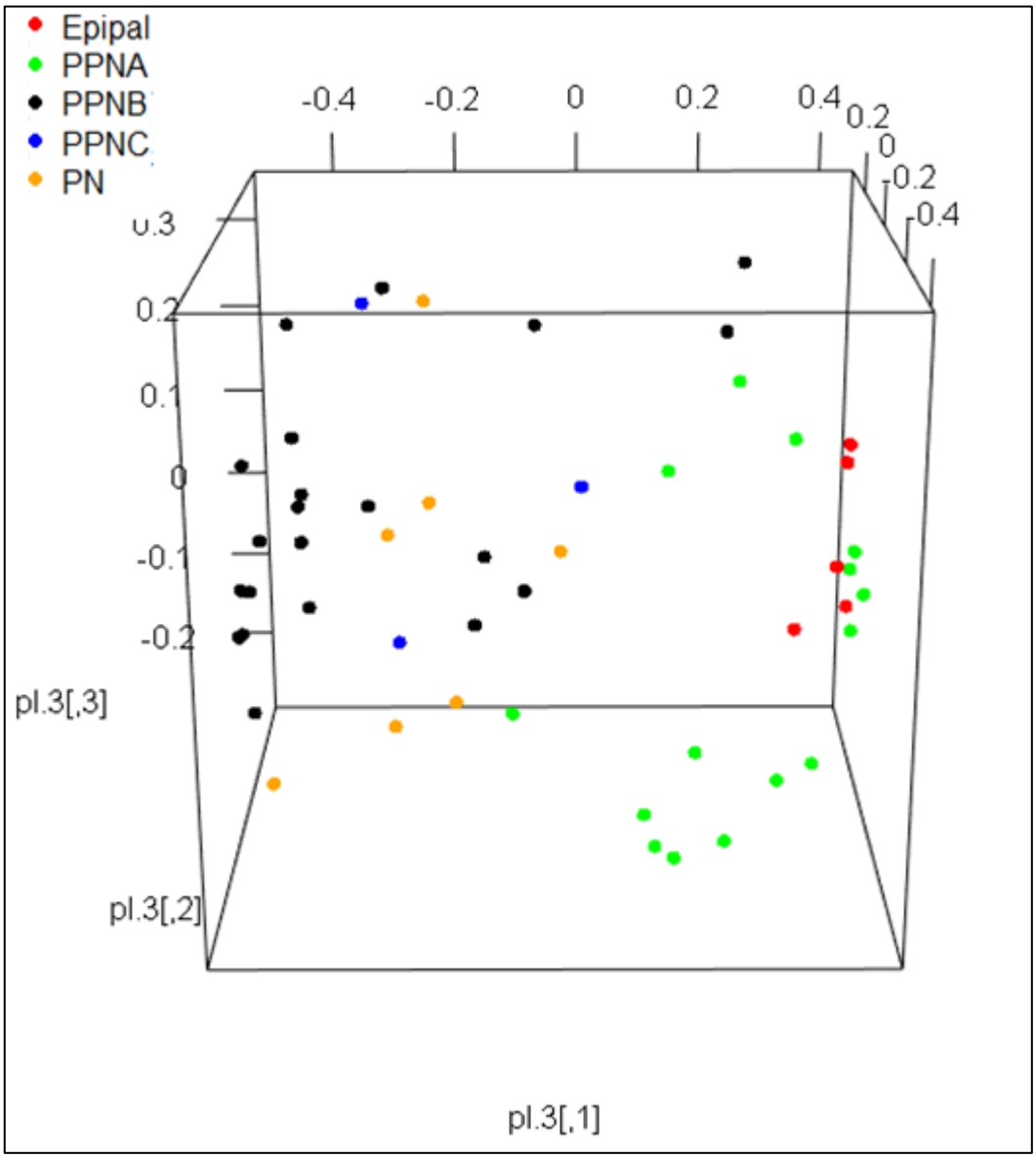


Figure 5:4: 3-d plot based on the subsistence variables for south-west Asian archaeological site-phases, coded in terms of cultural phase

Figures 5.3 and 5.4 show the results of the MDS analysis for the south-west Asian archaeological data relating to subsistence variables—coded in terms of either Epipalaeolithic or one of the four Neolithic cultural phases. Generally, the PPNA, PPNB and Epipalaeolithic site-phases form distinctive clusters. The Epipalaeolithic site-phases are located in the middle to upper right-hand section of the plots. A number of the Epipalaeolithic site-phases are superimposed upon other Epipalaeolithic site-phases—due to the superimposed nature of the site-phases, we are seeing five rather than the full

fifteen Epipalaeolithic site-phases in the plot. The superimposition indicates that these site-phases have identical subsistence practices—representing mobile groups with a reliance on hunting and gathering with no evidence of domesticated crops or animals and low levels of food storage. The PPNB site-phases (black) form a cluster on the left-hand side of the plots. We can observe examples of PPNB site-phases on the upper right-hand section of the plots nearer to the PPNA and Epipalaeolithic site-phases. The PPNA site-phases (green) are located in the middle to right-hand section of the plots—with a definite concentration of site-phases in lower right-hand section of the plots. The PN site-phases (orange) are dispersed in the middle to left section close to the majority of PPNB site-phases. The PPNC site-phases (blue) are distributed evenly in the middle to left-hand section of the plots.

In Figure 5.3, the greatest statistical separation is observed between PPNB Çatalhöyük I (site-phase no. 16) and Epipalaeolithic Kharaneh IV (site-phase no. 39). Epipalaeolithic Kharaneh IV has yielded evidence of a subsistence strategy focusing on hunting, gathering with no evidence of agriculture or a long term storage strategy (Muheisen 1988a; 1988b; 1985; Maher and Richter 2007; Damick 2011; Maher *et al.* 2012). Conversely, PPNB Çatalhöyük I has yielded evidence of a full sedentary group practicing intensive farming incorporating domesticate crops and animals, with evidence of a long term food storage strategy (Hodder 1996;1997; 1998; 1999a; 1999b; 2000;2001; 2004a; 2004b; ; 2005; 2006a; 2006b; 2007a; 2007b; 2008; 2010; Russell and Martin 2000; Voigt 2000; Fairbairn *et al*. 2002; Richards *et al.* 2003; Edwards *et al.* 2004; Hodder and Cessford 2004; Mithen 2004; Düring 2005; Düring and Marciniak 2005; Fairbairn 2005; Russell *et al.* 2005; Russell and Düring 2006; Marciniak and Czerniak 2007; Fairbairn *et al.* 2007; Koutsadelis 2007; Marciniak 2008a; 2008b; 2007a; 2007b; Meskell *et al.* 2008; Rosen 2008 ; Twiss 2008; Twiss *et al.* 2008; Hodder and McAnany 2009; Nakamura and Meskell 2009; Roberts and Rosen 2009; Shillito *et al.* 2009; Twiss *et al.* 2009; Russell and Bogaard 2010; Ryan 2011; Russell and Martin 2012).

There are examples of overlap between site-phases from different culture-historical periods in the plots. For instance, PPNB Kfar Hahoresh (site-phase no. 38) is located on the left-hand side of the plot adjacent to a number of Epipalaeolithic site-phases. This site-phase is located adjacent to the Epipalaeolithic site-phases as it offers evidence of hunting but no evidence of domesticated animals or crops, and no evidence of a permanent settlement or a long-term food storage strategy (Goring-Morris 1994; Goring-Morris *et al.* 1995; Horwitz and Goring-Morris 2000; 2004; Twiss 2008). In these examples, it is evident that aspects of subsistence strategy are responsible for the broad separation between Epipalaeolithic and Neolithic site-phases, as well as multi-period clustering. The eigenvalue calculated via R-statistics for the three-dimensional plots is 0.9276857, which indicates that 93% of the information from the South west Asian archaeological database was reduced to variables in 3 dimensions with only a loss of 7% of information.

In sum, the MDS analysis based on subsistence variables suggests the following:

1. the site-phases cluster more distinctly by cultural phase on the basis of subsistence practice than in the analysis based on ritual variables only;
2. there is a high level of uniformity in the Epipalaeolithic subsistence strategies;
3. the greatest separation is between a PPNB and an Epipalaeolithic site-phase, reflecting a broader separation between site-phases of these periods;
4. the PPNA site-phases cluster near the Epipalaeolithic site-phases, reflecting a degree of similarity in their subsistence strategies; and
5. the PN site-phases cluster near the PPNB site-phases reflecting parallels in subsistence practice.

5.1.3 Multidimensional scaling based on the social complexity variables, coded by culture-historical period

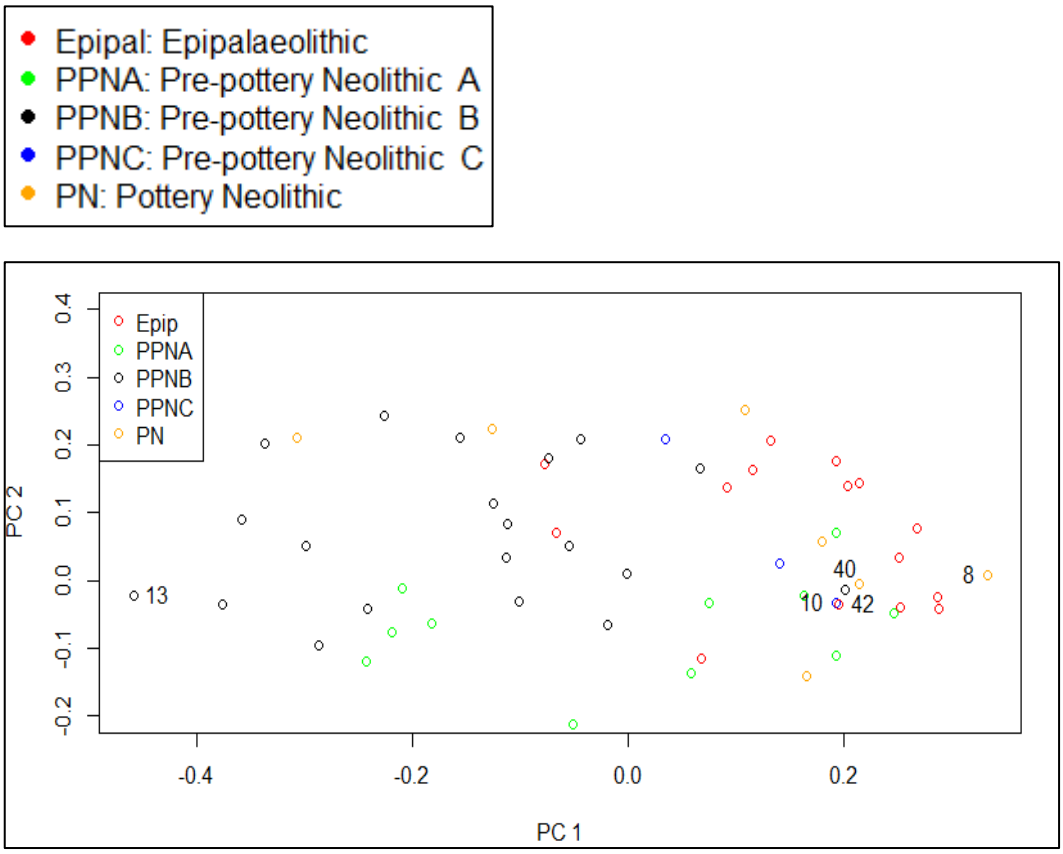


Figure 5:5: 2-d plot based on the social complexity variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected site-phases: PN Ain Rahub (8), PPNC Atlit Yam (10), PPNB Beidha II (13), PPNB Khirbet Hammam (40) and Epipalaeolithic Mureybit II (42)

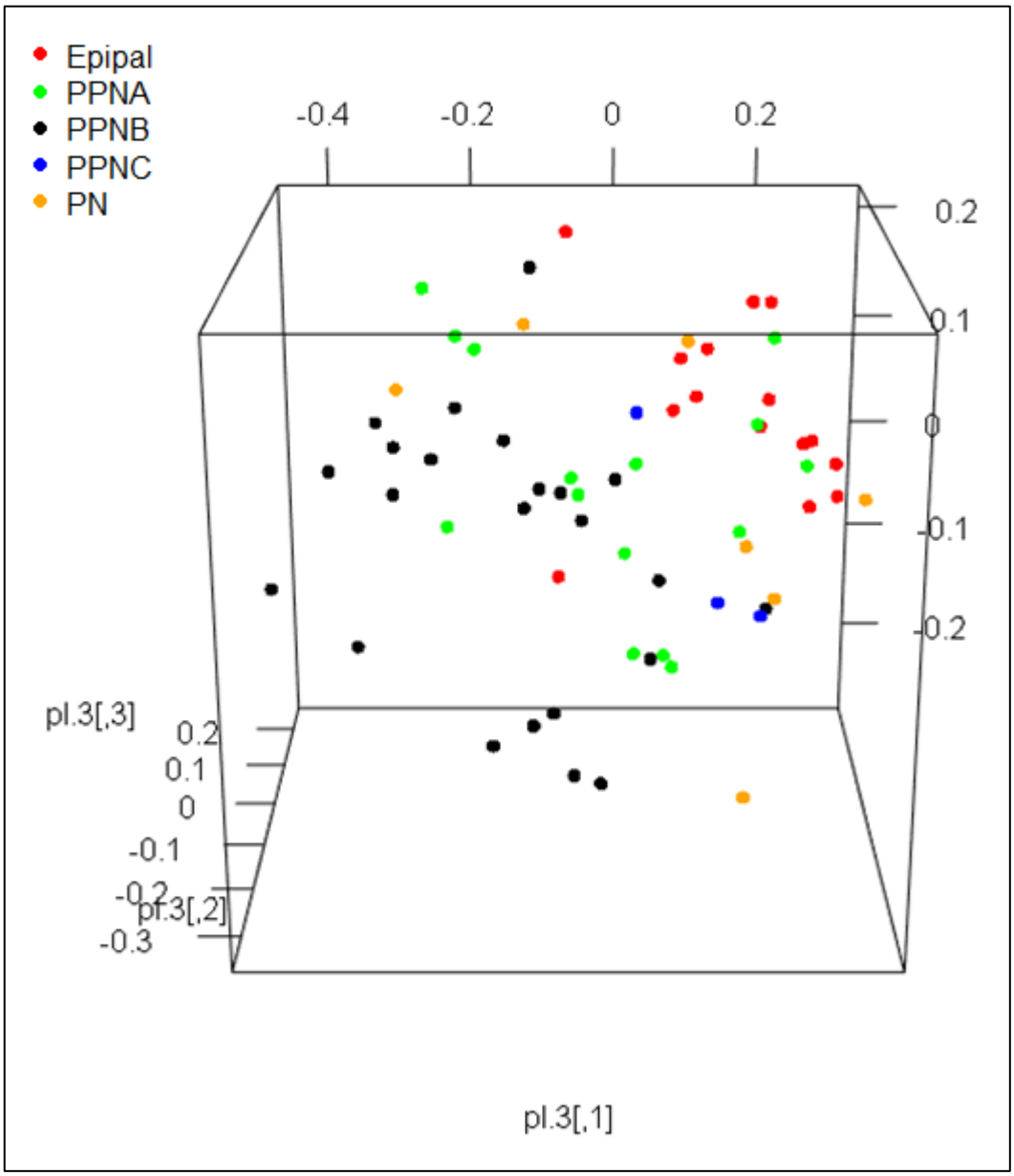


Figure 5:6: 3-d plot based on the social complexity variables for south-west Asian archaeological site-phases, coded in terms of cultural phase

From figure 5.5 and 5.6 we can observe that the Epipalaeolithic site-phases (red) form a distinct cluster around the middle to upper right-hand section of the plots. The PPNB site-phases (black) are positioned in the middle to left-hand side of the plots. The PPNC site-phases (blue) are located in the middle to right-hand section of the plots. The PPNA site-phases (green) and the PN site-phases (orange) are dispersed evenly throughout the plots.

In Figure 5.5 we can see that the greatest statistical separation is identified between PN Ain Rahub (site-phase no. 8) and PPNB Beidha II (site-phase no. 13). PPNB Beidha II has yielded social complexity evidence including full sedentism, food storage, burial goods, communal building(s) and evidence of social inequality (Kirkbride 1960; 1966a; 1966b; 1966c 1967; 1968a; 1968b; 1984; Mortensen 1970; Hecker 1982; Byrd 1988; 1991; 1994; 2005). By contrast, the Pottery Neolithic phase at Ain Rahub has yielded no evidence of burial goods, food storage or communal building(s) (Gebel and Muheisen 1985; 1986; Muheisen *et al.* 1988; Gebel and Müller-Neuhof 1994; al-Shiyab 1997). It is worth noting that Ain Rahub is located on the right-hand side in close proximity to the majority of Epipalaeolithic site-phases. From these examples it is evident that aspects of permanent settlement and burial practice are responsible for the distribution observed in the plots. There are examples of overlap among site-phases of different cultural phase in the plot. Examples are PPNC Atlit Yam, PPNB Khirbet Hammam and Epipalaeolithic Mureybit II (site-phases no. 10, 40 and 42), which cluster together on the lower section of the plots. Examples of material culture causing these site-phases to cluster includes evidence of hunting, gathering and food storage but a lack of evidence for burial goods or communal building(s) (Van Loon 1966; 1968; Skinner 1968; Ducos 1975; Van Zeit and Bakker-Heeres 1984; Galili and Nir 1993; Galili *et al.* 1999; Willcox, and Fornite 1999; Colledge 2002; Barkai and Galili 1987; 1993; 2003; Peterson 2000; 2004; Cauvin 2004). The eigenvalue calculated via R-statistics for the three-dimensional plot is 0.8308766 which indicates that 83% of the site-phase information from the south-west Asian archaeological database was reduced to variables in 3 dimensions with only a loss of 17% of information.

In sum, the MDS analysis based on social complexity variables shows the following:

1. the site-phases seem to form more distinct clusters by cultural phase than in the MDS based on ritual variables only

2. the site-phases seem to clusters less distinctly than in the MDS based on the subsistence variables only

5.1.4 Multidimensional scaling based on all variables, coded by culture-historical period

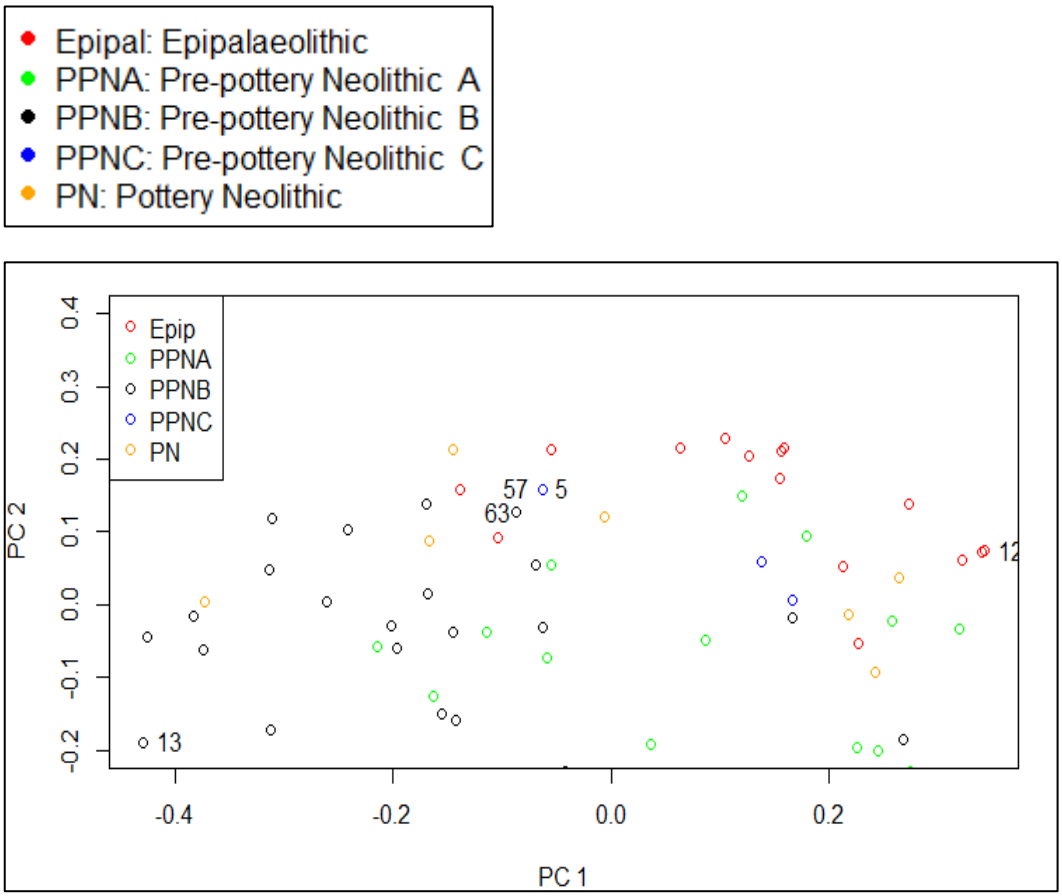


Figure 5:7: 2-d plot based on all variables for south-west Asian archaeological site-phases coded in terms of cultural phase, showing selected cultures: PPNC Ain Ghazal III (5), Epipalaeolithic Beidha I (12), PPNB Beidha II (13), PPNB Tell Halula (57) and Epipalaeolithic Wadi Hammeh 27 (63)

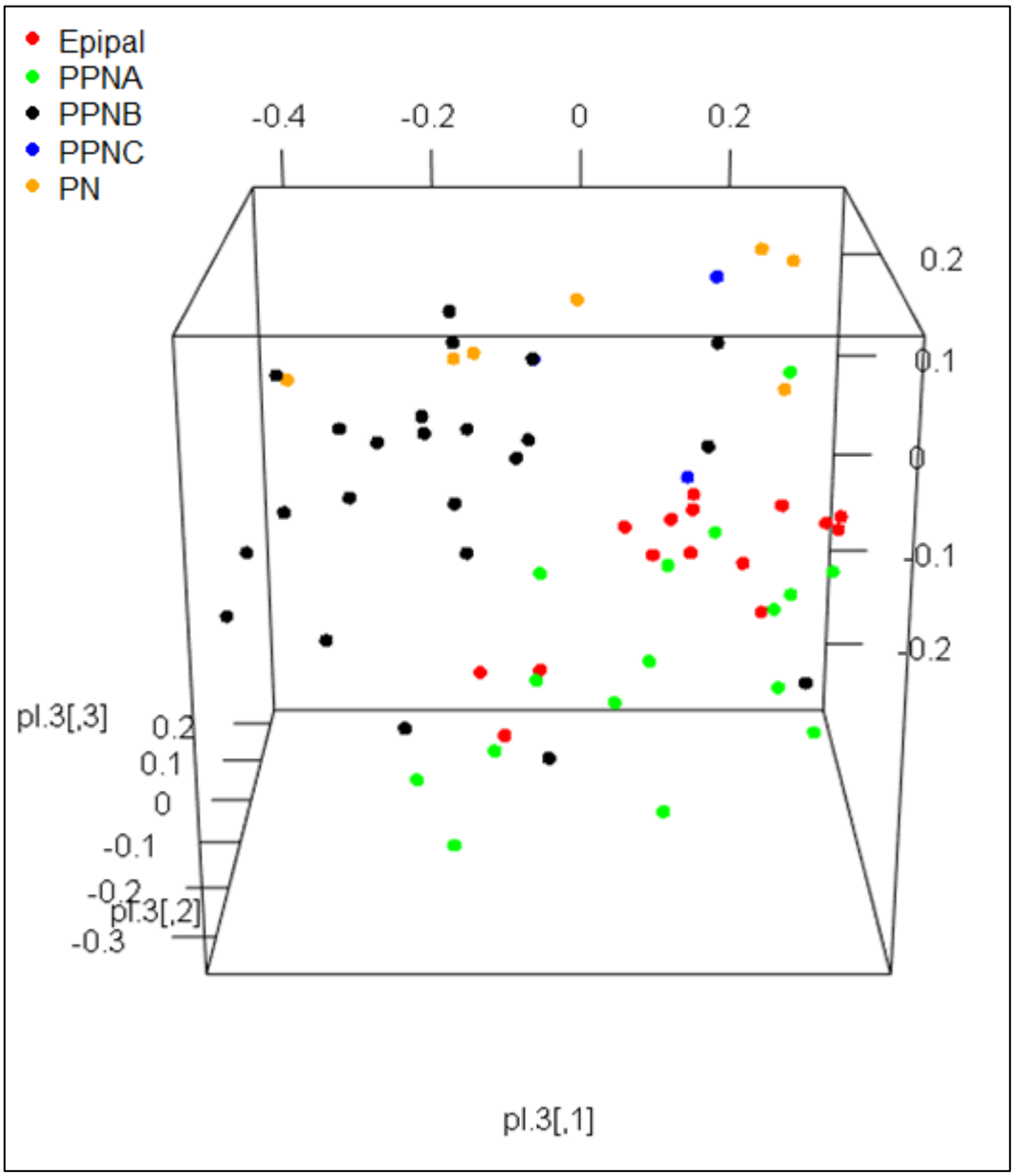


Figure 5:8: 3-d plot based on all variables for south-west Asian archaeological site-phases, coded in terms of cultural phase

Figures 5.7 and 5.8 show the results of the MDS statistical analysis for the south-west Asian archaeological data relating to all variables (ritual activity, subsistence strategy and social complexity) coded in terms of cultural phase. We can observe that the Epipalaeolithic site-phases (red) are concentrated in the middle and right-hand parts of the plot. The PPNB site-phases (black) are predominantly concentrated toward the upper left-hand section of the plot. The PPNA site-phases (green) are distributed throughout the right-hand section to the lower middle section of the plot. Some PPNA site-phases cluster

near some Epipalaeolithic site-phases on the right-hand side and in the lower middle section of the plot. The PPNC site-phases (blue) are distributed in the upper right section of the plot, a number of PPNC site-phases are superimposed upon other PPNC site-phases; showing that they share an almost identical set of variables. The PN site-phases (orange) also largely occur in the upper section of the plot, adjacent to a number of PPNB site-phases. For the most part, the PPNB and Epipalaeolithic site-phases form two distinctive clusters distinguished along the horizontal axis. The analysis shows that the greatest separation is between Epipalaeolithic Beidha I (site-phase no. 12) and the PPNB Beidha II (site-phase no. 13) (see Fig 7). Beidha I was, also, identified as an extreme case when MDS was performed on the basis of the ritual variables (section 5.1.1). Similarly, Beidha II was identified as an extreme case when MDS was performed based on the social complexity variables (section 5.1.3). In terms of material culture, Epipalaeolithic Beidha I has yielded evidence of hunting/gathering, no indications of sedentism and no burials (Kirkbride 1960; 1966a; 1966b; 1966c 1967; 1968a; 1968b; 1984; Mortensen 1970; Hecker 1982; Byrd 1988; 1991; 1994; 2005). Conversely, PPNB Beidha II provides us with evidence of a sedentary population engaged in agriculture and food storage, as well as burials, burial goods, skull caching and a communal structure (*Ibid*). It is evident that the difference in subsistence strategy and burial/ritual material culture recorded at these two site-phases is causing them to be located at the two extremities of the MDS plot, displaying the greatest distance on the dissimilarity matrix, despite the fact that they represent different phases of the same archaeological site.

In the middle of the plot a number of site-phases from different periods overlap. Examples of the site-phases displaying a degree of closeness or overlap in this middle section include PPNC Ain Ghazal III (site-phase no. 5), PPNB Tell Halula (site-phase no. 57) and Epipalaeolithic Wadi Hammeh 27 (site-phase no. 63). The variables that appear to be causing these site-phases to coalesce include: evidence of sedentism, evidence of hunter/gathering, intra-mural burials, flexed burials and burial goods (Banning and Byrd

1987; Köhler-Rollefson 1989a; 1989b; Rollefson 1993; 1997; 1998; Molist *et al*. 1994; Molist and Ferrer 1996; Cruells 1996; Molist 1998; von den Driesch and Wodtke 1997; Freeman and McEwan 1998; Barker *et al.* 1998; Findlater 1998; Barker *et al.* 1999; Barker *et al*. 2000; Molist *et al.* 2001; Kafafi, 2004a; 2004b; Finlayson and Mithen 2007; Guerrero *et al.* 2009; Finlayson *et al.* 2011; Kuijt *et al*. 2011). The eigenvalue calculated for the three-dimensional plots is 0.8910341, indicating that 89% of the information from the south-west Asian archaeological database was reduced to variables in 3 dimensions, with only a loss of 11% of the information.

In sum, the MDS analysis based on the combination of all variables reveals the following:

1. two relatively distinct clusters, Epipalaeolithic and PPNB;
2. maximum separation is between the Epipalaeolithic and PPNB phases of the same archaeological site (Beidha); and
3. grouping of site-phases in the middle of the plot; reflecting site-phases with little evidence of permanent settlement and shared aspects of burial material culture.

5.1.5 General MDS summary

The MDS analyses of the south-west Asian data have revealed a number of trends. For instance, the Neolithic (PPNA-PN) and Epipalaeolithic site-phases show the greatest statistical separation when analysed using the subsistence variables; particularly the PPNB and Epipalaeolithic site-phases. The Neolithic (PPNA-PN) and Epipalaeolithic site-phases demonstrate a more even dispersion when analysed using the ritual variables. This result is quite different to the MDS result received for the eHRAF cultures. For instance, the doctrinal and imagistic cultures showed the greatest statistical separation when analysed using the ritual variables only. Also, the doctrinal and imagistic cultures demonstrated the greatest degree of closeness when analysed using the subsistence variables only. This result suggests that contrasts among culture-historical periods relate more directly to subsistence practice than to ritual practice.

5.2 Multidimensional scaling coded by population size

This section gives the results of MDS based on ritual activity, subsistence strategy, social complexity and the combination of all variables; categorised in terms of the population size estimated for each cultural phase at each site-phase. As discussed in Chapter 3 and section 3.6, a number of papers have examined and commented on empirical evidence concerning the relationship between group size limits and aspects of subsistence practice, social organisation and ritual practice (Flannery 1972; Forge 1972; Wright and Johnson 1975; Wright 1977; Johnson 1978; Kosse 1989; Whitehouse 2004; Atkinson and Whitehouse 2011). To examine the connection between population size and ritual activity, subsistence practices and social complexity across the south-west Asian Neolithic transition, all site-phases were categorised and colour-coded in terms of three population measures:

1. Red: populations less the 150 individuals
2. Green: populations between 150 and 500 individuals
3. Blue: populations between 500 and 5,000 individuals

5.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size

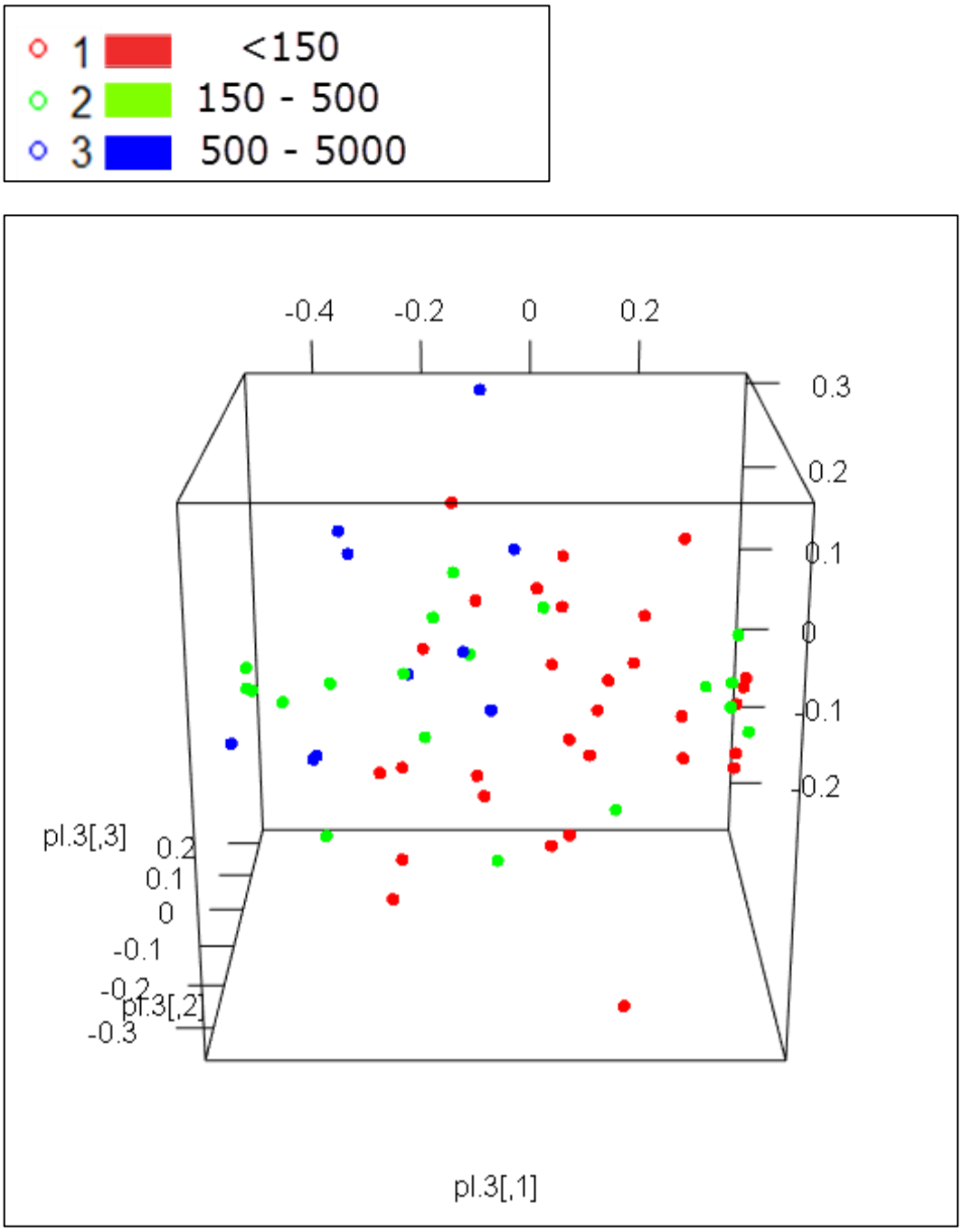


Figure 5:9: 3-d plot based on the ritual variables for south-west Asian archaeological site-phases, coded in terms of population size

Figure 5.9 presents the results of the MDS statistical analysis for the south-west Asian archaeological site-phases based on the ritual variables, coded in terms of population size. From figure 5.9 we can observe that generally the three population sizes are dispersed evenly throughout the plot. The site-phases with less than 150 individuals are distributed

through the plot with a more distinct concentration of points in the middle right-hand section of the plot, suggesting that these site-phases have material culture pointing to a shared ritual system. However, there are examples of site-phases with less than 150 individuals in close proximity to site-phases representing the other two population sizes. The site-phases representing a population of 150 - 500 seem to be distributed evenly throughout the plot. In the middle sector of Figure 5.9 we can observe that two site-phases with a population of 150 – 500 form an, almost, superimposed relationship with two site-phases representing populations of 500 - 5,000. Similarly, on the extreme right of the plot, two site-phases with a population of 150 – 500 are located close to a cluster of site-phases with a population of less than 150 people. This shows that site-phases with a population of 150 – 500 share aspects of ritual activity with the other population sizes. The site-phases reflecting populations of 500 – 5,000 are located in the middle to upper left side of the plot and do not form a clear cluster. The site-phases reflecting populations of 500 - 5,000 are distanced from site-phases with a population of less than 150.

The MDS based on ritual variables and coded according to population size suggests that:

1. site-phases with less than 150 individuals, to an extent, form a relatively distinct cluster in the mid to right hand section of the plot;
2. site-phases with a population of 150 – 500 individuals are dispersed evenly through the plot, showing that they share material culture with the other two population sizes; and
3. site-phases with the largest populations (500 – 5,000 individuals) are, somewhat, distinct from the site-phases with less than 150 individuals.

The broad separation between the smallest and largest population sizes suggests that there is a relationship between ritual and group size, as suggested by Whitehouse (2004). Also, the distribution of the site-phases reflecting population groups of 150 – 500 individuals

demonstrates that these site-phases shares aspects of ritual material culture with the other two groups.

5.2.2 Multidimensional scaling analysis based on the subsistence variables, coded by population size

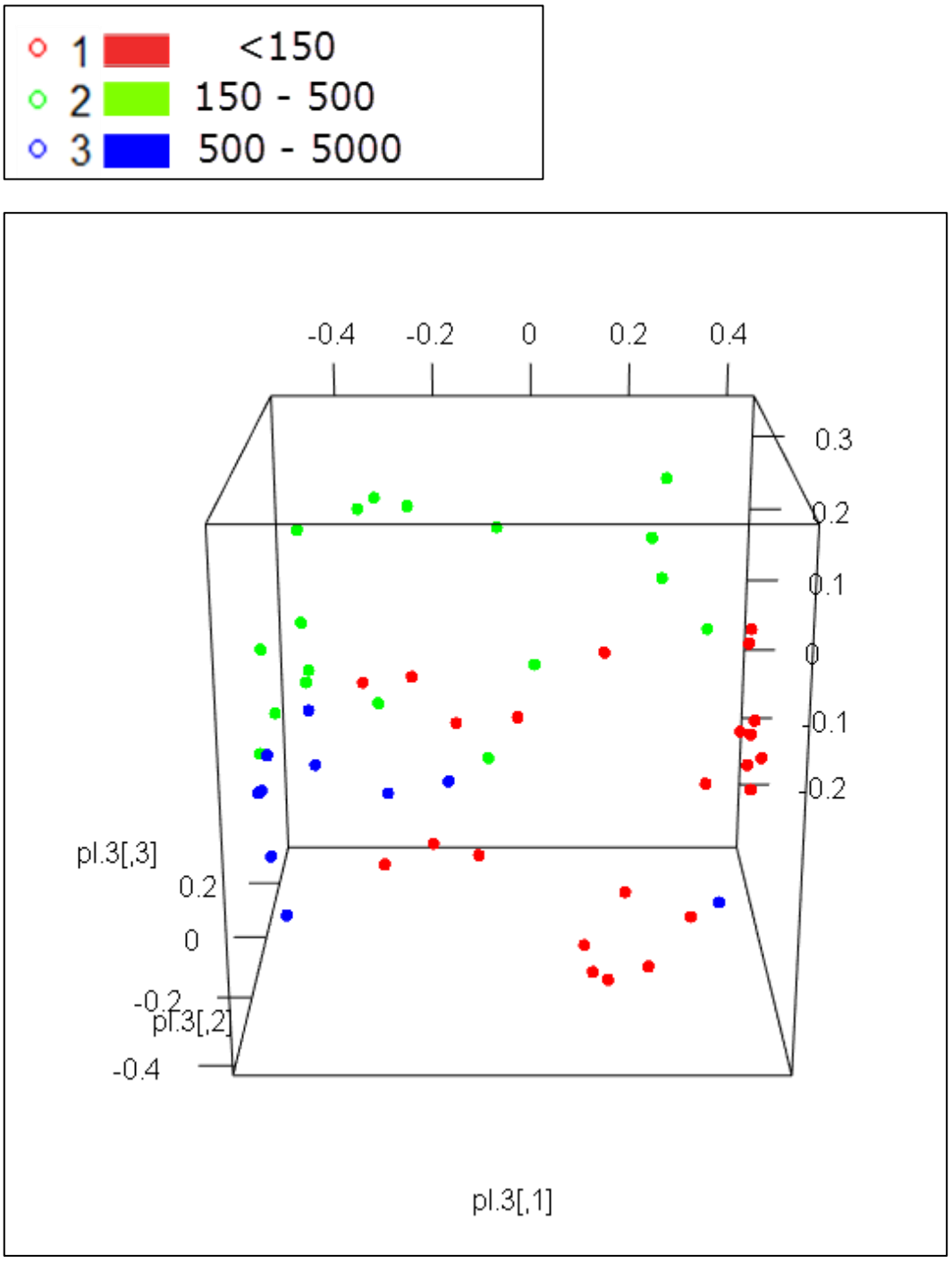


Figure 5:10: 3-d plot based on the subsistence variables for south-west Asian archaeological site-phases, coded in terms of population size

Figure 5.10 presents the results of the MDS statistical analysis for the south-west Asian archaeological site-phases based on the subsistence variables, coded in terms of population size. The site-phases with less than 150 individuals (red) are distributed

throughout the plot; with a concentration in the middle right and the lower right section of the plot. A number of points on the right-hand section are superimposed upon each other, indicating that these site-phases engage in a similar subsistence strategy. The site-phases reflecting populations of 500 - 5,000 individuals are located in the middle to left side of the plot—with an obvious cluster located in the extreme left of the plot. Generally, we can see the greatest statistical separation is between the site-phases reflecting populations of 500 - 5,000 (in blue) and the site-phases with a population of less than 150. The site-phases representing a population of 150 – 500 seem to be scattered evenly in the upper part of the plot. These site-phases are not located on the mid and lower right sections of the plot where the site-phases of a population less than 150 individuals are positioned. In the middle sector of Figure 5.10 we can observe a concentration of site-phases representing the different population sizes.

The MDS based on subsistence variables and coded according to population size suggests that:

1. site-phases with less than 150 individuals form a relatively distinct cluster on the right hand side of the plot, pointing to shared subsistence practices;
2. site-phases with populations of 150 – 500 are dispersed evenly through the plot, showing that they share aspects of subsistence strategy with the other two population sizes; and
3. site-phases with the largest populations group (500 – 5,000 individuals) appear separated from the site-phases with less than 150 individuals; indicating a distinction in subsistence strategy.

5.2.3 Multidimensional scaling analysis based on the social complexity variables, coded by population size

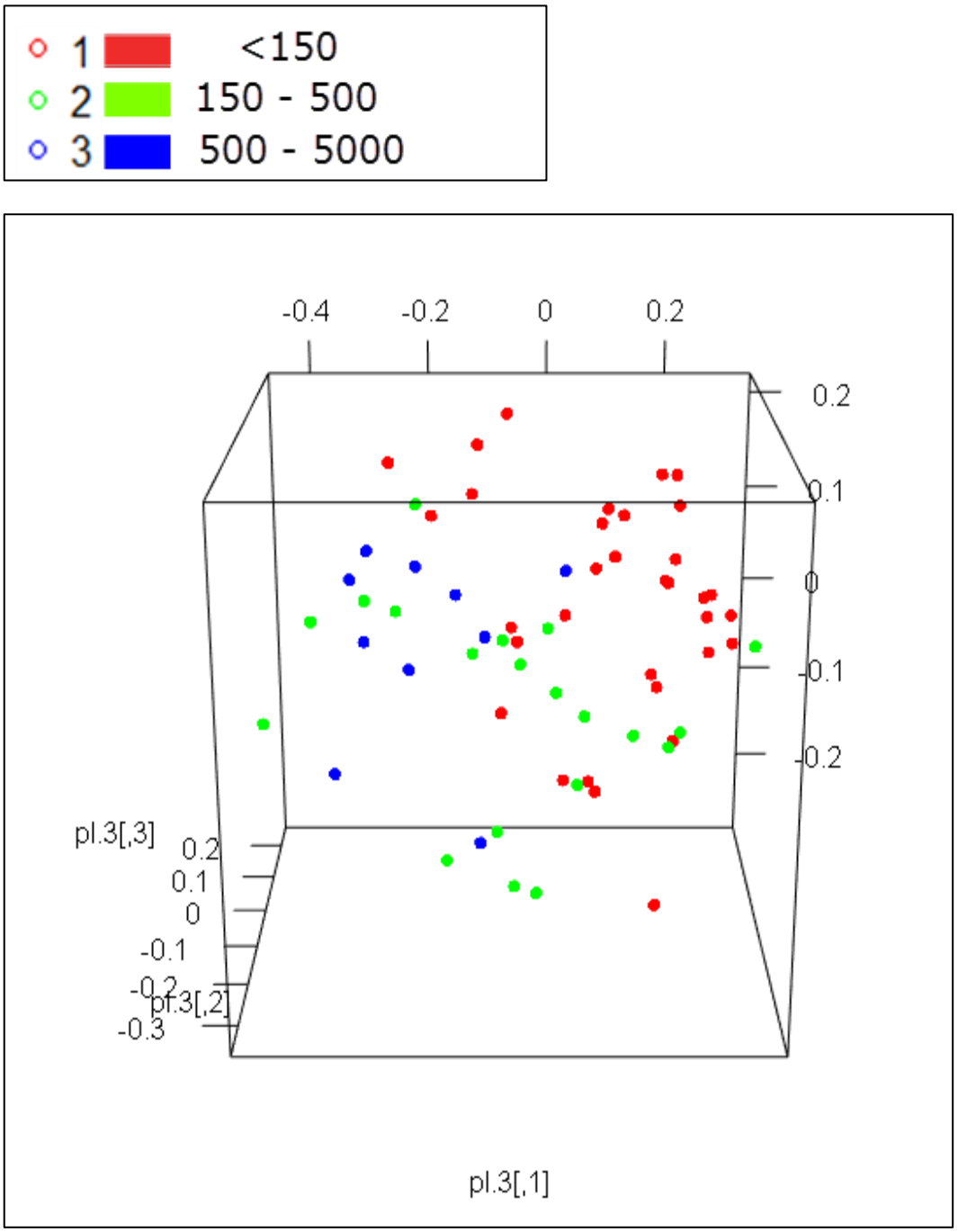


Figure 5:11: 3-d plot based on the social complexity variables for south-west Asian archaeological site-phases, coded in terms of population size

From Figure 5.11, it is evident that the site-phases with less than 150 individuals are distributed through the plot but that there is a distinct concentration in the upper right section, suggesting that these site-phases share material culture relating to social complexity. Site-phases with estimated populations of 150 – 500 individuals seem to be

dispersed evenly throughout the plot but are absent from the upper right sections of the plot where site-phases with populations of less than 150 individuals are concentrated. In the middle sector there is overlap among site-phases from different population sizes.

The MDS based on social complexity variables and coded according to population size suggests that:

1. many site-phases with less than 150 individuals form a relatively distinct cluster, pointing to a shared level of social complexity;
2. site-phases with a population of 150 – 500 individuals share characteristics of social complexity with the other two population sizes but are distanced form the most distinctive cluster of site-phases with less than 150 individuals; and
3. many site-phases belonging to different population sizes overlap.

This result suggests that group size is more weakly associated with levels of social complexity then with subsistence variables. However, group size based on the social complexity variables results in a, somewhat similar, pattern to the plot produced based on the ritual variables. For instance, in both plots we can see the site-phases with less than 150 individuals form a distinct cluster and the site-phases with a population of 150 – 500 individuals are dispersed more evenly throughout the plot.

5.2.4 Multidimensional scaling analysis based on all variables, coded by population size

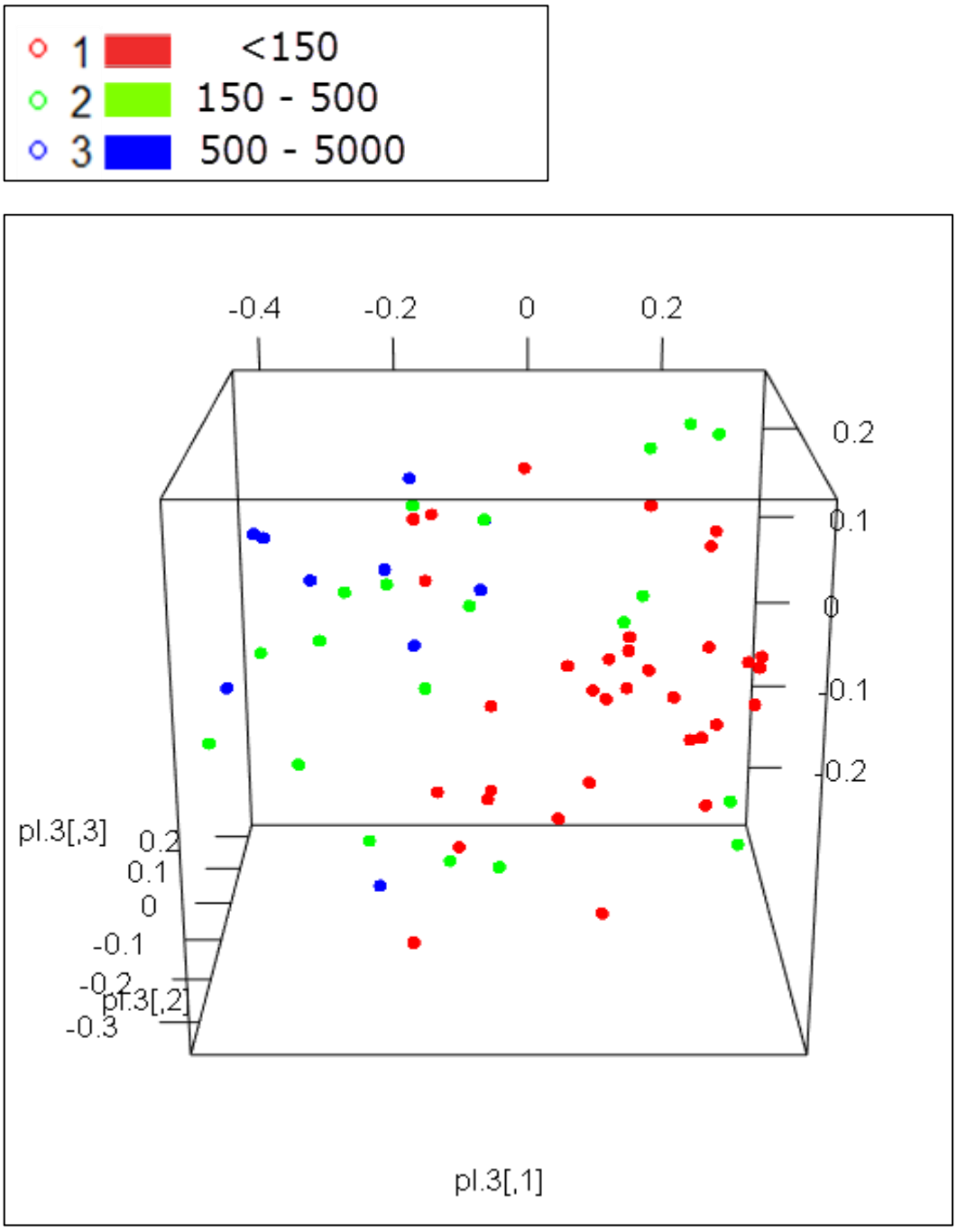


Figure 5:12: 3-d plot based on all variables for south-west Asian archaeological site-phases, coded in terms of population size

Figure 5.12 presents the results of the MDS statistical analysis for the south-west Asian archaeological site-phases based on the combination of all variables (ritual, subsistence and social complexity), coded in terms of population size. It is evident that site-phases

with less than 150 individuals (red) form one distinctive cluster in the middle to right-hand section of the plot, though there are also examples of site-phases with less than 150 individuals in the mid and upper right-hand section of the plot. The site-phases reflecting population sizes of 150 - 500 (green) are generally dispersed throughout the plot but tend not to overlap with the concentration of site-phases with less than 150 individuals. The site-phases with populations of 500 - 5,000 (blue) are located in the upper left side of the plot, with one example in the lower middle section. For the most part, there is a broad separation between the site-phases with less than 150 individuals and those with populations of 500 – 5,000 individuals.

The MDS based on all variables coded by population size suggests that:

1. site-phases with less than 150 individuals cluster closely—particularly in the middle right-hand section;
2. site-phases with populations less than 150 individuals are dispersed nearer to the site-phases representing of 150 – 500 individuals—showing that this category may share more material culture than the larger population site-phases; and
3. site-phases with larger populations (500 – 5,000 individuals) are distinct from the site-phases with the lowest populations (< 150 individuals).

From these results, it can be suggested that site-phases with the smallest populations (<150 individuals) share aspects of subsistence, ritual and social complexity that distinguish them from the largest population site-phases (500 – 5,000 individuals).

5.2.5 General MDS summary based on population size

Table 5.1 and figure 5.13 demonstrate how the different population sizes relate to the south-west Asian archaeological site-phases. For the most part Epipalaeolithic and PPNA site-phases reflect population group of less than 150 individuals (100% of Epipalaeolithic site-phases and 81% of the PPNA site-phases). Conversely, a number of PPNB (32%), PN (14%) and the PNNC (33%) site-phase reflect the largest population groups.

Table 5:1: Summary of south-west Asian cultural phases, in terms of population size; showing the percentages and numbers for each category

Phase	% in Population Group <150	No.	% in Population Group 150-500	No.	% in Population Group 500-5,000	No.
Epipal	100	15	0	0	0	0
PPNA	81	13	12	2	6	1
PPNB	9	2	59	13	32	7
PPNC	0	0	67	2	33	1
PN	57	4	28	2	14	1

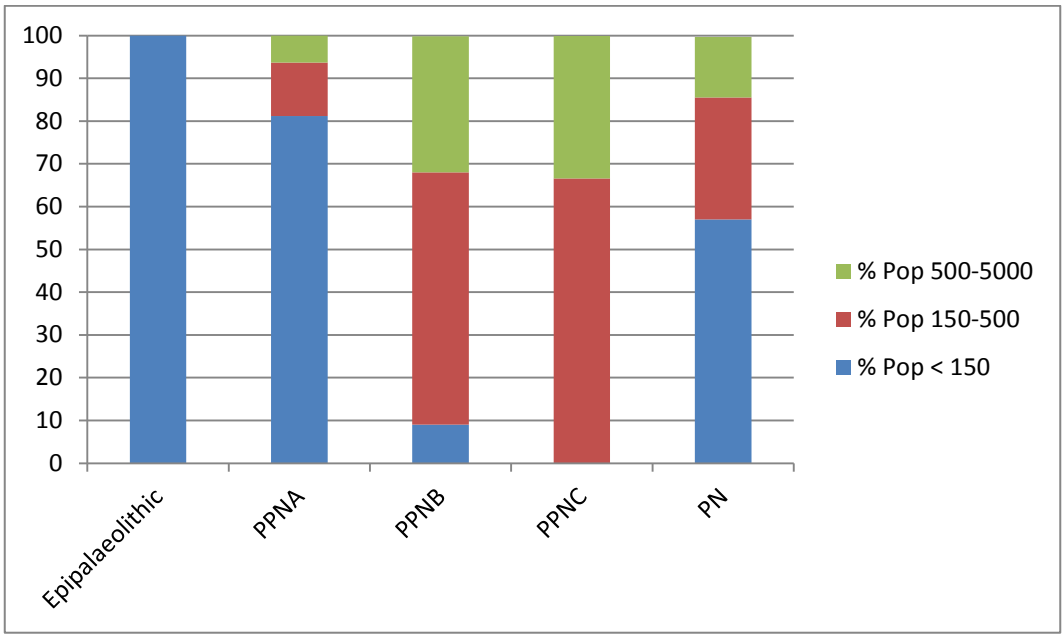


Figure 5:13: Percentage of each phase represented in each population group, the number of site-phases in each percentage category are shown in table 5.1

The population sizes show the greatest separation when analysed using the subsistence variables. The three population sizes appear more randomly distributed when the analysis is based on the ritual variables. The site-phases reflecting populations of less than 150 individuals and site-phase representing 500 – 5,000 individuals, generally, show separation—especially, when using the subsistence and all variables respectively. The results indicate that subsistence variables resulted in the greatest separation while MDS based on ritual and social complexity resulted in a similar level of distinction between the three population sizes. The results suggest a strong connection between group size and subsistence, particularly for the smallest and largest population sizes. The site-phases

representing 150 – 500 individuals appears more distributed between the other groups on all the plots, suggesting that site-phases with this population level may reflect intermediary levels of ritual, subsistence and social complexity associated with this middle population level. The analysis of both the south-west Asian and the eHRAF datasets show a strong relationship between group size and subsistence practices—particularly, in relation to the groups with less than 150 people. The site-phases representing 150 – 500 individuals appeared to be the most evenly distributed group in the plots based on the eHRAF cultures and the south-west Asian archaeology. However, to comprehensively examine the relationship between population dynamics and aspects of subsistence, ritual and social complexity, a much larger sample size would be needed (particularly including more site-phases with populations representing the two larger population sizes).

5.3 Principal Component Analysis

As described in Chapter 3 section 3.9.2, the application of PCA to south-west Asian archaeological data enables the extraction/identification of dominant patterns in the matrix in terms of a complementary set of score and loading plots (Esbensen and Geladi 1987; Ringner 2008). PCA yields a correlation circle (variable factor map) and an individual factor map. The correlation circle presents the five most important variables that account for the variance in the data set in relation to the first two principal components. The factor map enables the visualization of how individual site-phases cluster in relation to the five variables that account for the variance in the dataset. To achieve a comprehensive result, PCA was performed for the ritual, subsistence and social complexity variables, as well as, a combination of all variables.

In Chapter 4 PCA was used to identify the five most important variables that account for the variance in the eHRAF datasets (for the ritual, subsistence social complexity variables, as well as the entire set of variables recorded). The associated factor maps showed how the identified variables cause the eHRAF cultures to cluster in relation to the

first two principal components. For the eHRAF cultures, the greatest separation between the imagistic and doctrinal cultures was achieved when PCA was performed based on the combination of all variables, and PCA based on the identified social complexity variables resulted in the highest degree of overlap.

5.3.1 Principal component analysis (PCA) based on the ritual variables

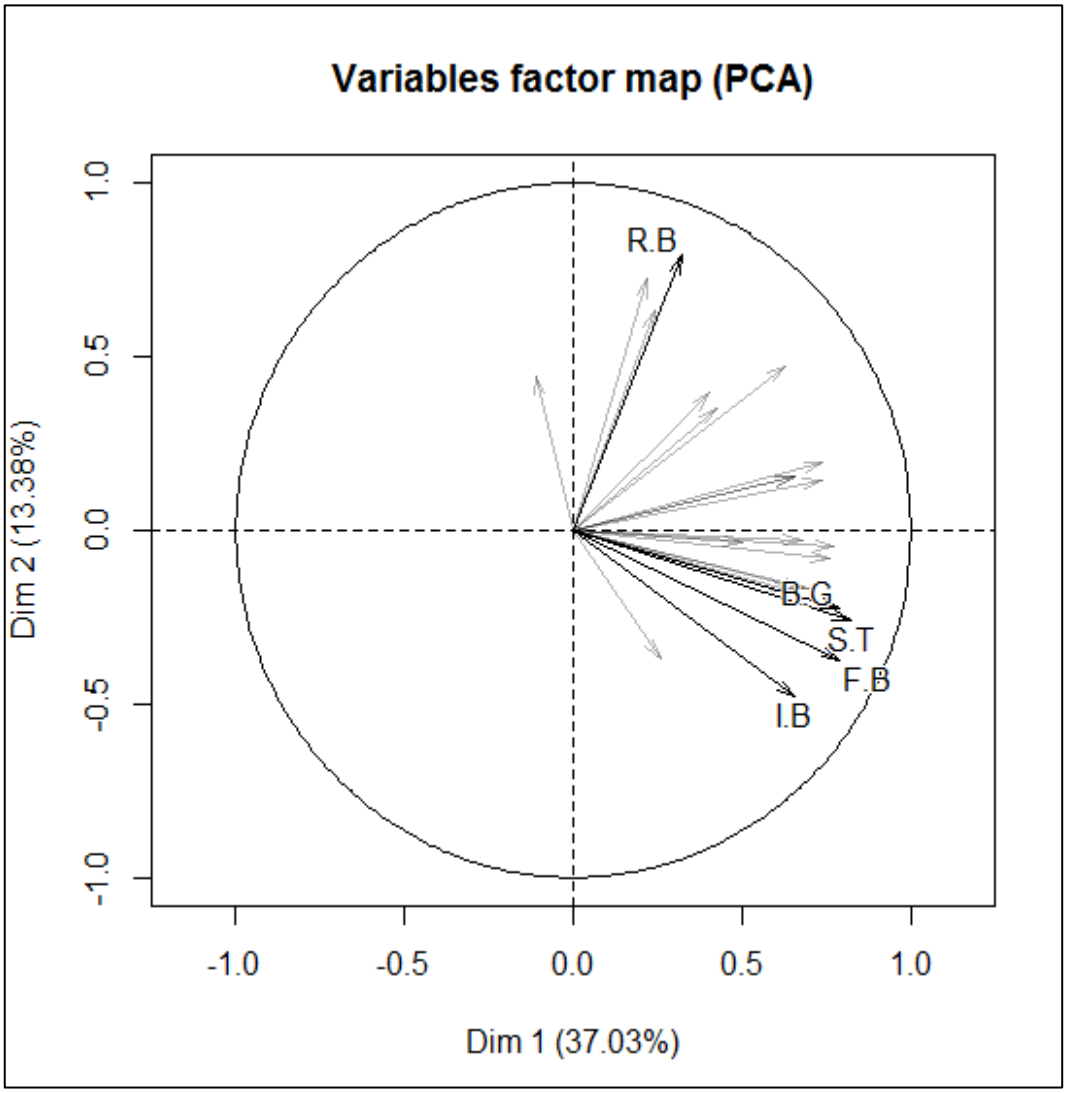


Figure 5:14: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the ritual variables: Ritual Buildings (RB), Burial Goods (BG), Special Treatment (ST), Flexed Burials (FB) and Individual Burials (IB).

Figure 5.14 presents the correlation circle received following the PCA using the recorded ritual variables. The correlation circle presents the five most important ritual variables that account for the variance in the data set in relation to the first two principal components. The variables are represented as vectors from the origin/centre. The length

of the vector gives an indication of how much that variable can be constructed from the first two principal components and the cosine of the angle between any pair of variables is a measure of the correlation or co-occurrence.

The first variable extracted via the PCA is flexed burials (FB), which is recorded in terms of absence or presence on the database, as are all of the variables considered in this section. The results suggest that flexed burials accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is individual burials (IB), the occurrence of individual burials (i.e. interments containing one individual. Individual burial refers to the interment of one individual in a grave (grave cut) or tomb. The third variable extracted by the PCA is special treatment (ST). The fourth variable extracted by the PCA is ritual buildings (RB). The fifth variable extracted by the PCA is burial goods (BG). On the correlation circle, the vectors representing the flexed burials, individual burials, special treatment and burial goods variables form an acute angle (angle less than 90^0) indicating that the cosine of the angle would be close to 1 (r close to 1). This result indicates that the four variables are highly positively correlated; at many site-phases these burial practices appear together. The special treatment and burial goods variable are the extremely positively correlated on the correlation circle. This result indicates a high level of co-occurrence between the variables. To further examine the relationship between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the variables. This measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a perfect positive correlation, 0 is no correlation, and −1 represents a perfect negative correlation. For the burial goods (BG) and special treatment (ST) variables, the correlation was estimated to be 0.7619817 with 95% confidence bounds (0.6351, 0.8488), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 2.62* 10^ (-13)]; thus the null hypothesis that

the burial goods (BG) and special treatment (ST) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables.

The ritual buildings variable, special treatment and burial goods variables show a positive but weak correlation with the angle formed between the vectors of these variables being close to 90^0. This result is indicative of a low level of co-occurrence between these variables. An angle of 90^0 (r = 0) between the ritual buildings variables and the flexed burials suggests that there is no correlation between these variables in the site-phases sampled. The correlation circle shows obtuse angles (> 90◦) between ritual buildings variable and the individual burials variable. As this angle is greater than 90^0 we can assert that these variables are very negatively correlated (r close to -1); this indicates that, in a substantial number of cases, there is no co-occurrence between the presences of these variables. It can be inferred that, at site-phases where ritual buildings were identified, individual burials have not been recorded.

In sum, the correlation circle based on the ritual variables suggests that:

1. flexed burials, individual burials, special treatment and burial goods are highly positively correlated;
2. special treatment and burial goods are the most strongly correlated variables;
3. ritual buildings, special treatment and burial goods show a positive but weak correlation; and
4. ritual buildings and individual burials are negatively correlated.

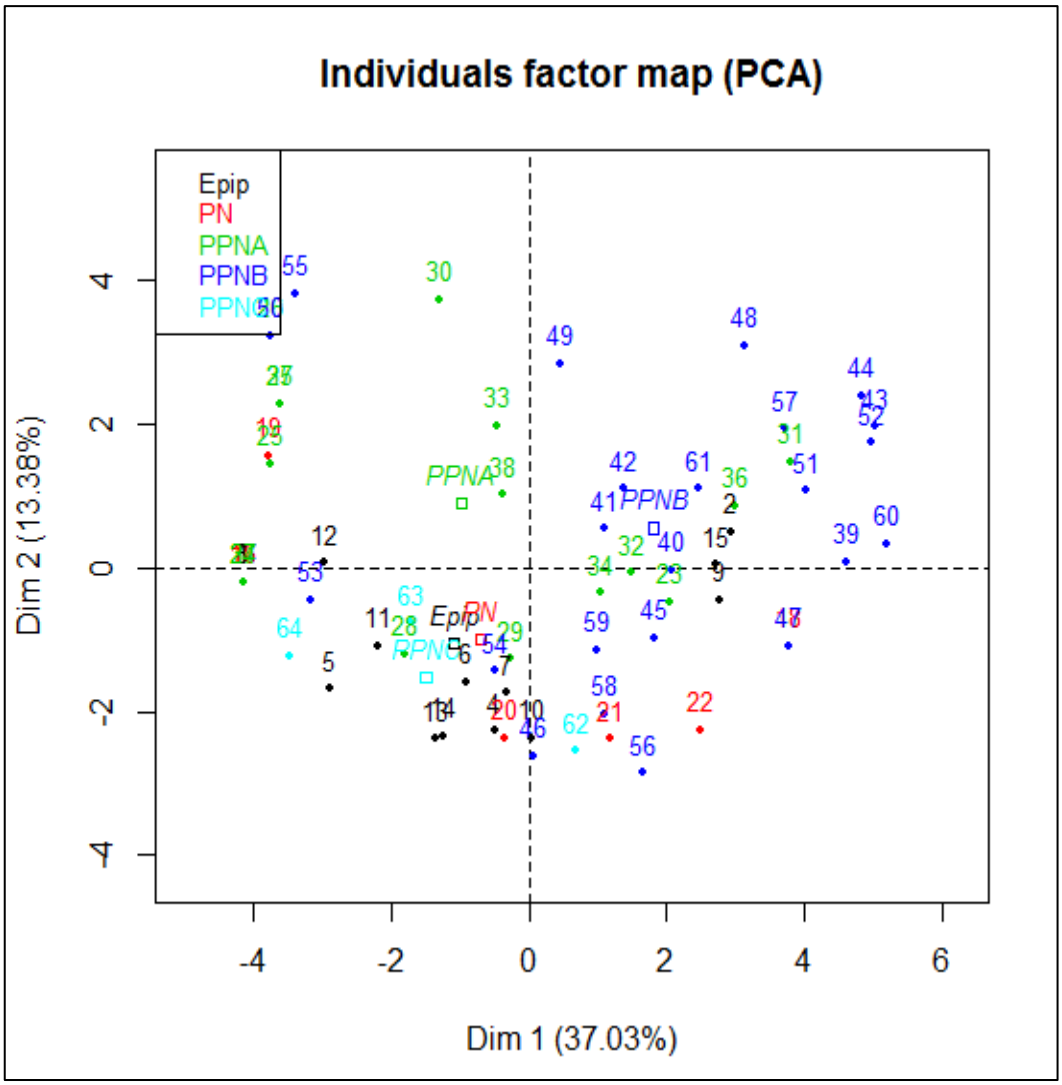


Figure 5:15: Individual factor map showing site-phases based on the ritual variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square.

Figure 5.15 presents the site-phases plotted on a PCA factor map, coloured according to their culture phase. The factor map shows how the five most important variables cause the site-phases to cluster in relation to the first two principal. The Epipalaeolithic site-phases (black) are distributed around the lower left quadrant of the factor map. This dispersal configuration shows a degree of homogeneity in ritual material culture for the Epipalaeolithic site-phases. However, there are three examples of Epipalaeolithic site-phases that are located in the right-hand section of the factor map, in close proximity to a number of PPNA and PPNB site-phases, examples being Ain Mallaha, Hilazon Tachtit and Wadi Hammeh 27 (site-phases no. 2, 9 and 15). The PPNA site-phases are distributed

evenly throughout the map; with the exception being the lower left quadrant. The majority of PPNB site-phases are distributed around the middle to right-hand side of the map, close to the PPNB centre. This distribution pattern indicates some shared ritual material culture among PPNB site-phases. However, there are examples of PPNB site-phases adjacent to Epipalaeolithic, PPNC and PN site-phases: examples are PPNB Cafer Höyük (site-phase no. 46) and Mureybit IV (site-phase no. 54). Also, there are two examples of PPNB site-phases in the upper left quadrant located some distance from the other PPNB site-phases: Nevalı Cori and Shu'eib I (site-phases no. 55 and 56). The PPNC site-phases are located in the lower part section of the plot. The PN site-phases (in red) are dispersed evenly through the lower section of the plot; with only Jebel Abu Thaawb (site-phase no. 19) positioned on the upper left-hand side.

The factor map shows that the PPNB and Epipalaeolithic cultures are broadly distinguished on the first two principal components, while the PPNA site-phases are spread across multiple sections of the plot. The greatest separation is between the PPNB Kfar Hahoresh (site-phase no. 52), on the one hand, and the PPNA and PN Ain Rahub, Ain Ghazal IV (site-phases no. 16, 17) and PPNB Tell Ramad I (site no. 37), on the other. The separation between these site-phases is due to the fact that PPNB Kfar Hahoresh has yielded a burial record that includes flexed burials, special treatment, and individual burials, as well as evidence of a ritual structure, whereas the contrasting site-phases do not provide such burial/ritual evidence (Gebel and Muheisen 1985; 1986; Muheisen *et al.* 1988; Gebel and Müller-Neuhof 1994; Goring-Morris 1994; Rollefson *et al.* 1994a; b; Goring-Morris, *et al.* 1995; Simmons 1995; Tubb and Grisson 1995; al-Shiyab 1997; Rollefson *et al.* 1999; Horwitz and Goring-Morris 2000; 2004; Rollefson 1986 1989; 1998a; 1998b; 1997; 2000; Twiss 2008).

In the middle to lower left section of the factor map we can observe some overlap between site-phases of different cultural-phases, examples being Epipalaeolithic Ein Gev I (site-phase no. 4), PPNA Iraq Ed-Dubb (site-phase no. 29), PPNB Cafer Höyük (site-

phase no. 46) and PPNC Ain Ghazal III (site-phase no. 62). Aspects of ritual practice such as flexed burials, special treatment, individual burials and grave goods are causing this overlap (Bar-Yosef and Arensburg 1973; Davis 1974; Bar-Yosef and Martin 1975; Cauvin 1985; 1987; 1991; 2000; Cauvin and Aurenche 1987; 1979; 1980; 1981; 1982; 1984; 1984; 1986a; 1986b; 1987; Crabtree, *et al.* 1989; Kafafi *et al.* 1990; Kuijt et al. 1991; Palumbo *et al.* 1991a; 19991b; Köhler-Rollefson; de Vries 1992; Kuijt 1994; 2004; von den Driesch and Wodtke 1997; Rollefson 1997; 1998; Cauvin *et al*. 1989a 1989b; 1999; Kafafi Z. 2004; Marom and Bar-Oz 2008). Ain Ghazal III was identified as showing an overlap with a number of PPNA, PPNB and Epipalaeolithic site-phases when MDS on all variables was performed (section 5.1.4)

PCA using ritual material culture shows a number of distribution patterns. For instance, the Epipalaeolithic, PPNA and PN centres are located in close proximity to each other in the lower left section of the plot, suggesting that these cultural phases shared similarities in ritual material culture. However, a broad separation between the Epipalaeolithic and the PPNB site-phases is clear on the basis of ritual variables only.

5.3.2 Principal component analysis (PCA) based on the subsistence variables

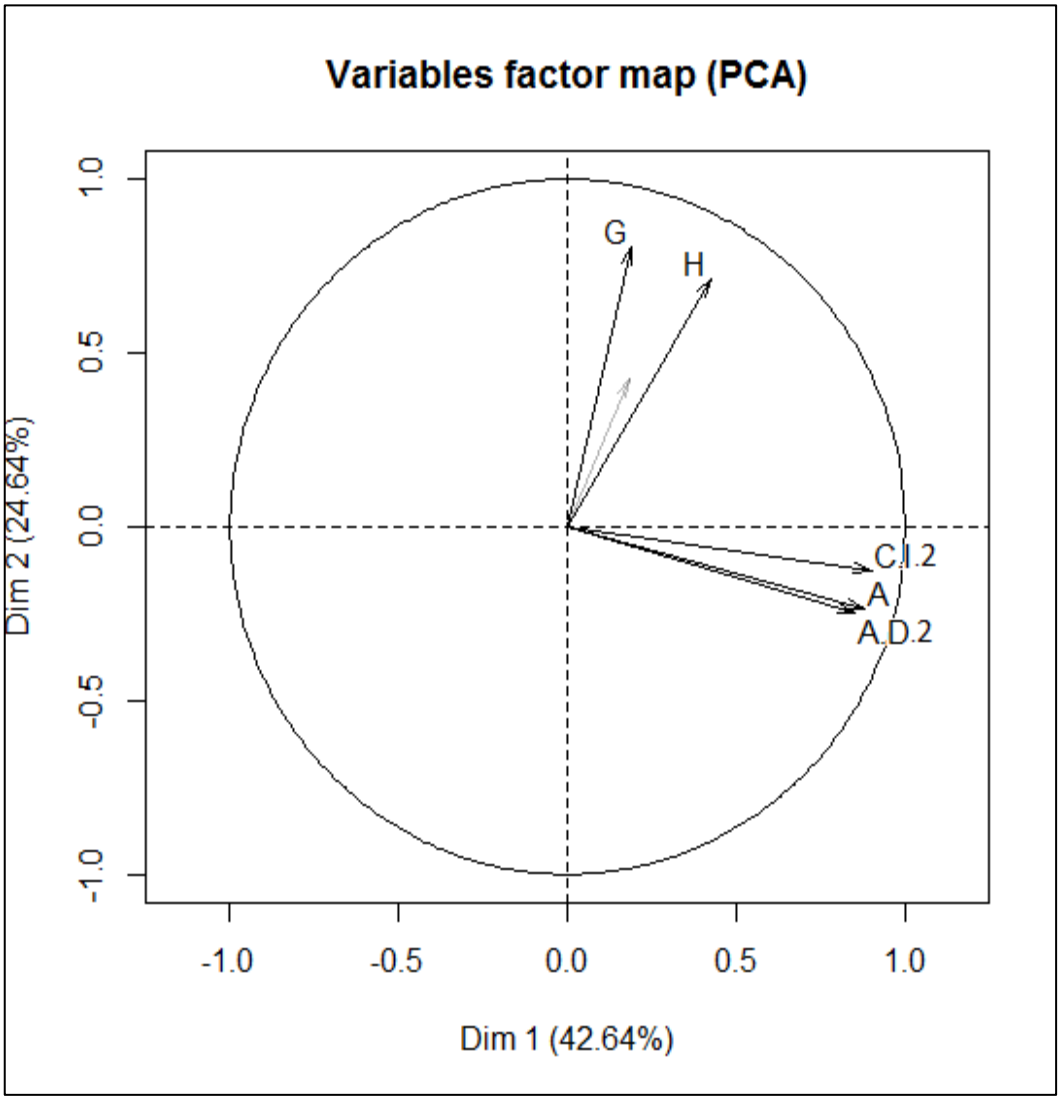


Figure 5:16: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the subsistence variables: Agriculture (A), Animal Domestication at 2 (A.D.2), Crop Intensity at 2 (CI.2), Hunting (H) and Gathering (G)

Figure 5.16 presents the correlation circle received following the PCA based on the subsistence variables. The first variable extracted via the PCA is agriculture (A), recorded in terms of absence or presence. The result suggests that agriculture accounts for the maximal amount of total variance in the observed variables. The second variable extracted by the PCA is animal domestication at level 2 (A.D.2), measured on a Likert scale from 0 to 2 (0 = No evidence of animal domestication, 1 = some domestication (caprine) and 2= Full domestication). This result highlights a distinction between site-phases based on the evidence for of a high level of animal domestication. The third

variable extracted via the PCA is crop intensity at level 2 (CI.2) (high crop intensity); demonstrating a separation of the site-phases based on their engagement in intensive cultivation/agriculture. The fourth variable extracted by the PCA is hunting (H), which is recorded in terms of absence or presence on the database. The fifth extracted by the PCA is gathering (G), recorded in terms of absence or presence.

On the correlation circle, the sets of agriculture, animal domestication and high crop intensity variables all form an acute angle (angle less than 30^0). This acute angle indicates that any set of two of these variables are highly positively correlated. The agriculture (A) and animal domestication at 2 (A.D.2) variables demonstrate the most positive correlation. An acute angle (angle less than 10^0) between these two variables indicates that the cosine of the angle is close to 1 (r close to 1). Additionally, the Pearson product-moment correlation coefficient (PPMCC) between these variables was calculated. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the agriculture and animal domestication at 2 variables, the correlation was estimated to be 0.7024631 with 95% confidence bounds (0.5519, 0.8086), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 9.859e-11 [9.859* 10^ (-11)]; thus the null hypothesis that the agriculture (A) and animal domestication at 2 (A.D.2) are uncorrelated was overwhelmingly rejected. This result indicates that these variables are significantly positively correlated; and at a majority of site-phases where there is evidence of agriculture (A) and evidence of the use of fully domesticated animals.

The hunting and gathering variables are far from the centre. An acute angle (angle less than 20^0) between these two variables suggests that the cosine of the angle is close to 1 (r close to 1). This result indicates that these variables are highly positively correlated;

many site-phases with evidence of hunting have, also, yielded evidence of gathering. The hunting variable shows a positive but weak correlation with the agriculture, animal domestication and high crop intensity variables, and the angle formed between the vectors of these variables being close to 90^0. This result is indicative of a low level of co-occurrence between these variables. An angle of 90^0 (r = 0) between the gathering and high crop intensity variables suggests that there is no correlation between these variables in the site-phases sampled. The correlation circle shows obtuse angles (> 90◦) between the gathering variable and the animal domestication at 2 variables. As the angle between these variables is greater than 90^0, these variables are negatively correlated (r close to -1).

The correlation circle indicates that:

1. hunting and gathering are highly positively correlated;
2. agriculture, animal domestication and high crop intensity are highly positively correlated;
3. hunting is weak but positively correlated with agriculture, animal domestication and high crop intensity;
4. gathering and high crop intensity are not correlated;
5. gathering is negatively correlated with domestication at 2.

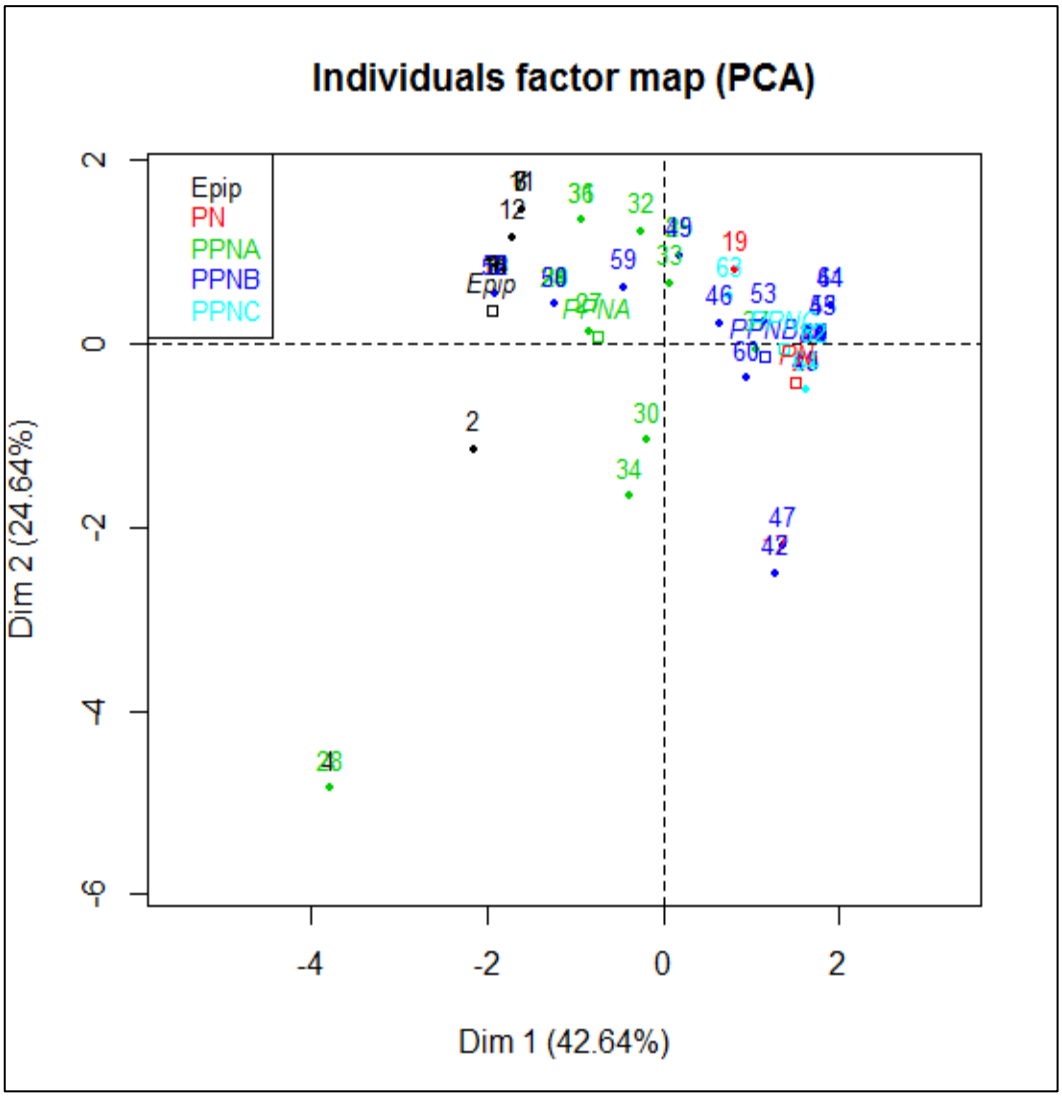


Figure 5:17: Individual factor map showing site-phases based on the subsistence variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square.

Figure 5.17 presents the site-phases plotted on a PCA factor map. The Epipalaeolithic site-phases (black) are distributed around the upper left quadrant of the factor map. This distribution pattern indicates a high degree of standardization in the subsistence practices of the Epipalaeolithic site-phases. The PPNA site-phases (green) are distributed evenly in the centre of the map. The PPNB site-phases (dark blue) are distributed around the right-hand side (mainly the upper right) of the map. However, there are examples of PPNB site-phases adjacent to Epipalaeolithic and PPNA site-phases. The PPNC site-phases (light blue) are located in the upper right section of the plot. The PN site-phases (red) are

concentrated in the upper right section of the plot, with Jebel Abu Thawwab (site-phase no. 19) positioned adjacent to the PPNC site-phases but still on the upper right-hand side.

A number of site-phases from the Epipalaeolithic, PPNB, PPNC and PN display overlap, which indicates a degree of homogeneity in subsistence practices for the site-phases representing these four distinct cultural phases. The factor map shows that the PPNB, PPNC and PN site-phases are clearly distinguished from the Epipalaeolithic, while the PPNA site-phases are spread evenly throughout the middle section the map. Examples of apparent overlapping cases are Epipalaeolithic Ein Gev I (site-phase no. 4) and the PPNA Hatoula II (site-phase no. 28), which appear to be more affected by the second component more than the other site-phases. There is a degree of similarity or overlap between the Epipalaeolithic and the PPNB site-phases. For example, a number of the PPNB site-phases overlap with a group of Epipalaeolithic site-phases located near the Epipalaeolithic centre. These PPNB site-phases have yielded evidence of hunting/gathering with low levels of crop intensity and animal domestication, which are more associated with Epipalaeolithic site-phases. In general, the observed separation of cultural phases on the basis of subsistence practices is unsurprising and reflects the shift from hunting-gathering to agriculture from the Epipalaeolithic through the PPNA to PPNB (Banning 1998; Bar-Yosef and Rollefson 1998; Tchernov 1998; Zohary *et al.* 1998; Harris 2002; Bar-Yosef 2004; Colledge and Connolly 2004; Jones 2004; Peters 2004; Twiss 2007; Zeder 2008; 2009; 2011; Allaybay *et al.* 2010; Asouti 2010; Fuller *et al*. 2011; Asouti and Fuller 2012).

5.3.3 Principal component analysis (PCA) based on the social complexity variables

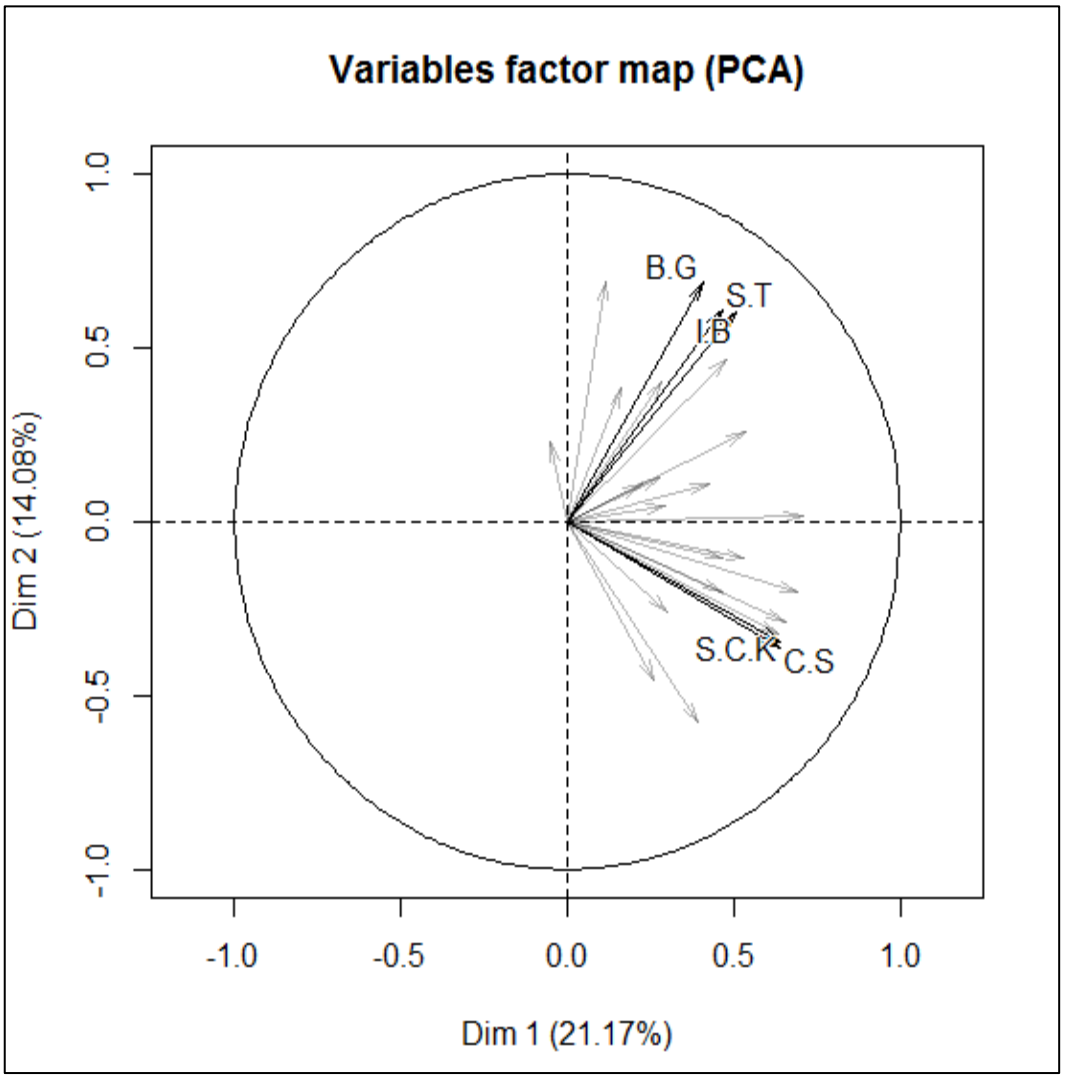


Figure 5:18: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the social complexity variables: Burial Goods (BG), Special Treatment (ST), Individual Burials (IB), Communal Structures (CS) and Storage of Cultural Knowledge (SCK)

Figure 5.18 presents the correlation circle received following the PCA based on the social complexity variables. The first variable extracted via the PCA is burial goods (BG), which is recorded in terms of absence or presence on the database, as are all of the variables considered in this section. The results suggest that burials goods accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is special treatment (ST). The third variable extracted by the PCA is individual burials (IB). The fourth variable extracted by the PCA is communal structures

(CS). The fifth variable extracted by the PCA is storage of cultural Knowledge (SCK). On the correlation circle the burial goods, special treatment and individual burials variables are highly positively correlated; an acute angle (angle less than 90^0) between these variables indicating that in all cases of pairs of these variables the cosine of the angle is close to 1 (r close to 1). The special treatment and individual burial variables are extremely positively correlated. This result indicates that, in a majority of site-phases in the south-west Asian archaeological dataset, special burial treatment and individual burials co-occur. To further examine the relationship between these variables, variables; by calculating the Pearson product-moment correlation coefficient (PPMCC) was calculated. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the special treatment and individual burials variables, the correlation was estimated to be 0.8707265 with 95% confidence bounds (0.7950, 0.9196), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 2.216* 10^ (-16)]; thus the null hypothesis that the special treatment (ST) and individual burials (IB) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables. Similarly, the communal structures and storage of cultural knowledge variables are extremely highly correlated. Again, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the communal structures (CS) and storage of cultural knowledge (SCK) variables. For the communal structures and storage of cultural knowledge variables, the correlation was estimated to be 0.8031101 with 95% confidence bounds (0.1746, 0.5904), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 1.577* 10^ (-8)]; thus the null hypothesis that the communal structures (CS) and storage of cultural knowledge (SCK) are uncorrelated was overwhelmingly rejected. This

result indicates that at a substantial number of the site-phases analysed we have a co-occurrence between communal structures (and storage of cultural knowledge. The special treatment and individual burial variables are weakly positively correlated with the communal structures and storage of cultural knowledge variables; with the angle formed between the vectors of these variables being close to 90^0. This result is indicative of a low level of co-occurrence between these variables. The vectors for burial goods, communal structures and storage of cultural knowledge are at 90^0 to each other. The orthogonal relationship indicates that these variables are not correlated. The correlation circle shows that:

1. burial goods, special treatment and individual burials are highly positively correlated;
2. communal structures and storage of cultural knowledge are highly significantly correlated;
3. special treatment and individual burials are weakly correlated with communal structures and storage of cultural knowledge; and
4. burial goods are not correlated with communal structures and storage of cultural knowledge.

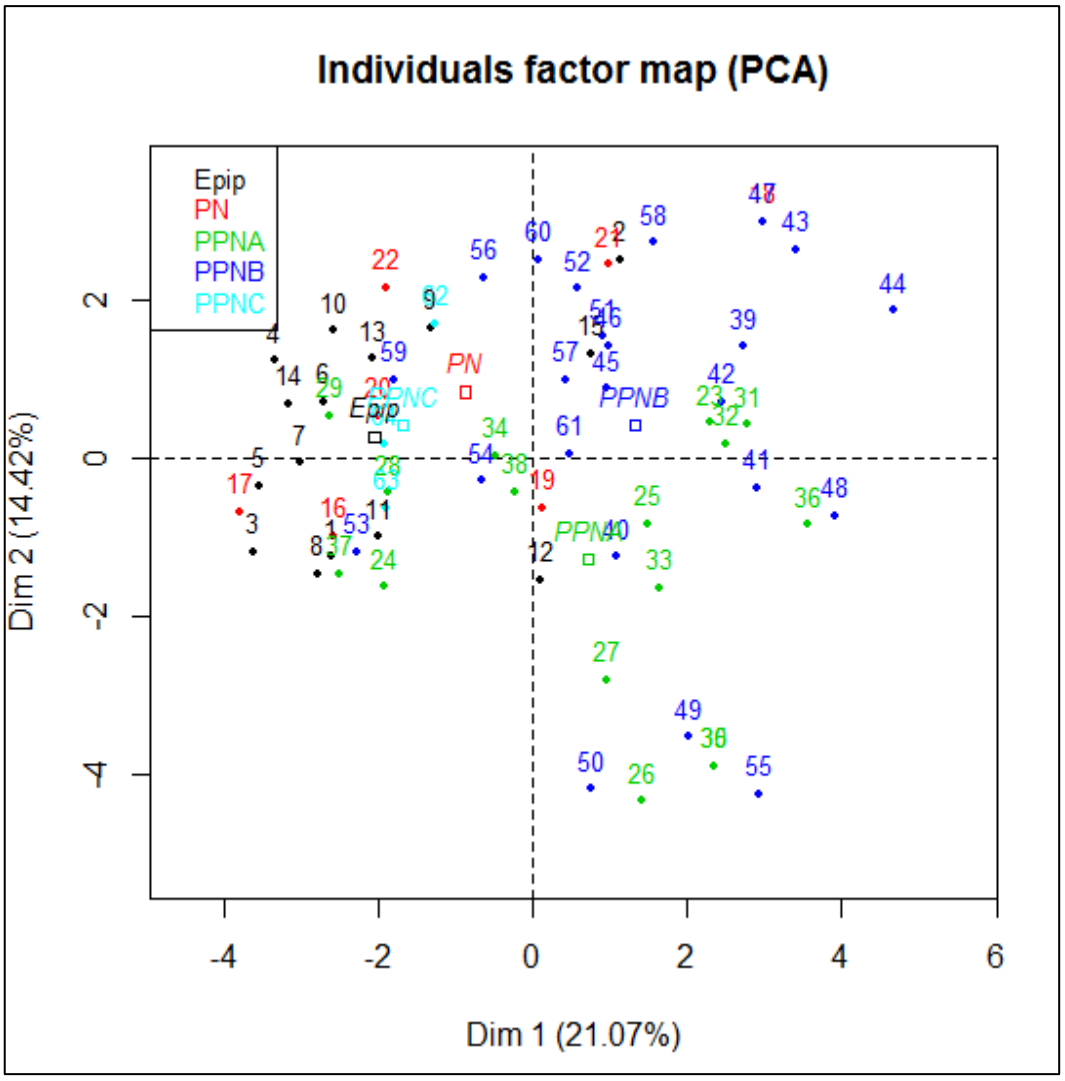


Figure 5:19: Individual factor map showing site-phases based on the social complexity variables following PCA analysis: with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square.

Figure 5.19 presents the site-phases plotted on a PCA factor map. The factor map shows how the five most important variables cause the site-phases to cluster in relation to the first two principal components that account. This distribution of the Epipalaeolithic site-phases indicates a high degree of homogeneity in the sample. There are two Epipalaeolithic site-phases that are separate from the Epipalaeolithic centre—e.g. Mureybit II (site-phase no. 12) is located near the PPNA centre and Wadi Hammeh 27 (site-phase no. 15) is positioned near the PPNB centre. The PPNA site-phases (green) are distributed evenly through the map. The PPNB site-phases (dark blue) are, generally, distributed around the right-hand side; with the largest concentration of PPNB site-phases

in the upper right of the map, close to the PPNB centre. However, Tell Halula (site-phase no. 59) is an example of PPNB site-phase adjacent to the Epipalaeolithic site-phases. The PPNC site-phases (light blues) are located in the upper left section of the plot, in close proximity to the Epipalaeolithic and PPNC centres. The PN site-phases (red) are spread throughout the plot. Examples of outliers or extreme cases are PPNA Wadi Faynan (WF 16) (site-phase no 38) and PPNB Nevali Cori (site-phase no. 55) which are located in the lower right section of the map. The factor map shows that the PPNB centre is distinct from the Epipalaeolithic, PPNC and PN centres. The greatest distance is between PPNB Beidha II (site-phase no. 44) and the Epipalaeolithic Beidha I (site-phase no. 3). The separation is because PPNB Beidha II provides us with evidence of a sedentary population that have burial goods, a communal structure and storage of cultural knowledge (Kirkbride 1960; 1966a; 1966b; 1966c 1967; 1968a; 1968b; 1984; Mortensen 1970; Hecker 1982; Byrd 1988; 1991; 1994; 2005). These aspects of social complexity account for the distance between these site-phases. PPNB Beidha II and the Epipalaeolithic Beidha I showed the greatest separation when PCA and MDS were carried out on the basis of all variables; and were well separated when both MDS and PCA were carried out for the ritual and the subsistence variables respectively (sections 5.1.1, 5.1.2, 5.2.1 and 5.2.2).

Some overlap is observed between the Epipalaeolithic and the PPNB site-phases. For example Epipalaeolithic Wadi Hammeh 27 (site-phase no. 15) is positioned adjacent to the PPNB centre on the right-hand side. Wadi Hammeh 27 provides us with evidence including burial goods, special treatment, individual burial and communal structures which are associated with the PPNB site-phases—which are responsible for the site-phases clustering in close proximity to PPNB site-phases (Edwards 1988; Edwards, *et al*. 1988; Edwards and Webb 2002; Hardy-Smith and Edwards 2004; Makarewicz, *et al*. 2006; Asouti and Fuller 2012; White and Makarewicz 2012). Wadi Hammeh 27 was identified as showing an overlap when with a number of PPNB site-phases when MDS

based on the combination of all the identified variables was performed (5.1.4). For PCA based on the ritual variables, Wadi Hammeh 27 was located in close proximity to a number of PPNA and PPNB site-phases. However, when PCA was carried out using the subsistence variables, Wadi Hammeh 27 clustered on the left-hand side of the plot with the other Epipalaeolithic site-phases. PCA on the basis of the social complexity variables results in a less distinct separation of the site-phases representing different culture-historical periods compared to PCA using the subsistence variables. In general, this analysis showed similar trends to the PCA based on the ritual variables, with identifiable Epipalaeolithic and PPNB clusters, as well as an even distribution of PPNA site-phases. As in other PCA factor maps, the Epipalaeolithic and PPNB site-phases showed the most distinct separation from each other.

5.3.4 Principal component analysis (PCA) based on all variables

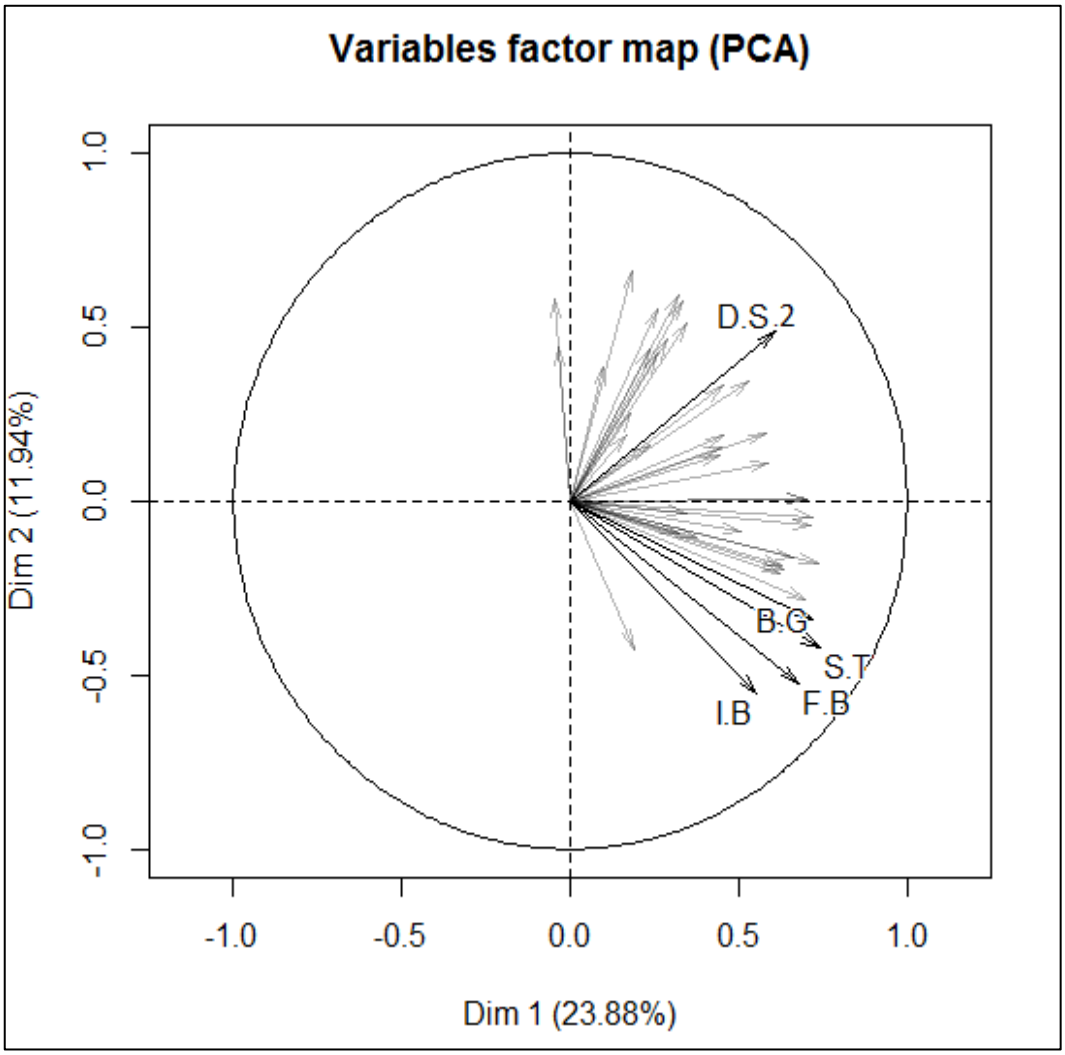


Figure 5:20: Correlation graph showing the first five variables that account for most of the variance in the south-west Asian dataset based on the all variables: Flexed Burials (FB), Special Treatment (ST), Individual Burials (IB), Degree of Sedentism at 2 (DS.2) and Burial Goods (BG)

Figure 5.20 presents the correlation circle received following the PCA using all variables. The first variable extracted via the PCA is flexed burials (FB), which is recorded in terms of absence or presence on the database. This result suggests that flexed burials accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is special treatment (ST), which is recorded in terms of absence or presence. The third variable extracted by the PCA is individual burials (IB); the occurrence of individual burials is recorded in terms of absence or presence. The fourth variable extracted by the PCA is degree of sedentism at level 2 (DS.2) (high degree of sedentism). As the degree of sedentism is measured on a Likert scale from 0 to 2, this

result indicates a separation of the site-phases based on the evidence for fully sedentary groups. The fifth variable extracted by the PCA is burial goods (BG); the inclusion of burial goods in burials at the site-phases is recorded in terms of absence or presence on the database.

On the correlation circle, the vectors for the variables flexed burials, special treatment, individual burials and burial goods are far from the centre. An acute angle (angle less than 20^0) between any pair of these four variables suggests that the cosine of the angle would be close to 1 (r close to 1). This result indicates that the four variables are highly positively correlated. The special treatment and burial goods variables are the most positively correlated variables on the correlation circle. An acute angle (angle less than 10^0) indicates that the cosine of the angle would be close to 1 (r close to 1); demonstrating a high level of co-occurrence between the two variables. To further examine the relationship between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between the special treatment (ST) and burial goods (BG) variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the special treatment and burial goods variables, the correlation was estimated to be 0.7619817 with 95% confidence bounds (0.6351, 0.8488), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 2.62* 10^ (-13)]; thus the null hypothesis that the special treatment (ST) and burial goods (BG) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables.

The PCA result indicates a low level of co-occurrence between the high degree of sedentism variable and the four mortuary variables; suggesting that they rarely occur in the fully sedentary groups recorded in this study. However, this result reflects the fact that

a number of the groups with a high level of sedentism identified in this study provide us with evidence of burial practices including; group burials, extended burials, burials in domestic spaces and burials in ritual or communal buildings.

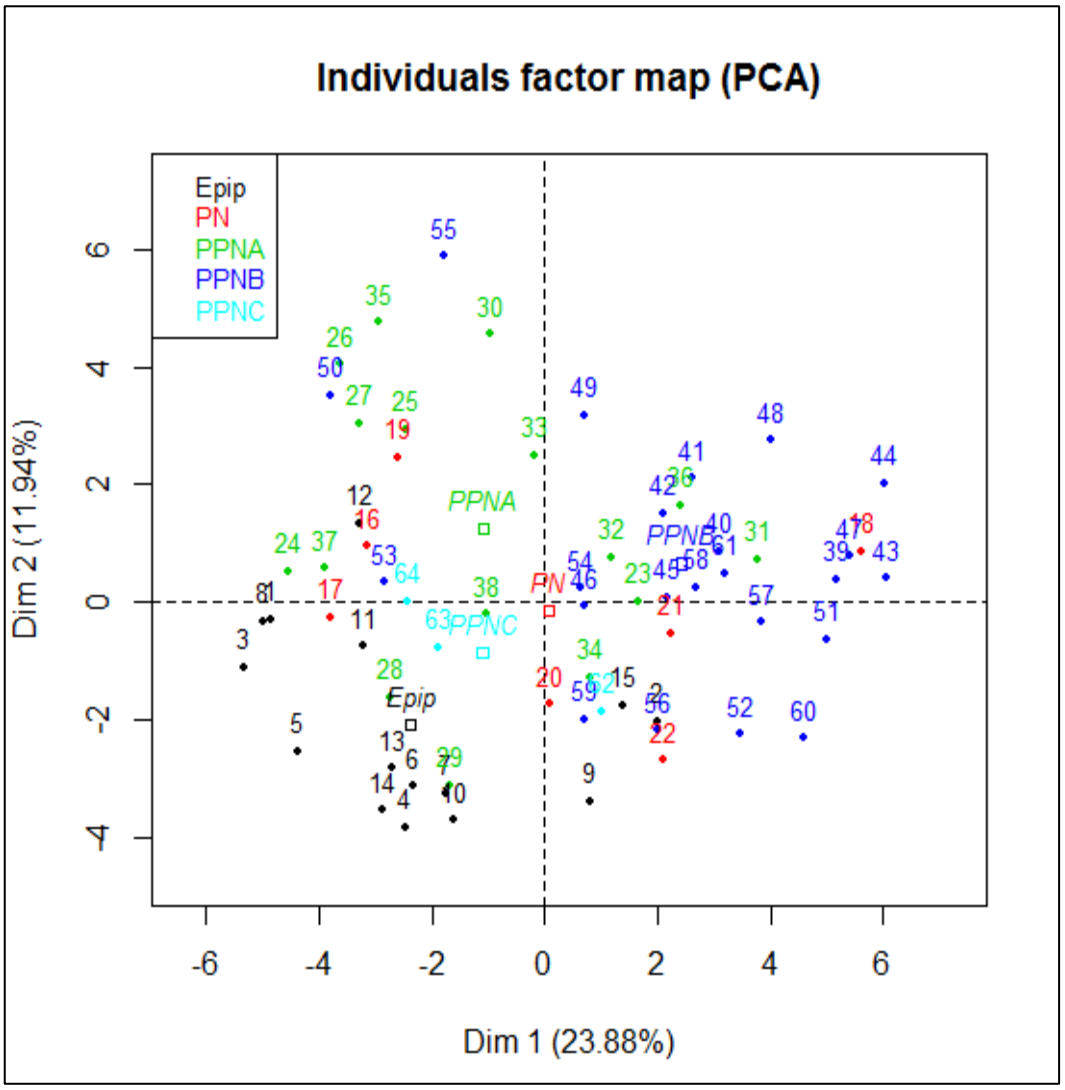


Figure 5:21: Individual Factor map showing site-phases clustering based on all variables following PCA analysis with Epipalaeolithic site-phases: 1-15, PN site-phases: 16-22, PPNA site-phases: 23-38, PPNB site-phases: 39-61, PPNC site-phases: 62-64, and the statistical centre of each cluster is represented by a square.

Figure 5.21 presents the site-phases plotted on a PCA factor map. The majority of Epipalaeolithic site-phases (black) are distributed around the lower left section of the factor map, near the Epipalaeolithic centre; three further site-phases are located in the lower middle section of the factor map. The PPNA site-phases (green) are located in each of the four sections of the factor map with the majority of site-phases in the upper

sections. The PPNA centre is located in the upper middle to left hand section of the factor map. Many PPNA site-phases are adjacent to the PPNB site-phases on the middle to right section of the map. The PPNB site-phases (dark blue) are distributed around the middle to right-hand side of the map, close to the PPNB centre. The PPNC centre or origin (indicated by a square on the plot) is close to the middle of the factor map and the PPNC site-phases (light blue) are also distributed around it. The PN site-phases (red) are generally dispersed throughout the plot.

The greatest separation occurs between PPNB Beidha II (site-phase no. 44) and Epipalaeolithic Beidha I (site-phase no. 3), as in the MDS analysis based on all variables, section 5.1.4. Epipalaeolithic Beidha I provide us with evidence of hunting/ gathering; and no evidence of sedentism and no burials. On the other hand, PPNB Beidha II provides us with archaeological evidence of a sedentary population engaged in agriculture and food storage. Also, PPNB Beidha II provides us with evidence of burials, burial goods, skull caching and a communal structure. Thus, it is aspects of the food procurement strategy and the burial record that are responsible for the separation between the Epipalaeolithic and the PPNB site-phases on the PCA matrix. These two site-phases showed the maximum separation when MDS was performed on all variables (section 5.1.4). In the middle to lower right section of the factor map there is some overlap between site-phases of different cultural horizons; with examples being Epipalaeolithic Wadi Hammeh 27 (site-phase no. 15), PPNA Netiv Hagdud (site-phase no. 34), PPNB Tell Halula (site-phase no. 59) and PPNC Ain Ghazal III (site-phase no. 62). It is aspects of ritual practices, subsistence strategy and social complexity that are causing this clustering near the centre. More specifically, these site-phases share the same high degree of sedentism, flexed burials, special treatment, skull caching and individual burials (Banning and Byrd 1987; Köhler-Rollefson 1989a; 1989b; von den Driesch and Wodtke 1997; Rollefson 1993; 1997; 1998; Kafafi *et al.* 1990; Molist *et al*. 1994; Molist and Ferrer 1996; Cruells 1996; McQuitty 1998; Molist 1998; Freeman and McEwan 1998;

Barker *et al.* 1998; Findlater 1998; Barker *et al.* 1999; Barker *et al*. 2000; Molist *et al.* 2001; Kafafi 2004a; b; Finlayson and Mithen 2007; Guerrero *et al.* 2009; Finlayson *et al.* 2011; Kuijt *et al*. 2011). Ain Ghazal III, PPNB Tell Halula and Wadi Hammeh 27 demonstrated an overlap when MDS on all variables was carried out (section 5.1.4).

5.3.5 General PCA summary

Considering the results, we can assert that PCA parallels the MDS analysis as we are seeing similar examples of separation and convergence when we perform both statistical techniques. For instance, using both statistical techniques the greatest separation of cultural phases is observed when analysed based on the subsistence variables. Epipalaeolithic and Neolithic site-phases show a limited separation when analysed using the social complexity variables. The Epipalaeolithic and Neolithic site-phases showed the greatest statistical overlap when analysed using the ritual variables. Importantly, the Epipalaeolithic and PPNB site-phases show broad separation in all analyses. The generalised distribution of the PPNA site-phases plausibly reflects their transitional nature in the emergence of farming; which will be discussed further in Chapter 8 section 8.10. When comparing the PCA results with those received from the eHRAF cultures we can observe some differences. For example, in the eHRAF sample, the greatest separation between the imagistic and doctrinal cultures was achieved when PCA was performed based on all variables combined. A high degree of overlap in the eHRAF dataset was observed when using the subsistence variables. In contrast, the south-west Asian archaeological site-phases demonstrated the greatest separation of cultural phases when analysed using the subsistence variables, while the analysis based on all variables combined resulted in greater overlap. It thus appears that the transition in subsistence practice charted by the culture-historical periods in south-west Asia is not identical with the ethnographic contrast between imagistic and doctrinal modes of religiosity. The extent to which the south-west Asian transition does ‘map onto’ a shift in religious mode will be considered further in chapter 8.

Chapter 6: Exploratory analysis of the North-west European archaeological database

6 Introduction

This chapter presents the analysis of the north-west European site-phases using multidimensional scaling (MDS) and principal component analysis (PCA).

6.1 Multidimensional Scaling

MDS was used to explore variation among the north-west European archaeological site-phases by constructing dissimilarity matrices based on Gower distances, using the *R-statistics* package. This section gives the results of MDS analysis on the basis of the ritual activity, subsistence strategy and social complexity variables, as well as, a combination of all variables. MDS analysis was conducted on a sample of 28 well documented archaeological sites from the Early Mesolithic to the Late Neolithic periods in southern Scandinavia and Ireland, with some sites represented by more than one phase (resulting in 42 site-phase phases in total) (Chapter 3, section 3.5.2). The north-west European archaeological database was used to construct two- and three-dimensional dissimilarity matrices in order to assess multivariate distances among the site-phases. The site-phases were categorised and colour-coded in terms of the culture-historical phases that they represent.

In Chapter 4 the extent to which the ritual, subsistence and social complexity variables are associated with mode of religiosity was examined using MDS for the eHRAF cultures. It is apparent that doctrinal and imagistic cultures show the greatest statistical separation when analysed using the ritual variables only, and the greatest degree of overlap when analysed based on the subsistence variables only. By contrast, for the south-west Asian site-phases, the Epipalaeolithic and Neolithic (PPNA-PN) site-phases

demonstrated the greatest statistical separation when MDS analysis was performed based on the subsistence variables. The south-west Asian Epipaleolithic and Neolithic (PPNA-PN) site-phases showed less separation when MDS was performed based on the ritual variables, though the Epipalaeolithic and PPNB site-phases remained relatively distinct. The MDS results for the south-west Asian dataset showed that ritual is a less differentiating factor than subsistence strategy in terms of culture-historical grouping, in contrast to the *known* ethnographic spectrum of imagistic-doctrinal cultures.

6.1.1 Multidimensional scaling based on the ritual variables, coded by culture-historical period

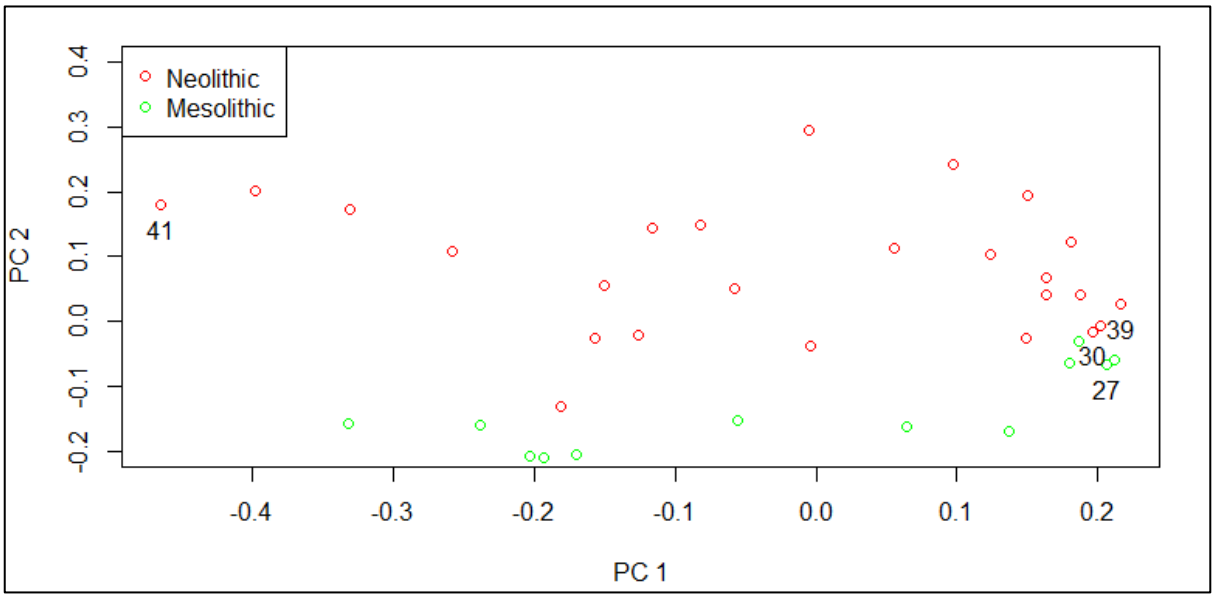


Figure 6:1: 2-d plot based on the ritual variables for north-west European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Lough Boora (27), Ballynagilly (30), Ballintaggart (39) and Brú Na Bóinne Complex (Newgrange) (41)

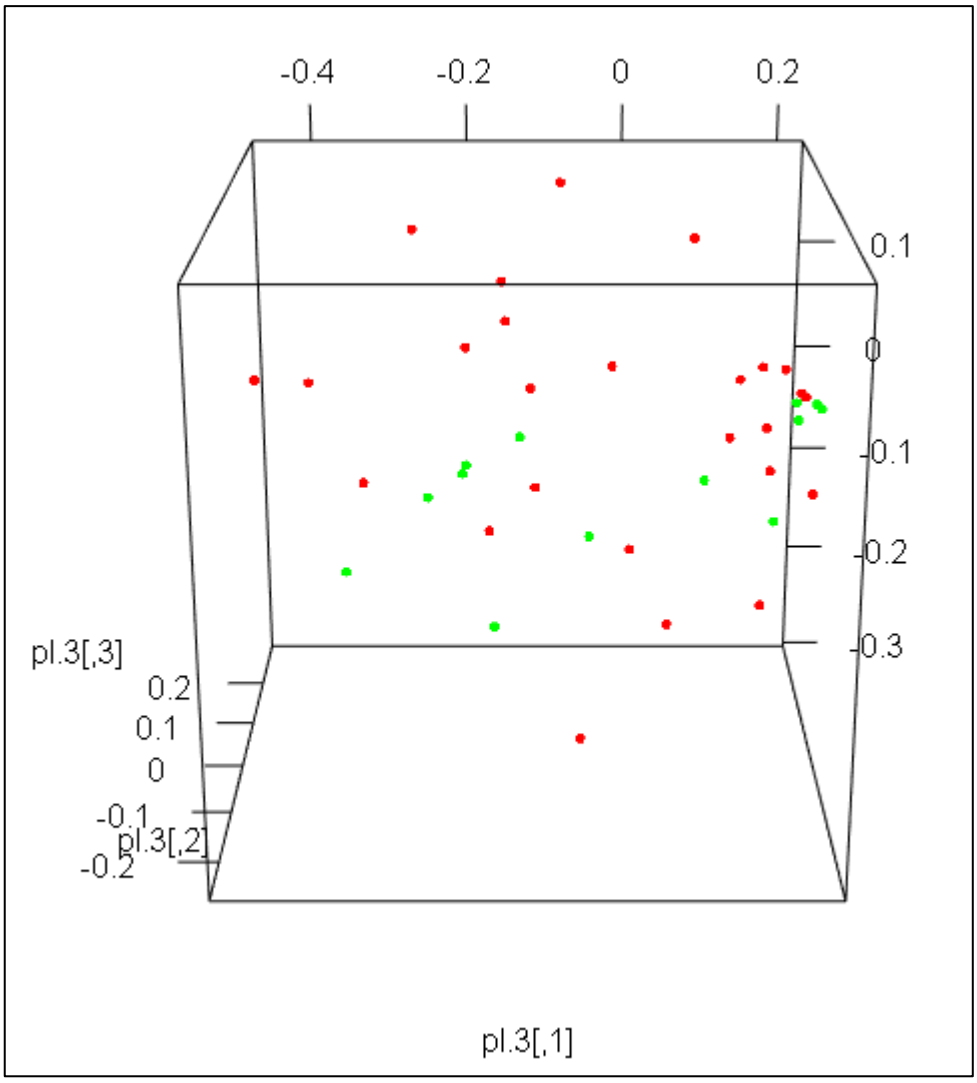


Figure 6:2a: 3-d plot based on the ritual variables for European archaeological site-phases, coded in terms of cultural phase

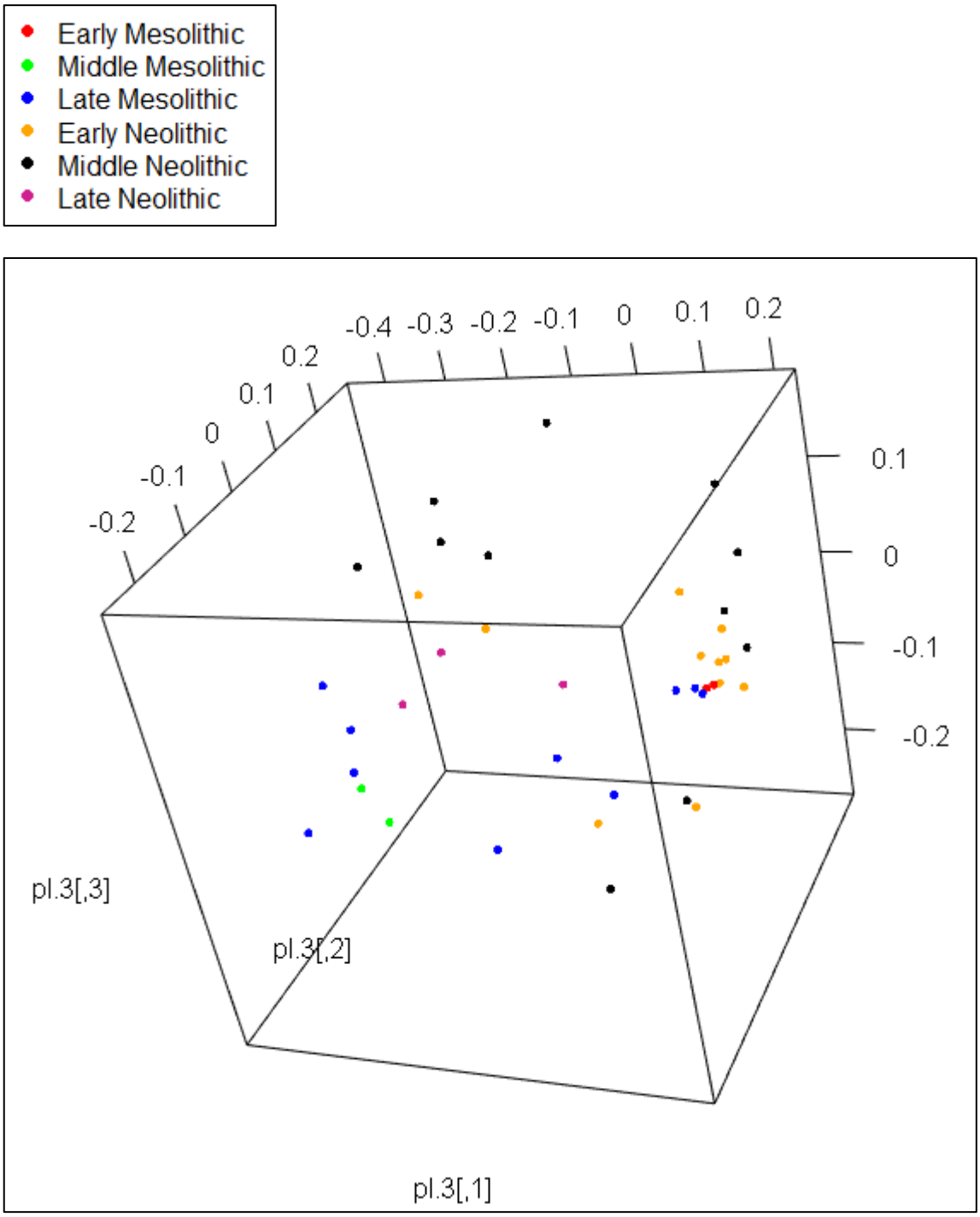


Figure 6:2b: 3-d plot based on the ritual variables for European archaeological site-phases, coded in terms of cultural sub-phase

Figures 6.1 and 6.2a show the results of the MDS statistical analysis for the north-west European archaeological site-phases based on the ritual variables—coded as either Mesolithic or Neolithic. In the two-dimensional MDS plot (Figure 6.1), the Mesolithic site-phases (green) are concentrated in the lower section of the plot, mainly centre-right. The Neolithic site-phases (red) mostly occupy the upper section of the plot, again mainly

centre-right with three site-phases on the left hand side. We can see that the separation between the Mesolithic and Neolithic site-phases is emphasized in terms of a distinction between the site-phases in the upper and lower sections of the two-dimensional MDS plot respectively. In the three-dimensional MDS plot (Figure 6.2a) the Mesolithic and Neolithic site-phases are more dispersed throughout the plot in comparison to the two-dimensional plot. Similar to the two-dimensional plot: (1) a number of Mesolithic and Neolithic site-phases are concentrated in the right-hand section; and (2) a number of Neolithic site-phases occupy the upper section of the plot. Figure 6.2b presents the results of the MDS plot coded in terms of cultural sub-phase. This plot is rotated on its X and Y axes compared to Figure 6.2a. For the most part, we can observe examples representing each of the cultural sub-phases dispersed throughout the plot. A number of Early Neolithic site-phases (orange) cluster on the right-hand side in close proximity to a number of middle Neolithic (black), Late Mesolithic site-phases (blue) and the two Early Mesolithic site-phases (red). The two Middle Mesolithic site-phases (green) are located in the lower left section of the plot.

In Figure 6.1, the greatest statistical separation occurs between Mesolithic Lough Borra (site-phase no. 27), and the Middle Neolithic Brú Na Bóinne Complex (Newgrange) (site-phase no. 41). Mesolithic Lough Borra provides no archaeological evidence of ritual activity. It should be noted that lough Borra reflects an Irish Mesolithic site-type with little ritual evidence (Ryan 1980; 1981; 1984; Woodman 1986; Griffiths 1998). On the other hand, the Brú Na Bóinne Complex provides us with evidence of ritual activity including monumental architecture and burials associated with monuments (Coffey 1912; Macalister 1943; Hartnett 1954; O Riordain 1956; Flanagan 1960; O'Kelly 1964; 1978; 1982; Eogan 1968; 1973; 1974; 1980; 1993; 1994; 1997; 1998; Shee-Twohig 1972; 1973; 1981; 1993; 2000; Wijngaarden-Bakker 1974; Patrick 1982; O'Kelly *et al*. 1983; McCormick and Murray 1985; 2007; Eogan 1986; Sweetman 1987; Boyle 1988; Roche 1989; O'Brien 1989; O'Sullivan 1989; Eogan and Grogan 1991; Mount 1992; Condit

1993; Mitchell 1994; Powell 1994; Fenwick 1995; Devereux; 1996; McGuinness 1996; Eogan and Roche 1997; Kearns 1997; Mac Uistin 1999; Phillips *et al*. 2001; Stout 2002; Harbison 2003; May 2003 May 2003; Meighan 2003; Swift 2003; Cooney 2006; Eriksen 2006; Mac Uistin 2007; Byrne *et al.* 2008; Ingalls 2008; Stout and Stout 2008; Fenwick *et al.* 2009; Lewis *et al.* 2009; Smyth *et al.* 2009).

Also, notable are examples of overlap between Mesolithic and Neolithic site-phases in the right-hand side of the plot. For example, the Early Neolithic site-phases of Ballynagilly (site-phase no. 30) and Ballintaggart (site-phase no. 39) are located close to a number of Mesolithic site-phases; these two early Neolithic site-phases provide no archaeological evidence of ritual activity such as special burial treatment, communal ritual buildings or megalithic monuments in the landscape (Pilcher 1968: 1972; ApSimon 1969; 1971; 1976; Chapple *et al*. 2007; Chapple 2008a; 2008b; Chapple *et al*. 2009; Whitehouse *et al.* 2010; McClatchie *et al.* 2012). The eigenvalue calculated via R-statistics for the three-dimensional plot is [1] 0.961746 2637 which indicates that 96% of the information from the north-west European archaeological database was reduced to variables in three-dimensions with only a loss of 4% of information.

6.1.2 Multidimensional scaling based on the subsistence variables, coded by culture-historical period

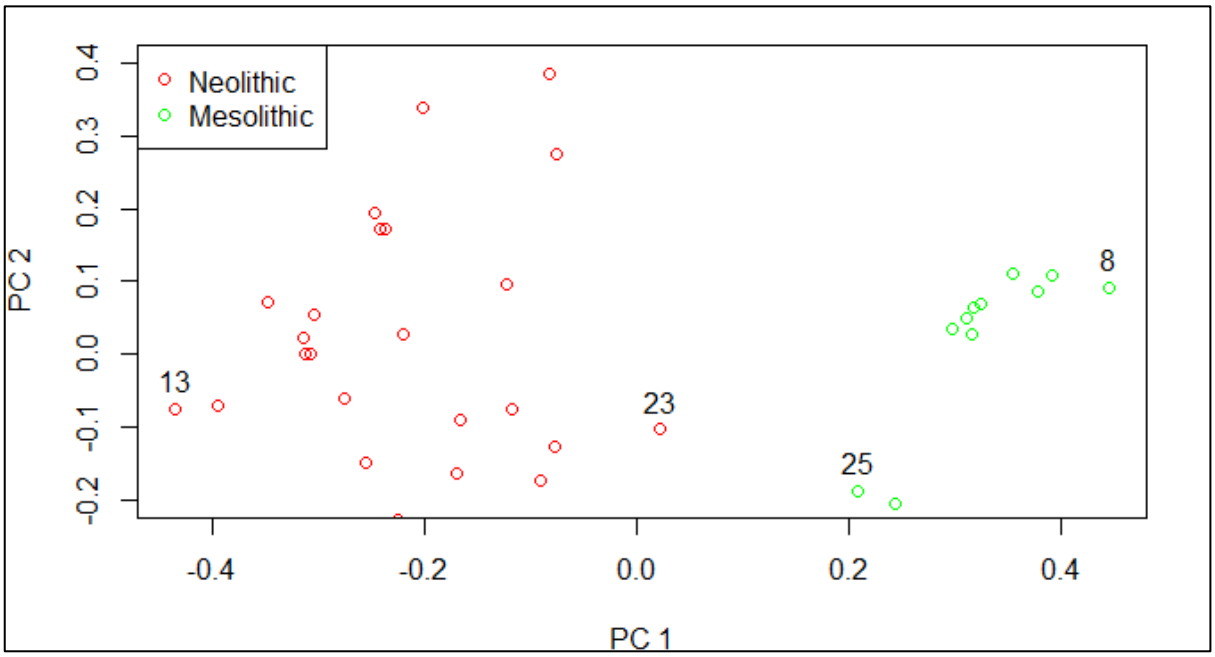


Figure 6:3: 2-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of cultural phase, showing selected site-phases: Tågerup (8), Sarup I (13), Clowanstown 1 (23) and Gortore (25)

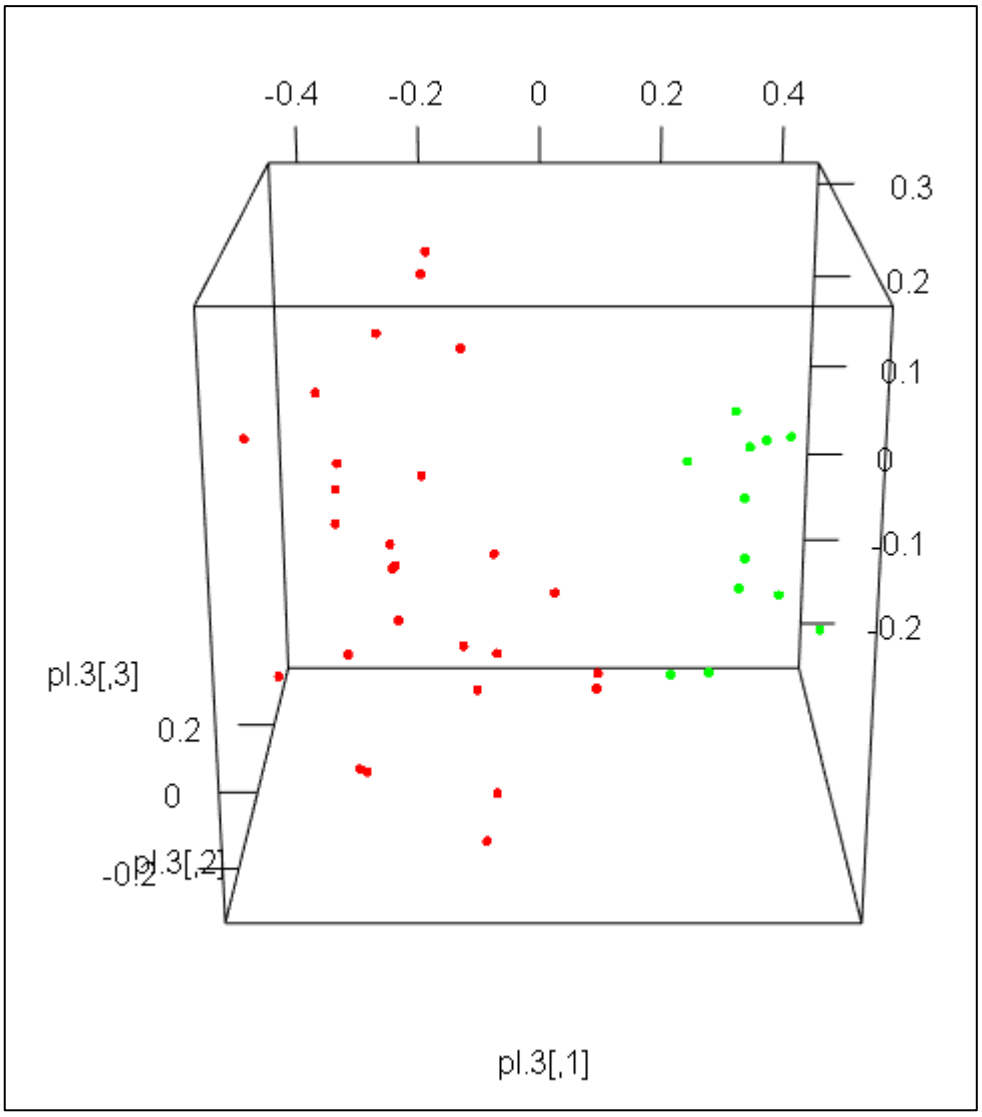


Figure 6:4a: 3-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of cultural phase

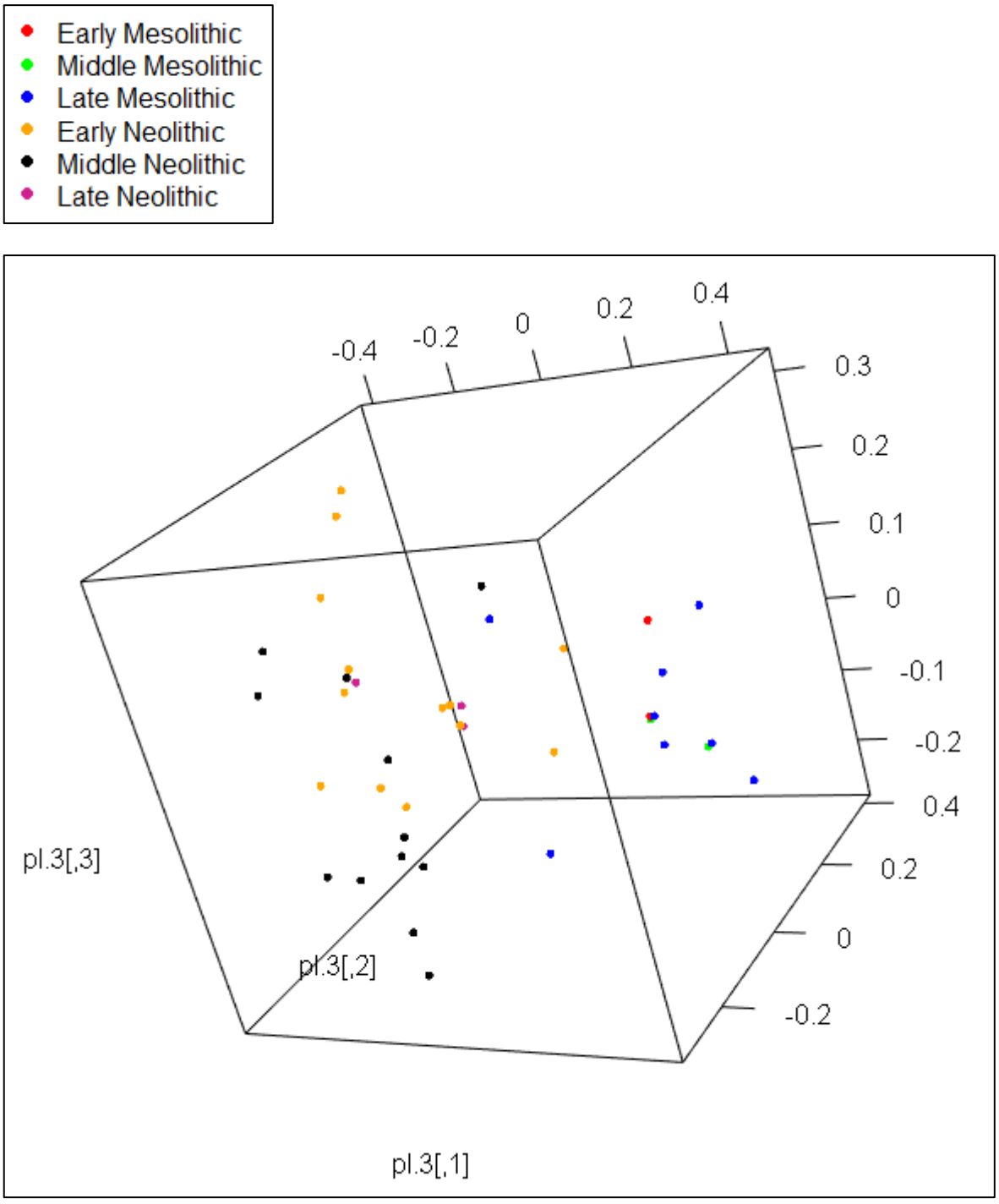


Figure 6:4b: 3-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of cultural sub-phase

Figures 6.3 and 6.4a and 6.4b show the results of the MDS statistical analysis for the north-west European archaeological data relating to subsistence variables—coded by cultural phase. In Figures 6.3 and 6.4a the Mesolithic site-phases (green) are concentrated on the right-hand section of the plot, while the Neolithic site-phases (red) are located on the middle to left-hand side. In this example, we can see that the separation between the

Mesolithic and Neolithic site-phases is emphasized in terms of a distinction between the site-phases on the left and right hand sections of the two MDS plots respectively. In both plots, the concentration of Mesolithic site-phases on the right-hand side of the MDS plots is more distinct than that of Neolithic site-phases on the left. Figure 6.4b presents the same MDS analysis, coded in terms of cultural sub-phase. This plot is rotated on its X and Y axes compared to Figure 6.4a. The Mesolithic site-phases (Early, Middle and Late) are distributed on the right-hand section of the plot, with two late Mesolithic examples (blue) located in the upper and lower middle sections of the plot, respectively. For the most part, the Neolithic site-phases (in orange, black and purple, respectively) cluster in the middle to left-hand side of the plots. However, there are examples of Neolithic site phases in close proximity to a number of Mesolithic site-phases, in the middle to left hand section of the plot. For instance, two Early Neolithic site-phases (orange) are located in close proximity to a number of Mesolithic site-phases, in middle to left-hand side of the plot.

The MDS analysis shows that the greatest separation occurs between Mesolithic Tågerup (site-phase no. 8) and Neolithic Sarup I (site-phase no. 13) (Figure 6.3). Tågerup is a late Mesolithic site-phase with evidence of a subsistence strategy focusing on hunting, gathering and fishing (Ahlström 2003; Karsten and Knarrstrum 2003; Andersson *et al*. 2004; Regnell 2012; Sørensen, *et al*. 2013). Conversely, Middle Neolithic Sarup I features evidence of agriculture including the use of both domesticated crops and animals, as well as a long-term food storage strategy (Jorgensen 1977; Whittle 1988a; b 1996; 1997a; b; 1999a; b; Raetzel-Fabian 1999; Tilley 2003; Andersen 2004). The best examples of two sites from different cultural horizons in relatively close proximity are Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) and Late Mesolithic Gortore (site no. 25). One of two Early Neolithic phases at Clowanstown 1, layer (F17/F22), was radiocarbon dated to 3790–3640 BC (Beta 246990, Oxcal: 3790–3650 BC). This peat layer included decayed wood pieces, fragments of animal bone, fragments

of prehistoric pottery, hazel (*Corylus avellana*) and several lithics, including a chert blade, a Bann flake, one piece of worked chert core tool, fragmented hammer-stones and a possible axe. This phase, however, produced no evidence of permanent settlement, agriculture or domesticated animals (Mossop and Mossop 2009). Late Mesolithic Gortore yielded evidence of gathering and food storage but no evidence of hunting or fishing (O'Donoghue 2010a; 2010b; Whitehouse *et al.* 2010; McClatchie *et al.* 2012), which is causing it to be a distance from the other Mesolithic site-phases (which provide us with evidence of hunting and gathering). It should be noted that these sites are still quite separated from each other on the plots; demonstrating a clear separation between the Mesolithic and Neolithic site-phases based on the recorded subsistence variables.

The MDS analysis based on the subsistence variables clearly results in a greater separation of the cultural phases than the analysis based on the ritual variables. This result is not surprising since the distinction between Mesolithic and Neolithic is based to a large extent on presence/absence of agriculture and herding. The specific features of the subsistence strategies causing separation and coalescence will be investigated in the PCA section of this chapter (section 6.3.2). The eigenvalue calculated via R-statistics for the three-dimensional plots is [1] 0.917856, which indicates that 92% of the variability in the data is accounted for by reducing the data to variables in three dimensions using MDS with a loss of only 8% of the information.

6.1.3 Multidimensional scaling based on the social complexity variables, coded by culture-historical period

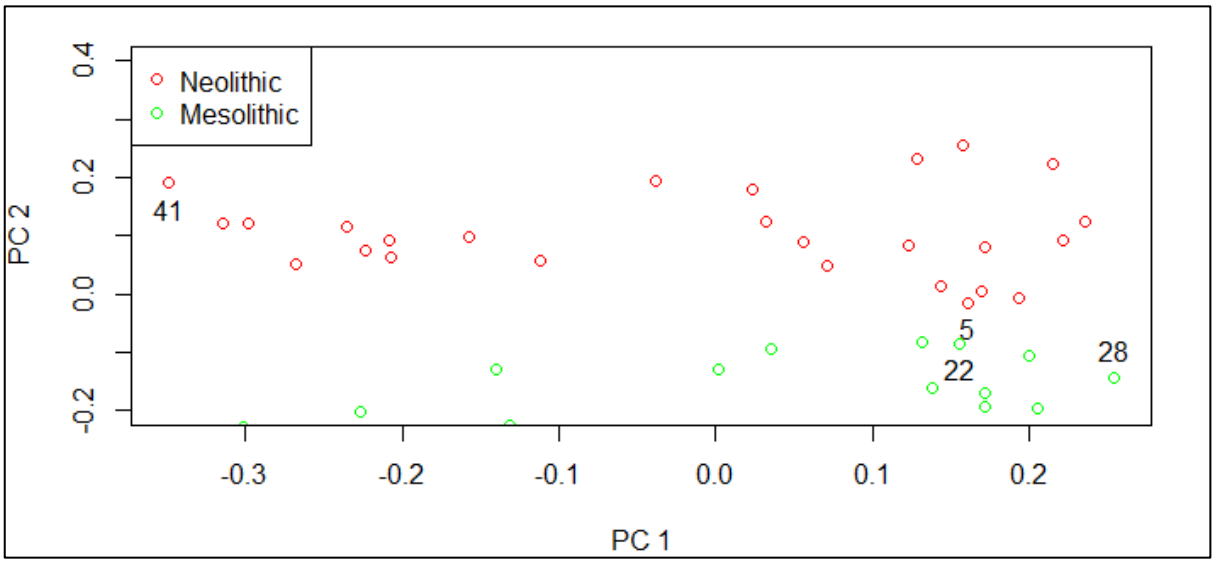


Figure 6:5: 2-d plot based on the social complexity variables for European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Norsminde (Køkkenmødding) (5), Clowanstown 1 (22), Mount Sandel (28) and Brú Na Bóinne Complex (41)

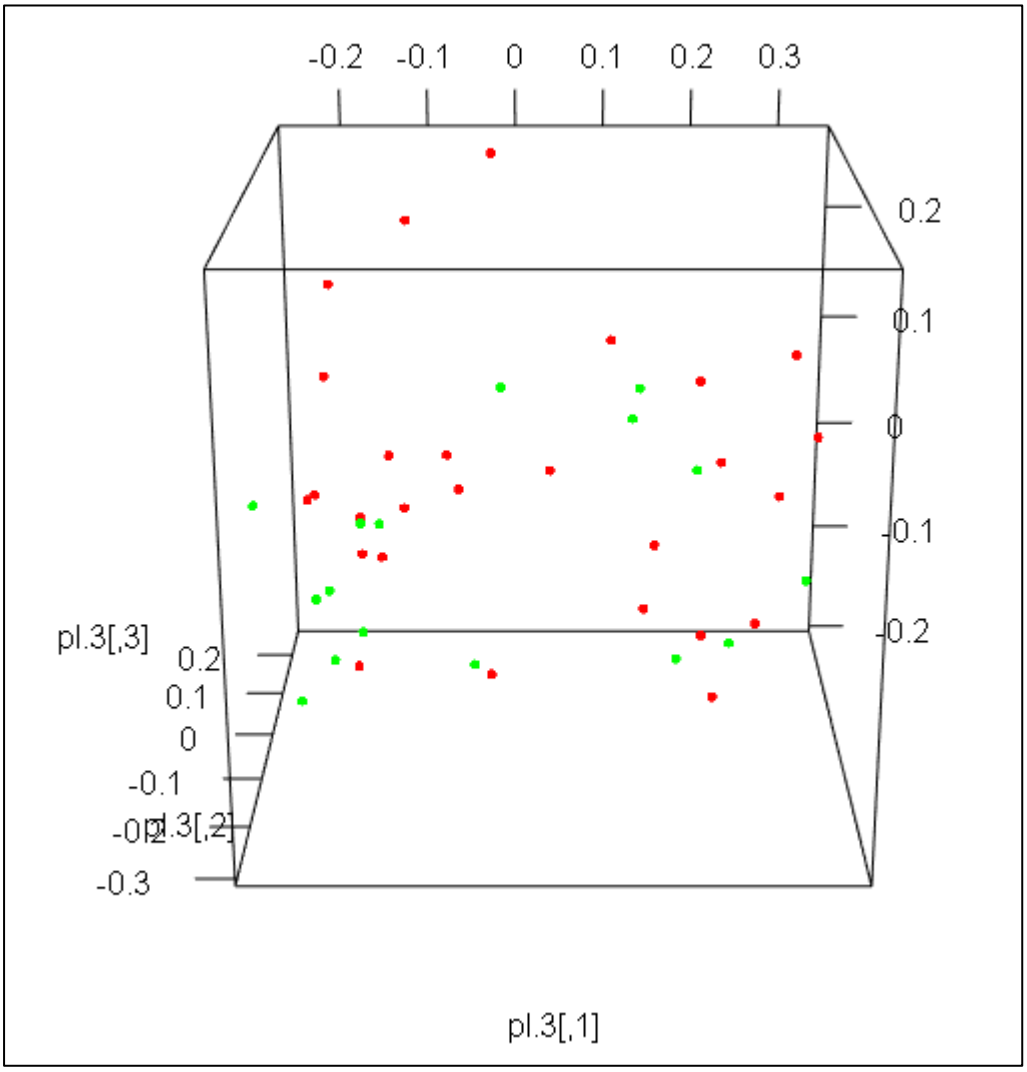


Figure 6:6a: 3-d plot based on the social complexity variables for European archaeological site, coded in terms of cultural phase

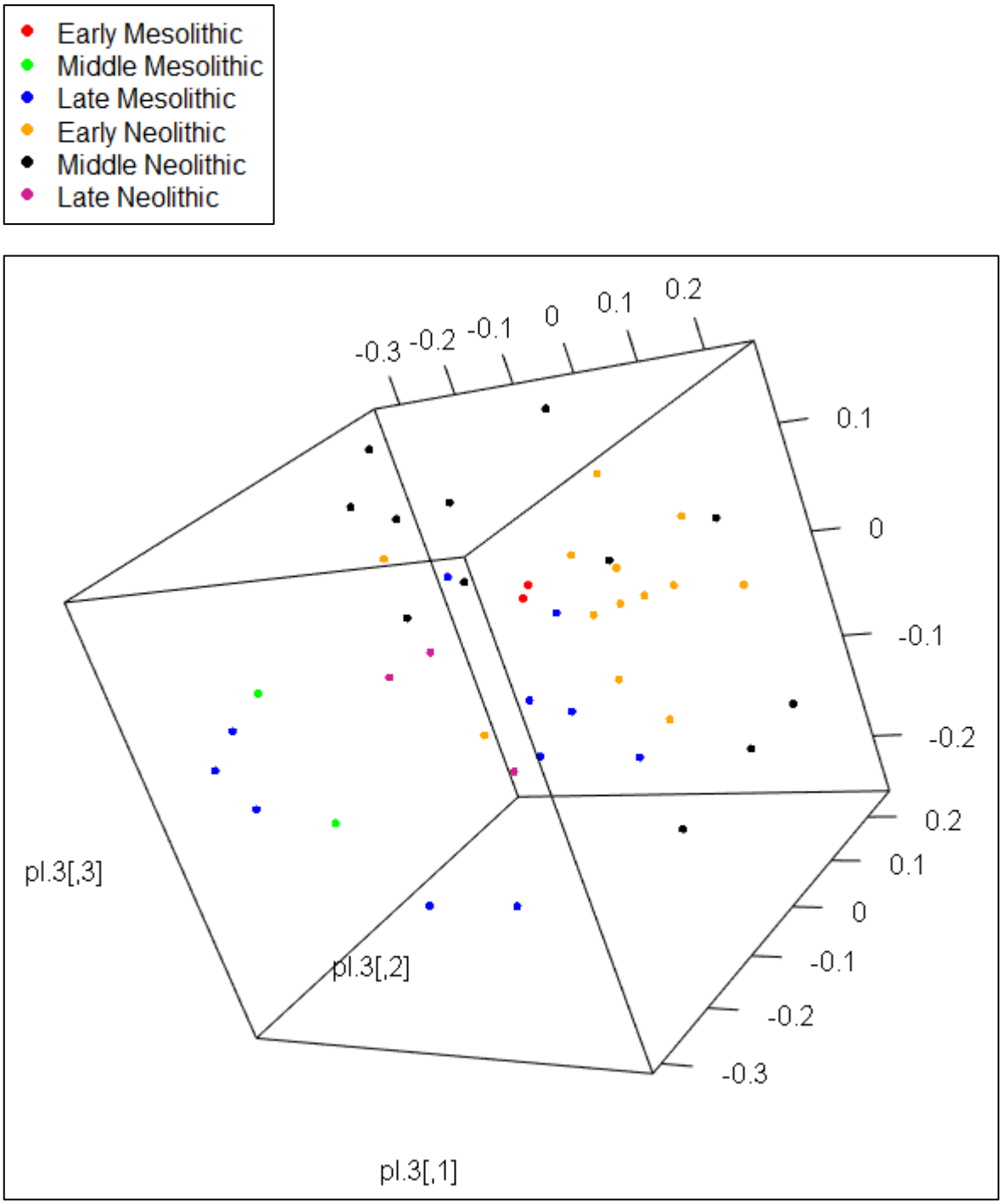


Figure 6:6b: 3-d plot based on the social complexity variables for European archaeological site-phases, coded in terms of cultural sub-phase

Figures 6.5 and 6.6a show the results of the MDS statistical analysis for the north-west European archaeological data relating to the recorded social complexity variables—coded as Neolithic or Mesolithic. In the two-dimensional plot (Figure 6.5), the Neolithic site-phases (red) are distributed across the upper section of the plot and Mesolithic site-phases (green) in the lower section. Similar to the MDS plot based on the ritual variables, the

separation between the Mesolithic and Neolithic site-phases is seen in terms of the Neolithic site-phases in the upper section and the Mesolithic site-phase in the lower section of the plot. In Figure 6.6a the Mesolithic site-phases (green) and the Neolithic examples (red) are dispersed evenly throughout the plot. As in the two-dimensional plot, we can see that the Mesolithic site-phases are mainly located in the lower section and the Neolithic site-phases are, generally, located in the middle to upper section of the three-dimensional plot. In Figure 6.6b (coded in terms of sub-phase, and rotated on its X and Y axes compared to Figure 6.6a), the Mesolithic and Neolithic site-phases are, generally, distributed through the plot (as in Figure 6.6a). There is some separation between Mesolithic and Neolithic sub-phases; for example, there is a distinct separation between a group of five of the middle and the two late Mesolithic site-phases (green and blue), on the one hand, and the Early and Middle Neolithic site-phases (orange and black), on the other.

In the two-dimensional MDS plot the greatest separation occurs between Early Mesolithic Mount Sandel (site-phase no. 28) and the Middle Neolithic Brú Na Bóinne Complex (site-phase no. 41) (Figure 6.5). Mount Sandel yielded subsistence evidence of a mobile group engaged in hunting and gathering, while the Brú Na Bóinne Complex provides evidence of a fully sedentary community, engaged in a subsistence strategy focused on domesticated crops and animals and food storage, and ritual activity evidence including monumental architecture and an associated set of burial practices. Examples of overlap in the two-dimensional plot include late Mesolithic Clowanstown 1 (site-phase no. 22) and Early Neolithic Norsminde (Køkkenmødding) (site-phase no. 5). These site-phases indicate aspects of similar material culture including evidence of hunting and gathering and an absence of monumental architecture (Andersen 1976; Andersen and Johansen 1987; Andersen 1989; Enghoff 1989; FitzGerald 2007a; 2007b; Laurie 2008; Mossop and Ruddle 2008; Brouwer 2009; Clancy 2009; Mossop and Mossop 2009; Whitehouse *et al.* 2010; McClatchie *et al.*2012). Clearly, there is a greater degree of

overlap in the sample when the site-phases are analysed based on the recorded social complexity variables in comparison with the results from the analysis based on the subsistence variables. The result reflects the fact that some Mesolithic and Neolithic site-phases have aspects of social complexity in common—the application of PCA in the next section is used to further examine the distinction between the site-phases by identifying the variables that are responsible for the maximum variance in the sample of site-phases. The eigenvalue calculated via R-statistics for the three-dimensional plots is [1] 0.818769 which indicates that 82% of the site-phase information from the north-west European archaeological database was reduced to variables in three-dimensions with only a loss of 18% of the information.

6.1.4 Multidimensional scaling based on all variables, coded by culture-historical period

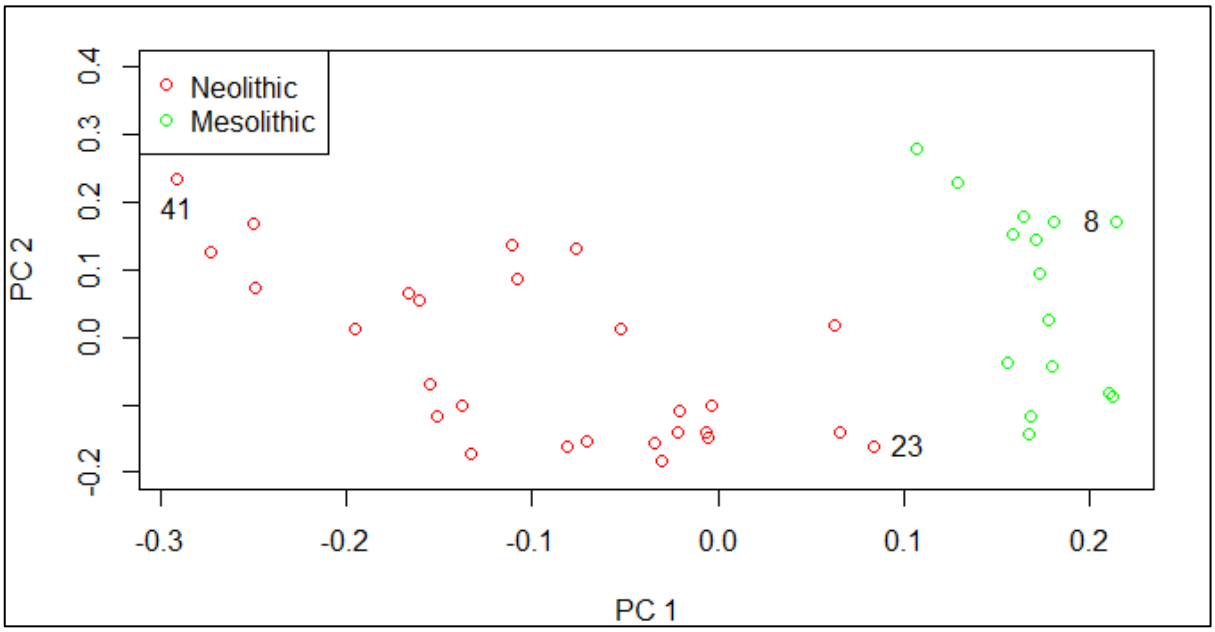


Figure 6:7: 2-d plot based on all variables for European archaeological site-phases coded in terms of cultural phase, showing selected site-phases: Tågerup (8), Clowanstown 1 (23) and Brú Na Bóinne Complex (41)

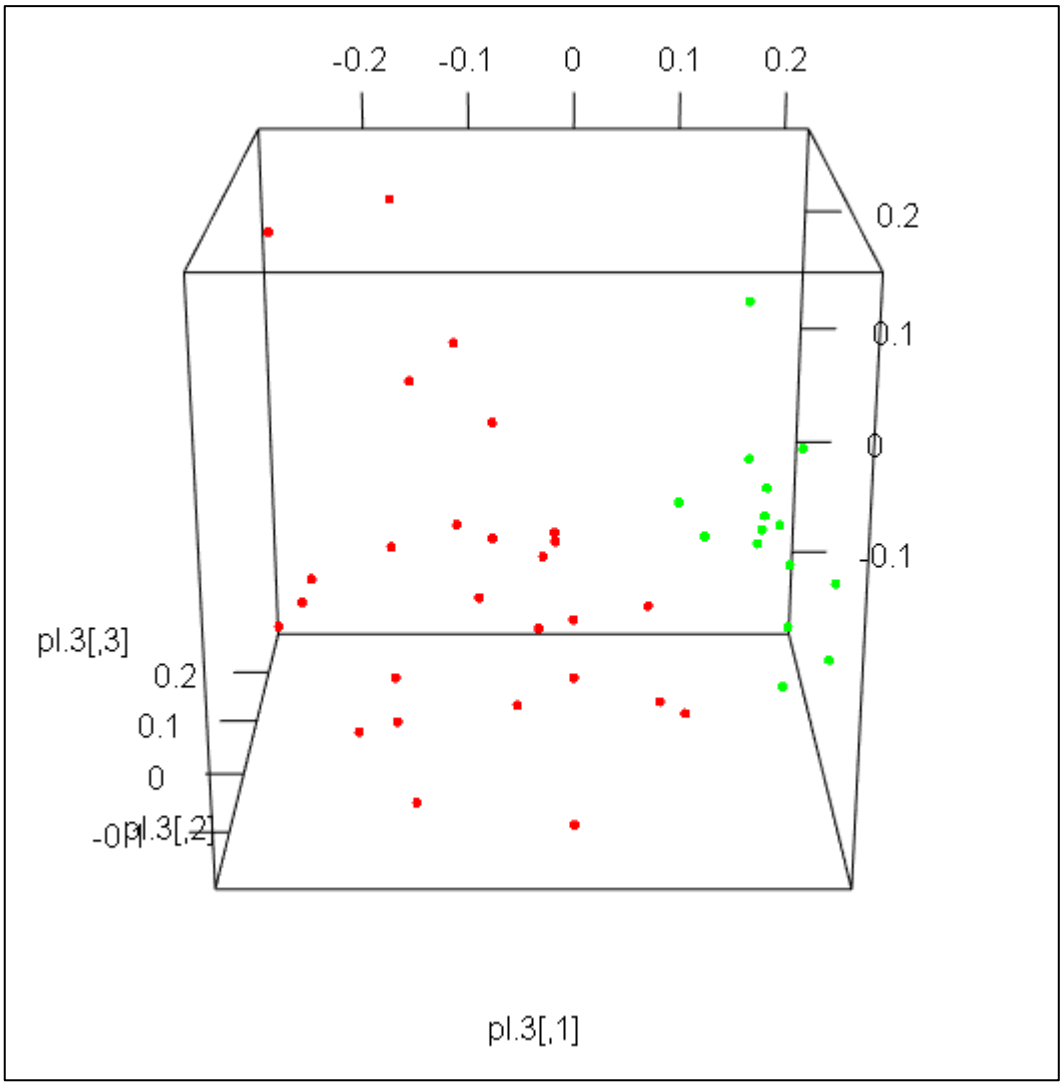


Figure 6:8a: 3-d plot based on all variables for European archaeological site-phases, coded in terms of cultural phase

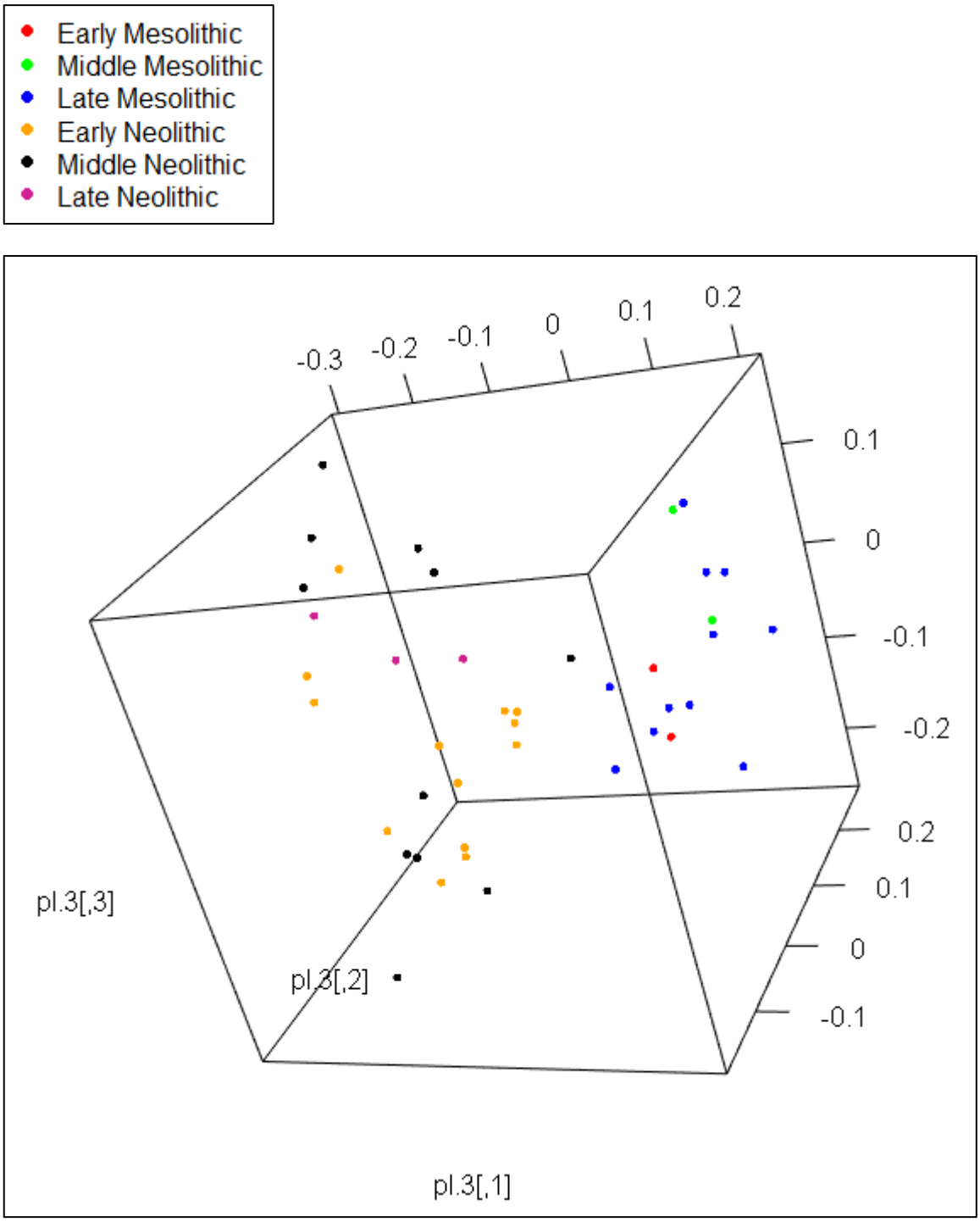


Figure 6:8b: 3-d plot based on all variables for European archaeological site-phases, coded in terms of cultural sub-phase

Figures 6.7 and 6.8a show the results of the MDS statistical analysis for the north-west European archaeological data relating to all variables (ritual activity, subsistence strategy and social complexity)—coded as Mesolithic or Neolithic. In Figure 6.7 and 6.8a a relatively clear separation between the Mesolithic (green) and the Neolithic (red) site-

phases is apparent. The Mesolithic site-phases (green) are distributed on right-hand section of the plots. The Neolithic site-phases (red) are distributed on the middle to left-hand side of the plot. Figure 6.8b, coded in terms of sub-phase and rotated on its X and Y axes compared to Figure 6.8a, shows that Mesolithic site-phases (Early, Middle and Late) are distributed around the middle to right-hand section of the plot, while Neolithic site-phases (Early, Middle and Late) are distributed around the middle to left-hand side. The Early Neolithic site-phases are, for the most part, concentrated in the centre to lower left-hand section of the plot. From figure 6.7, we can see that the greatest separation occurs between late Mesolithic Tågerup (site-phase no. 8) and the Middle Neolithic Brú Na Bóinne Complex (site-phase no. 41). Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) presents us with an example of a Neolithic site-phase that is located closest to the Mesolithic site-phases, as in the analysis based on the subsistence and social complexity variables (section 6.1.2. and 6.1.3). It is evident that there is a distinction between the Mesolithic and Neolithic site-phases when MDS analysis was performed on the basis of all variables; with less closeness or overlap in the sample compared to when the site-phases are analysed based on the social complexity and ritual variables respectively (sections 6.1.1. and 6.1.3). The eigenvalue calculated via R-statistics for the three-dimensional plots is [1] 0.936789, which indicates that 94% of the information from the European archaeological database was reduced to variables in three dimensions, with only a loss of 6% of the information.

6.1.5 General MDS summary

The two- and three-dimensional MDS plots of the north-west European data indicate that the Neolithic and Mesolithic site-phases are principally separated on the basis of the subsistence variables. MDS analysis based on the ritual variables resulted in the highest degree of overlap between Mesolithic and Neolithic site-phases. Similarly, MDS analysis based on the social complexity variables resulted in considerable overlap. The results from the MDS analysis of the north-west European site-phases thus parallels the MDS

results for the south-west Asian site-phases as: (1) MDS analysis based on the subsistence variables resulted in the clearest distinction between pre-Neolithic and Neolithic site-phases; and (2) MDS analysis based on the ritual variables resulted in the weakest separation between the pre-Neolithic and Neolithic site-phases. On the other hand, the results contrast with the MDS analysis of the eHRAF cultures, which demonstrated the greatest separation based on the ritual variables and the least distinct separation for the MDS analysis based on the subsistence variables. Although the agricultural transition in the north-west European sample coincides with radical changes in ritual material culture (a major example being megalithic architecture), the statistical results suggest that the ritual contrast between Mesolithic and Neolithic site-phases used in this analysis is less distinct than that in subsistence practice.

6.2 Multidimensional scaling analysis coded by population size

This section gives the results of MDS analysis based on ritual, subsistence, social complexity and a combination of all variables, coded in terms of the population size estimated for each site-phase. As discussed in Chapter 3 (section 3.6), a number of papers have examined and commented on the empirical evidence concerning the relationship between population size limits and aspects of subsistence practices, social organisation and ritual practices (Flannery 1972; Forge 1972; Wright and Johnson 1975; Wright 1977; Johnson 1978; Kosse 1989; Whitehouse 2004; Atkinson and Whitehouse 2011). To examine the connection between population size and ritual activity, subsistence practices and social complexity across the north-west European Neolithic transition, all site-phases were categorised and colour coded in terms of three population measures:

1. Red: populations less the 150 individuals
2. Green: populations between 150 and 500 individuals
3. Blue: populations between 500 and 5,000 individuals

6.2.1 Multidimensional scaling analysis based on the ritual variables, coded by population size

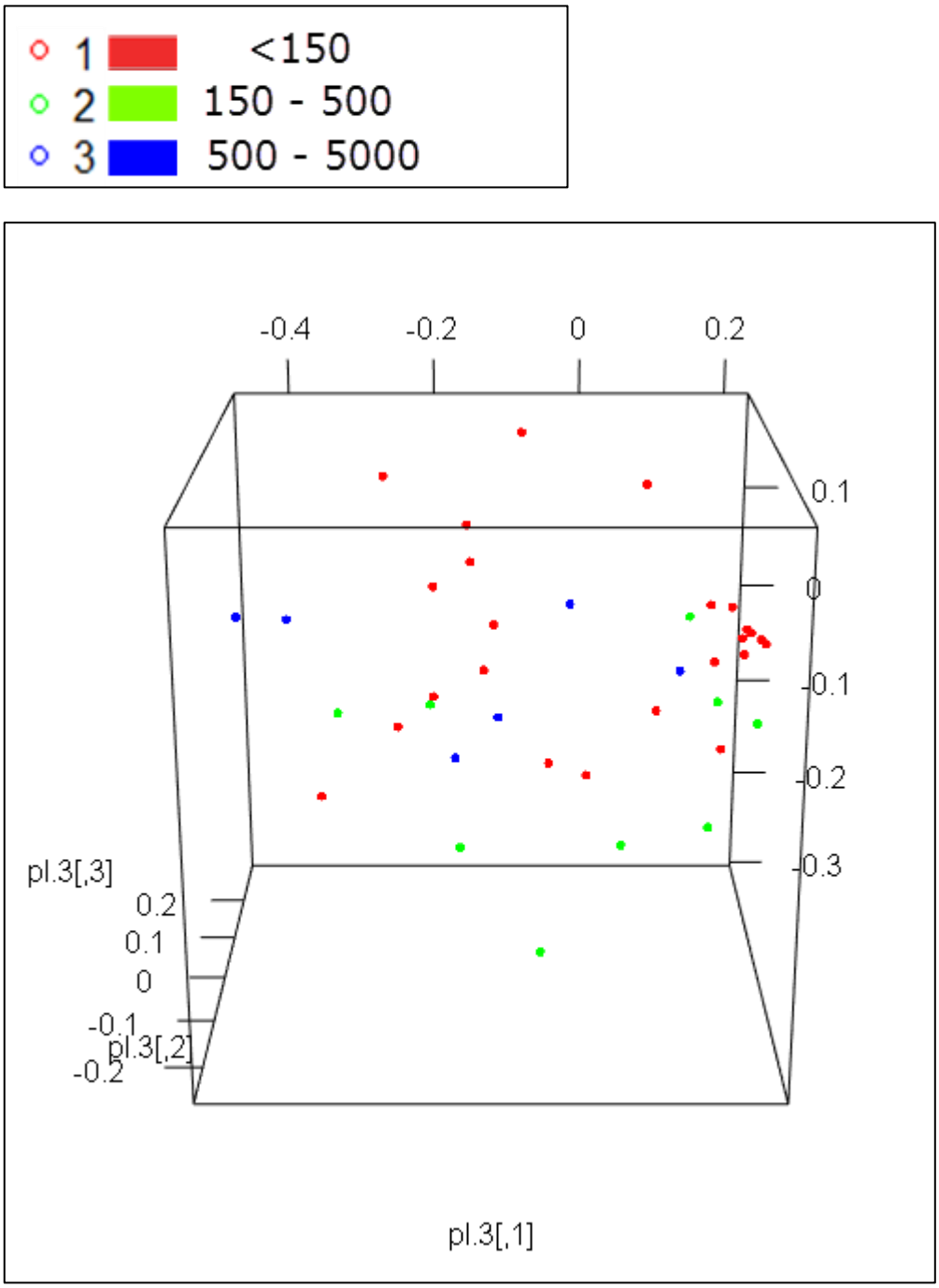


Figure 6:9: 3-d plot based on the ritual variables for European archaeological site-phases, coded in terms of population size

Figure 6.9 presents the results of the MDS statistical analysis for the north-west European archaeological dataset based on the ritual variables—coded in terms of population size. In Figure 6.9 the site-phases reflecting the three population categories are dispersed throughout the plot. A total of nine site-phases with populations of less than 150

individuals (red), form a distinct group in the in the upper right hand section of the plot. The site-phases representing 150 to 500 individuals (green) are evenly distributed across the mid to lower section of the plot, with one site-phase in the upper right hand section. The site-phases representing 500 to 5,000 individuals (blue) are evenly distributed across the plot. In the centre of the plot we can observe that a number of site-phases representing each of the three population categories overlap. Aside from the group of nine site-phases in the less than 150 individuals' category in the upper right hand section of the plot, perhaps reflecting a relationship between ritual and population size in the context of smaller groups (cf. Whitehouse 2004), the MDS analysis based on the ritual variables does not provide a clear separation or grouping pattern in terms of three population size categories used.

6.2.1 Multidimensional scaling analysis based on the subsistence variables, coded by population size

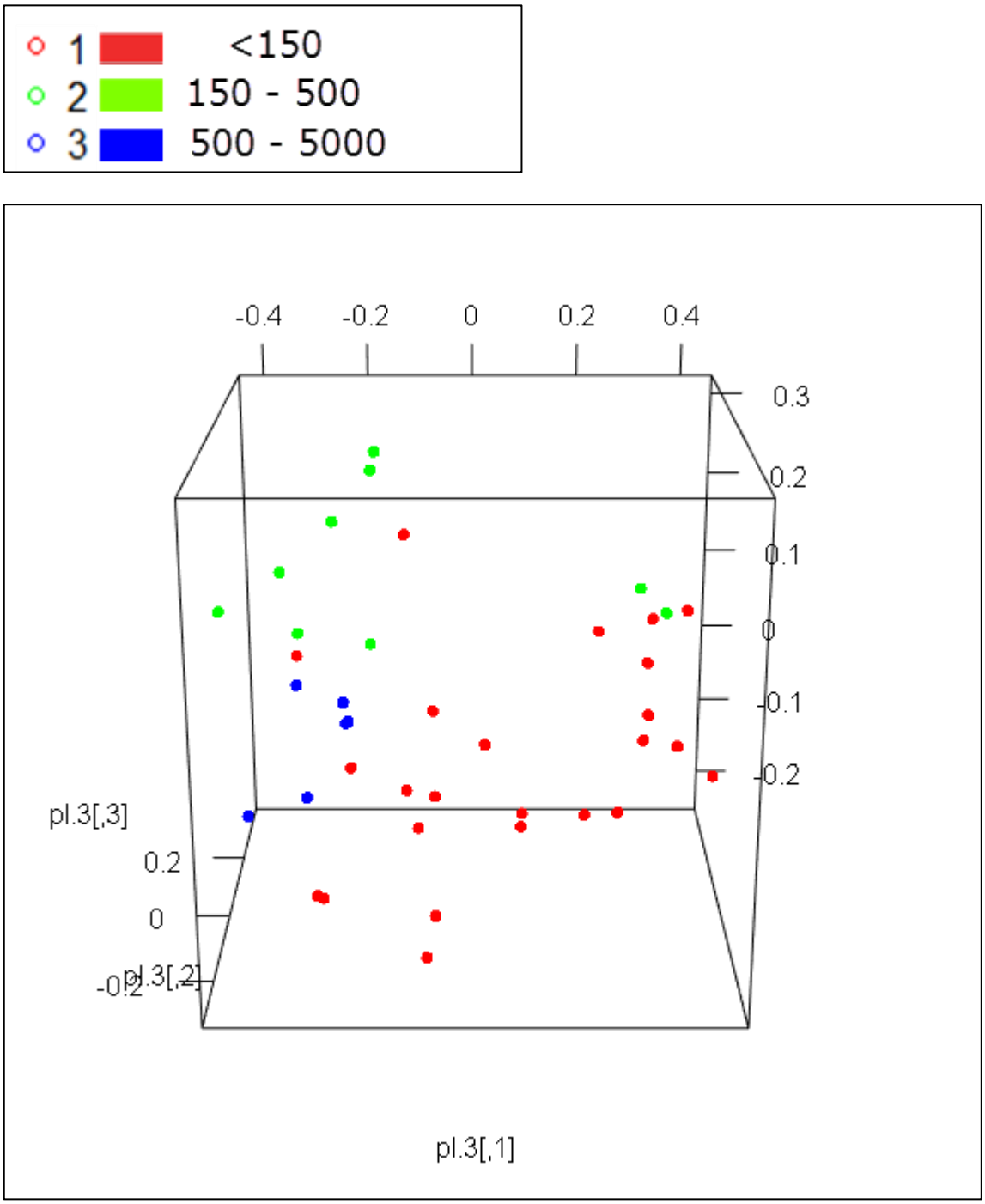


Figure 6:10: 3-d plot based on the subsistence variables for European archaeological site-phases, coded in terms of population size

Figure 6.10 presents the results of the MDS analysis for the north-west European archaeological data relating to subsistence variables, coded in terms of population size. In Fig. 6.10, a number of site-phases with populations of less than 150 individuals (red) are

located in the middle and the right-hand section of the plot. The site-phases with populations of 150 to 500 individuals (green) display a degree of concentration in the upper left-hand section of the plot—with two examples on the right hand side of the plot. The site-phases with populations of 500 to 5,000 individuals (blue) are located in the left side of the plot. To an extent, there appears to be a connection between population size and subsistence practices, reflected in the distribution of the site-phases representing the different population size categories used in this analysis but it is not entirely distinctive.

6.2.2 Multidimensional scaling analysis based on the social complexity variables, coded by population size

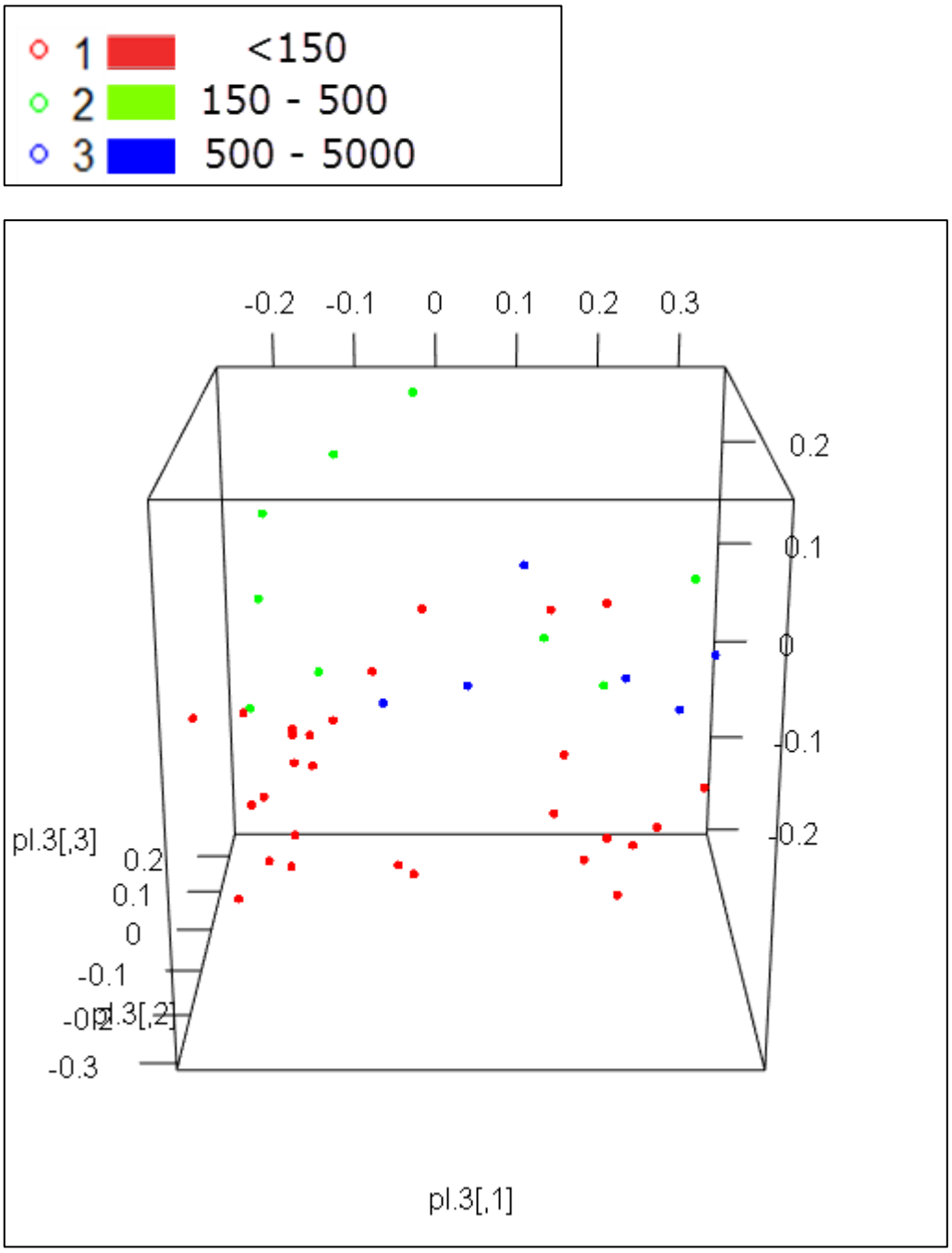


Figure 6:11: 3-d plot based on the social complexity variables for European archaeological site-phases, coded in terms of population size

Figure 6.11 presents the results of the MDS statistical analysis for the European archaeological data relating to the social complexity variables, coded in terms of population size. The site-phase representing the three population categories seem to

disperse evenly throughout the plot. However, some patterns can be discerned. For example, the site-phases representing population category of less than 150 individuals (red) are distributed in the lower section of the three-dimensional plot, forming two distinct clusters on the right and left-hand sides respectively. Four of the site-phases representing populations of 150 to 500 individuals (green) are located on the upper left hand section of the plot. The remaining examples from this category are distributed across the middle section of the plot (from left to right). The site-phases representing populations of 500 to 5,000 individuals (blue) are located in the middle to right hand section of the plot. Across the middle of the plot, we can see examples of site-phases reflecting each of the three population categories in close proximity to each other. In general, this plot shows a relatively even distribution of the site-phases representing the three population categories used—particularly, in the middle section of the plot. The greatest distinction is between the site-phases representing populations 150 to 500 individuals (green), located on the upper left hand section of the plot and a number of site-phases representing the population group of less than 150 individuals (red), positioned on the lower right section of the plot. There is thus a weak indication of a relationship between population size and social complexity, particularly, in relation to the population category of less than 150 individuals.

6.2.3 Multidimensional scaling analysis based on all variables, coded by population size

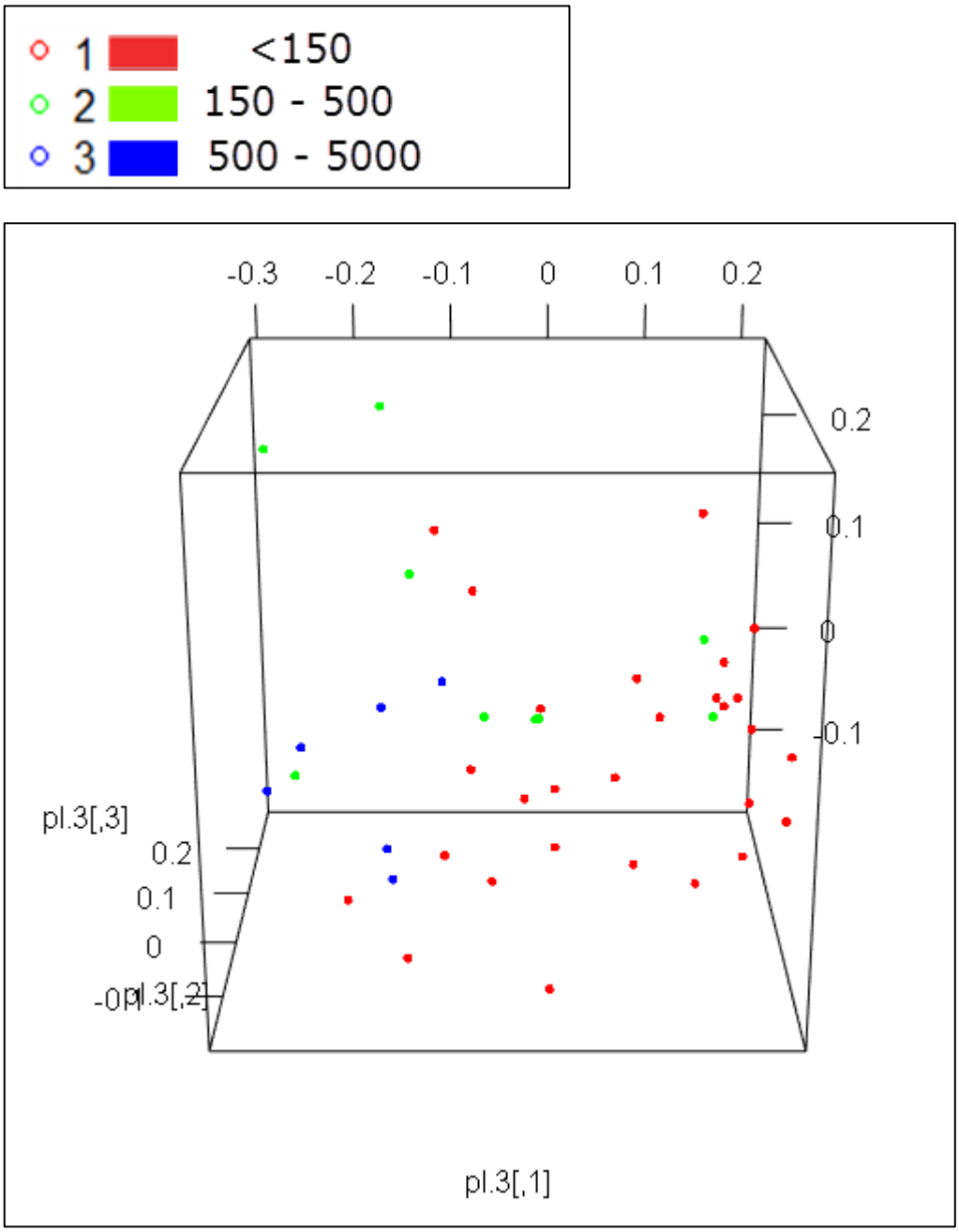


Figure 6:12: 3-d plot based on all variables for European archaeological site-phases, coded in terms of population size

Figure 6.12 presents the results of the MDS statistical analysis for the north-west European archaeological data relating to all variables (ritual activity, subsistence strategy and social complexity variables)—coded in terms of population size. For the most part, the site-phases with less than 150 individuals (red) are distributed in the middle to lower

right hand section of the plot. However, there are examples of site-phases representing this population category in the upper middle (two examples) and upper right hand sides (one example) of the plot. The site-phases representing the 150 to 500 population category (green) are dispersed across the plot with two examples located in the upper left hand side of the plot. The site-phases reflecting populations of 500 to 5,000 (blue) are located in the middle to left-hand side of the plot. In the centre of plot, we can see examples of site-phases reflecting each of the three population categories in close proximity to each other. This plot shows a relatively even distribution of the site-phases representing the three population categories. However, the result indicates that site-phases reflecting populations of less than 150 individuals share aspects of subsistence, ritual and social complexity that are causing them to be located in the middle to lower right hand section of the plot.

6.2.4 General MDS summary in relation to population size

Table 6.1 and Figure 6.13 show how population sizes relate to the north-west European archaeological site-phases. All the Early and Middle Mesolithic site-phases and virtually all Late Mesolithic site-phases reflect population categories of less than 150 individuals. While 58% of the Early Neolithic site-phases reflect population sizes of less the 150 individuals, 21% of the site-phases represent larger population sizes of 150 to 500 individuals and population sizes of 500 to 5,000 respectively. The Middle Neolithic site-phases represent each of the three population categories; with 60% of the site-phases reflecting population sizes of less the 150 individuals, 30% of the site-phase reflecting population sizes of 150 to 500 individuals and 10% of the site-phase representing population sizes of 500 to 5,000. Of the late Neolithic site-phases, 33% represent population sizes of 150 to 500 individuals and 67% of the late Neolithic site-phase represents population sizes of 500 to 5,000.

The MDS statistical analysis based on the social complexity variables results in the least separation of the three population categories. The MDS analysis based on the ritual

variables resulted in partial clustering of site-phases with populations of less than 150 individuals, but most of the site-phases representing the three population categories were evenly distributed throughout the plot. The population categories show the greatest separation when analysed based on the subsistence variables—with: (1) the site-phases with less than 150 individuals located in the middle to lower right hand section of the plot; (2) The population group of 150 to 500 individuals mostly positioned in the upper left-hand section of the plot; and (3) the population group of 500 to 5,000 individuals located in the left section of the plot. The results in relation to the subsistence practices are suggestive of a relationship between population size and subsistence strategy, in the context of the north-western European archaeological sample.

To examine comprehensively the relationship between population dynamics and aspects of ritual activity, subsistence practices and social complexity a much larger sample size would be needed (especially incorporating site-phases with populations representing the two larger population categories). Table 6.2 shows the population sizes for the eHRAF cultures and the archaeological site-phases. For the most part, we can observe that the imagistic, Epipalaeolithic, and the European Mesolithic site-phases reflect population groups of less than 150 individuals. On the other hand, the doctrinal, Pre pottery Neolithic, Pottery Neolithic and north-west European Neolithic site-phases are represented in all, relatively evenly in relation to the three population categories.

Table 6:1: Summary of north-west European cultural sub-phases, in terms of population size; showing the percentages and numbers for each category

Phase	% in Population Group <150	No.	% in Population Group 150-500	No.	% in Population Group 500-5,000	No.
Early Mesolithic	100	2	0	0	0	0
Middle Mesolithic	100	2	0	0	0	0
Late Mesolithic	91	10	9	1	0	0
Early Neolithic	58	8	21	3	21	4
Middle Neolithic	60	6	30	3	10	1
Late Neolithic	0	0	33	1	67	3

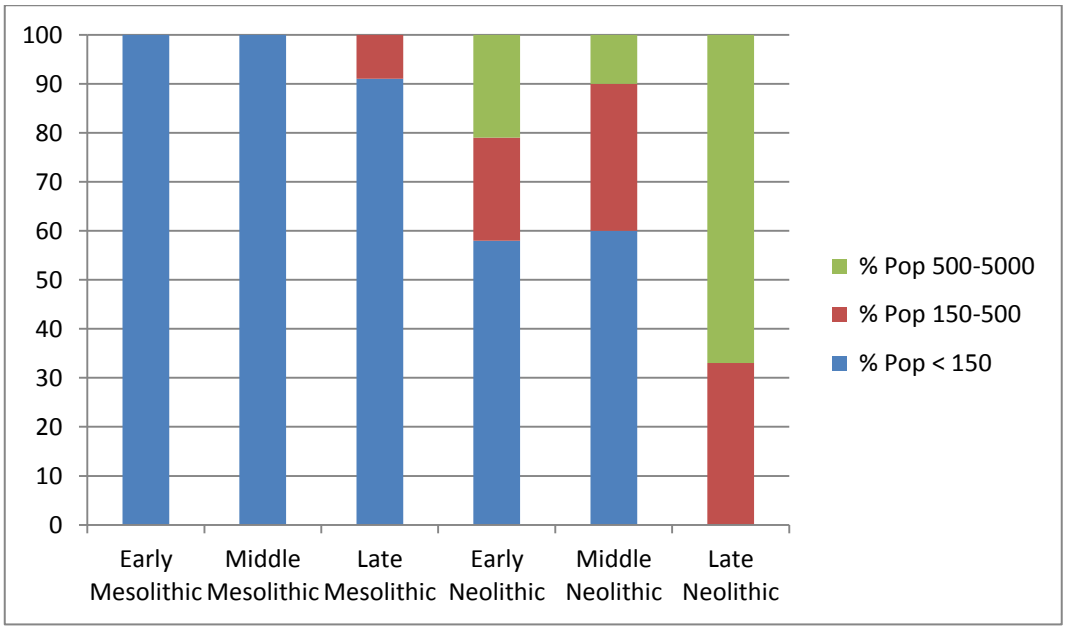


Figure 6:13: Percentage of each phase represented in each population group, the number of site-phases in each percentage category are shown in table 6.1

Table 6:2: Percentage of each archaeological phase or eHRAF culture represented in each population group

Sample	Phase/Mode	% in Population Group <150	% in Population Group 150-500	% in Population Group 500-5,000
eHRAF	Imagistic	73	13	13
	Doctrinal	37	37	26
South-west Asia	Epipalaeolithic	100	0	0
	Pre Pottery Neo	36	41	22
	Pottery Neo	57	28	14
North-western Europe	Mesolithic	93	7	0
	Neolithic	52	26	22

6.3 Principal Component Analysis

As described in Chapter 3 (section 3.9.2), the application of PCA enables the extraction/identification of the dominant patterns in the matrix in terms of a complementary set of scores and loading plots (Esbensen and Geladi 1987; Ringner 2008). PCA yields a correlation circle (variable factor map) and an individual factor map. The correlation circle presents the five most important variables that account for the variance in the data set in relation to the first two principal components. The factor map enables the visualization of how individual site-phases group in relation to the five variables that account for the variance in the dataset. To achieve a comprehensive result, PCA was performed for the ritual, subsistence and social complexity variables, as well as, a combination of all variables recorded.

In Chapter 4 and 5 PCA was used to identify the five most important variables that account for the variance in the eHRAF and south-west Asian archaeological datasets (for the ritual, subsistence social complexity variables, as well as the entire set of variables recorded). The associated factor maps showed how the identified variables cause the eHRAF cultures and south-west Asian site-phases to group in relation to the first two principal components. For the eHRAF cultures, the greatest separation between the imagistic and doctrinal cultures was achieved when PCA was performed based on the combination of all variables, and the greatest degree of overlap when analysed based on the social complexity variables. For the south-west Asian site-phases, the Epipalaeolithic and Neolithic (PPNA-PN) site-phases demonstrated the greatest statistical separation when PCA analysis was performed based on the subsistence variables, and PCA based on the identified ritual variables resulted in the highest degree of overlap.

6.3.1 Principal component analysis (PCA) based on the ritual variables

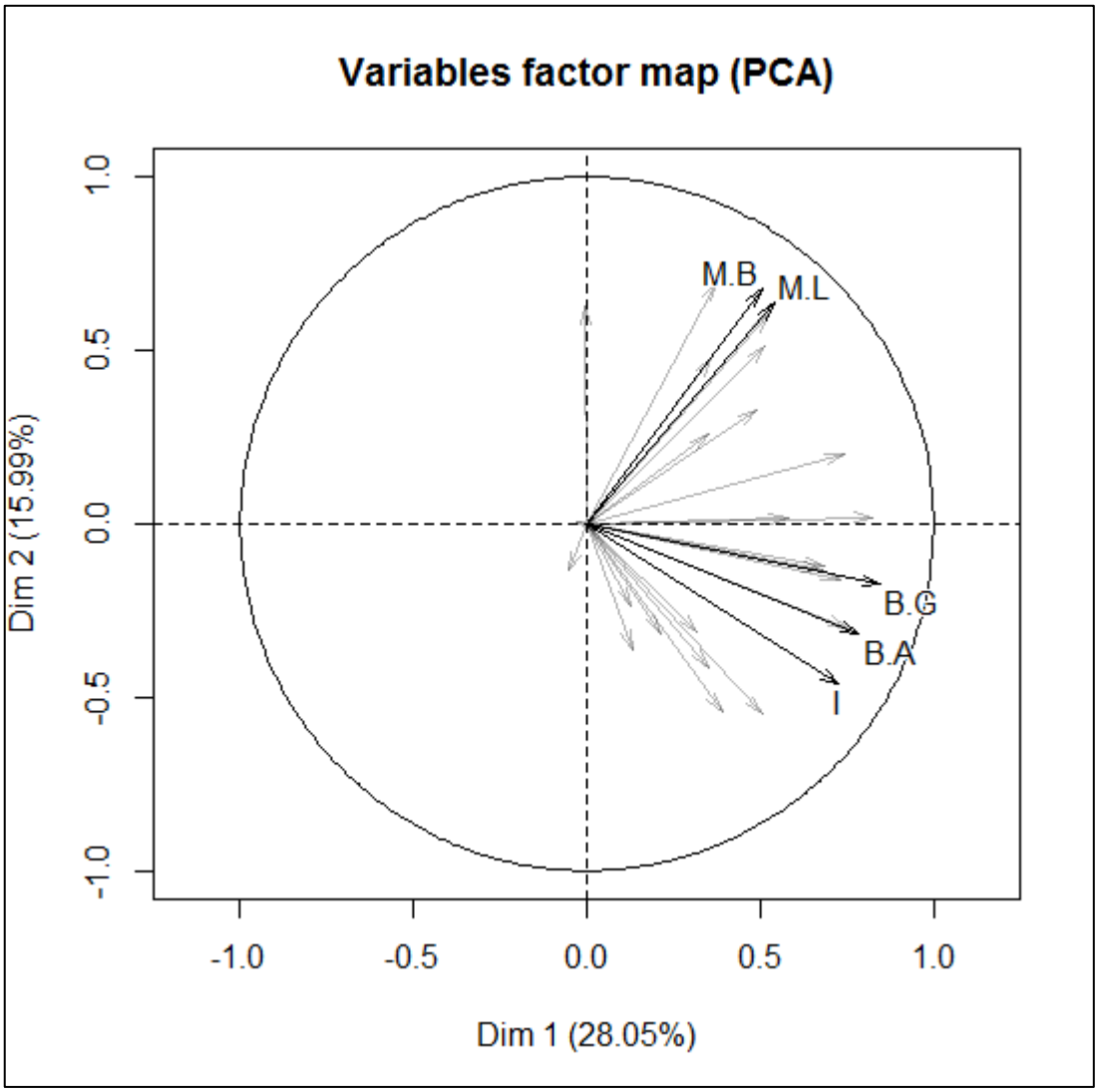


Figure 6:14: Correlation graph showing the first five variables that account for most of the variance in the north-west European dataset based on the ritual variables: Burial Goods (BG), Burial Associated with Animals (BA), Inhumation (I), Monuments in the landscape (ML) and Monumental Burials (MB).

Figure 6.14 presents the correlation circle received following the PCA based on the ritual variables for the north-west European site-phases. The correlation circle shows the five most important variables that account for the variance in the data set in relation to the first two principal components. The variables are represented as vectors from the centre. The length of the vector gives an indication of how much each variable can be constructed from the first two principal components and the cosine of the angle between any pair of variables is a measure of the correlation or co-occurrence. The first variable extracted via the PCA is burial goods (BG), recorded in terms of absence or presence in the database,

as are all of the variables considered in this section. The result suggests that the presence of burial goods in burials accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is burials associated with animals (BA). The third variable extracted by the PCA is inhumation (I). The fourth variable extracted by the PCA is monuments in the landscape (ML). The fifth variable extracted by the PCA is monumental burials (MB). Following the PCA, we can assert that these five variables are responsible for variance observed in the dataset when the database is analysed based on the ritual variables.

On the correlation circle, the variables are (to varying degrees) positively correlated, with angles less than 90^0 between any pair of these variables. However, the variables can be considered in terms of two identifiable (highly positively correlated) sets of variable: (1) monumental burials and monuments in the landscape; and (2) burial goods (BG), burials associated with animal (BA) and inhumation (I). An acute angle (angle less than 20^0) between the monumental burials and monuments in the landscape variables suggests that the cosine of the angle would be close to 1(r close to 1). This result indicates that these two variables are highly positively correlated. However, an element of autocorrelation in relation to these two variables must be acknowledged as, although you can have monuments in the landscape without monumental burials, it is impossible to have monumental burials without monuments in the landscape; thus, it is expected that the monumental burials and monuments in the landscape variables are highly correlated. To further examine the correlation between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between them. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the monumental burial (M.B) and the monuments in the landscape (M.L) variables, the correlation was estimated to be 0.7607572 with 95% confidence bounds (0.5789, 0.8587). Thus, the PPMCC clearly

demonstrates that these variables are highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 1.028* 10^ (-8)]; thus the null hypothesis that the monumental burial and the monuments in the landscape variables are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between these two variables.

The vectors representing the burial goods, burials associated with animal and inhumation variables reflect a positively correlated set of variables, with acute angles between the vectors of any pair of these variables. The monuments in the landscape variable is positive but weakly correlated with the burial goods, burials associated with animal and inhumation variables. The monumental burials variable is, also, weakly correlated with the burial goods, burials associated with animal and inhumation variables; with the angle between the vectors of these variables being less than 90^0. The correlation circle demonstrates that the largest angle is between the monumental burials variable and the inhumation variables respectively. As this angle is close to 90^0 (r close to 0), we can assert that in a substantial number of cases, there is very little co-occurrence between the presence of inhumations and monumental burials, in the dataset analysed.

From the correlation circle we can state that:

1. the variables are positively correlated, to varying degrees;
2. monumental burials are, as expected, significantly highly positively correlated with monuments in the landscape;
3. burial goods, burials associated with animal (e.g., inclusion of animal bone) and inhumation are highly positively correlated;
4. monuments in the landscape are weakly correlated with burial goods, burials associated with animal and inhumation;

5. monumental burials are weakly correlated with burial goods and burials associated with animal; and
6. monumental burials are very weakly correlated with inhumation

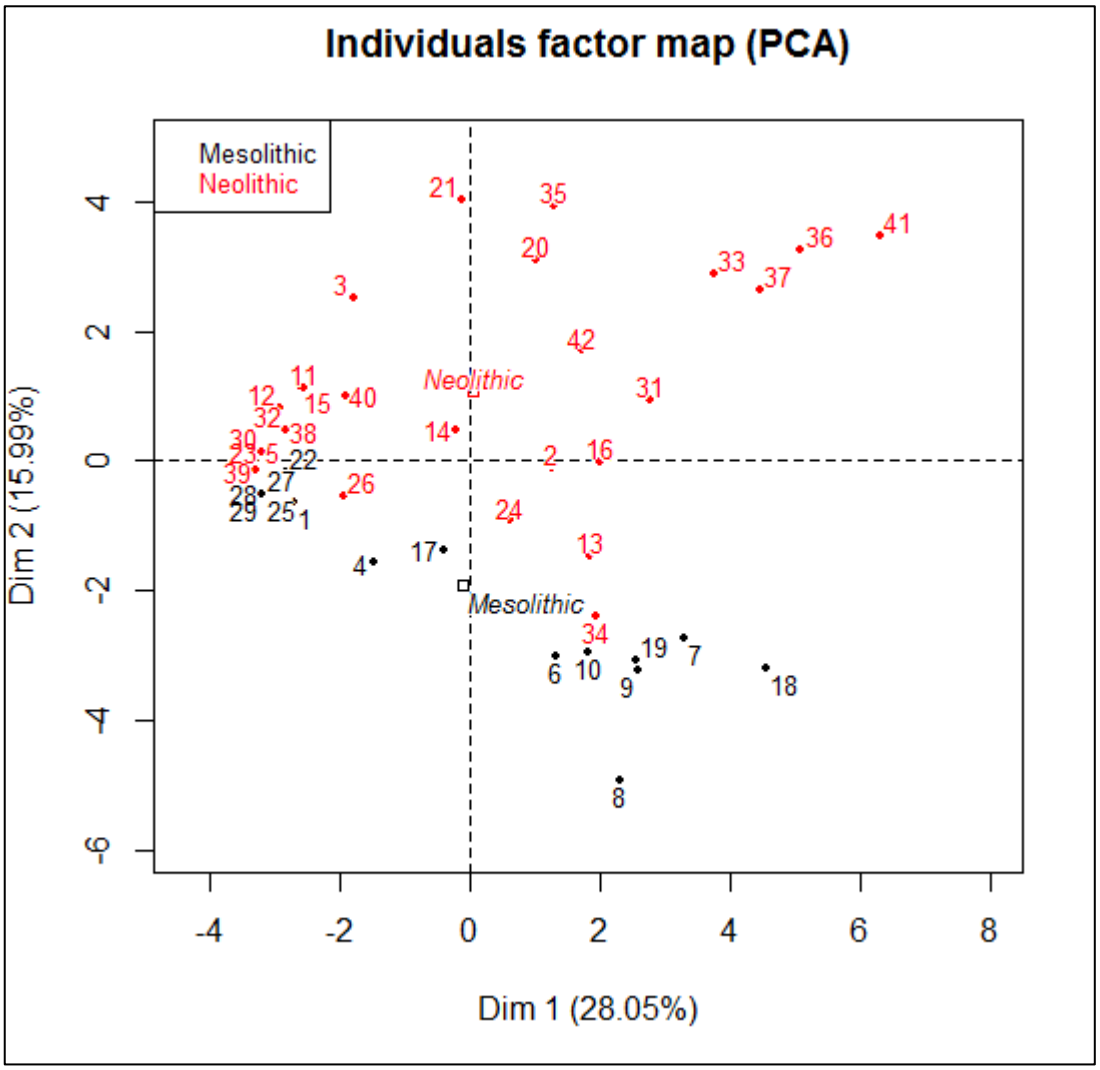


Figure 6:15: Individual factor map showing site-phases based on the ritual variables following PCA analysis, with Neolithic site-phases in red and the Mesolithic site-phases in black, and the statistical centre of each cluster represented by a square.

Figure 6.15 presents the site-phases plotted on an individual PCA factor map. The factor map shows how the five variables cause the site-phases to group and separate in relation to the first two principal components following PCA based on the ritual variables. The factor map shows that the Mesolithic site-phases are mostly located in the lower section of the factor map and the Neolithic site-phase in the upper section. As in the MDS analysis based on the ritual variables, the greatest separation is between the Middle

Neolithic Brú Na Bóinne Complex (Newgrange) (site-phase no. 41) and Late Mesolithic Tågerup (site-phase no. 8). The distance is based upon specific aspects of ritual material culture identified. For instance, Middle Neolithic Brú Na Bóinne Complex provides us with archaeological evidence of ritual activity including monumental architecture and monumental burials. Middle Neolithic Brú Na Bóinne Complex was identified as an outlier in the MDS plots based on the ritual variables (section 6.1.1). Whereas, Tågerup is a late Mesolithic site-phase which yields archaeological evidence of inhumation burials and burials associated with animals but has no evidence of megalithic monuments (Ahlström 2003; Karsten and Knarrstrum 2003; Andersson *et al*. 2004; Regnell 2012; Sørensen, *et al*. 2013).

In the lower section of the plot we are seeing a number of Mesolithic site-phases group; this includes Late Mesolithic Stranvägen (site-phase no. 6), Middle Mesolithic Tågerup (site-phase no. 7), Late Mesolithic Vedbaek (site-phase no. 9), Middle Mesolithic Vedbaek (site-phase no. 10) and Late Mesolithic Skateholm I (site-phase no. 19). These site-phases provide us with similar ritual material culture which includes inhumations, examples of grave goods, burials associated with animals and no evidence of megalithic monuments (Albrethsen and Petersen 1977; Larsson 1981b; 1982a; 1984b; I984c; 1985a; 1985b; 1988c; 1989c; 1993; 2002; 2004; 2007; 2008; 2010; Price and Petersen 1987; Petersen 1989; Meiklejohn and Wymann 1993; Johansen 1998; Carlsson, Kaliff and Larsson 1999; Ahlström 2003; Karsten and Knarrstrum 2003; Stutz 2003 ; Andersson *et al*. 2004; Carlsson 2005; 2007; 2008; Carlsson, Gruber and Molin 2005; Midgley 2005; Regnell 2012; Sørensen, *et al*. 2013). The Neolithic site-phase located closest to the Mesolithic centre is Late Neolithic Lough Gur (site-phase no. 34). This Late Neolithic site-phase provides us with archaeological evidence of inhumations, grave goods and burials associated with animals but no evidence of monumental architecture (French 1892; Windle 1913; O Ríordáin; 1947; 1949; 1950; 1951; 1954; 1955; Mitchell 1954; Liversage 1958; O'Kelly and O'Kelly 1981; Cleary; 1980; 1982; 1984; Grogan *et al.*

1987; Twohig 1993; Ó Nualláin 1996; Ahlberg *et al.* 2001; Doyle *et al.* 2001; Cooney 2007).

We can observe a degree of closeness between the Mesolithic and the Neolithic site-phases in the left hand section of the factor map. This group includes Late Mesolithic Bjørnsholm (site-phase no. 1), Late Mesolithic Clowanstown 1 (site-phase no. 22), Early Neolithic Ballynagilly (site-phase no. 30) and Early Neolithic Ballintaggart (site-phase no. 39). The identified Mesolithic site-phases have yielded no evidence of inhumations, grave goods, burials associated with animals or monuments (Andersen 1990; 1991; Andersen and Johansen 1990; Bratlund 1991; Enghoff 1991; Rasmussen 1991; FitzGerald 2007; Mossop and Ruddle 2008; Clancy 2009; Mossop and Mossop 2009; Whitehouse *et al.* 2010; McClatchie *et al.* 2012). Similarly, Early Neolithic Ballynagilly (site-phase no. 30) and Ballintaggart (site-phase no. 39) have yielded no archaeological evidence of special burial treatment or megalithic monuments in the landscape (Pilcher 1968: 1972; ApSimon 1969; 1971; 1976; Chapple *et al*. 2007; Chapple 2008a; 2008b; Chapple *et al*. 2009; Whitehouse *et al.* 2010; McClatchie *et al.* 2012). Early Neolithic Ballynagilly (site-phase no. 30) and Early Neolithic Ballintaggart (site-phase no. 39) were identified as reflecting overlap in the MDS plot based on the ritual variables (sections 6.1.1). The PCA results parallel the MDS analysis by revealing similar examples of separation and overlap based on ritual material culture.

6.3.1 Principal component analysis (PCA) based on the subsistence variables

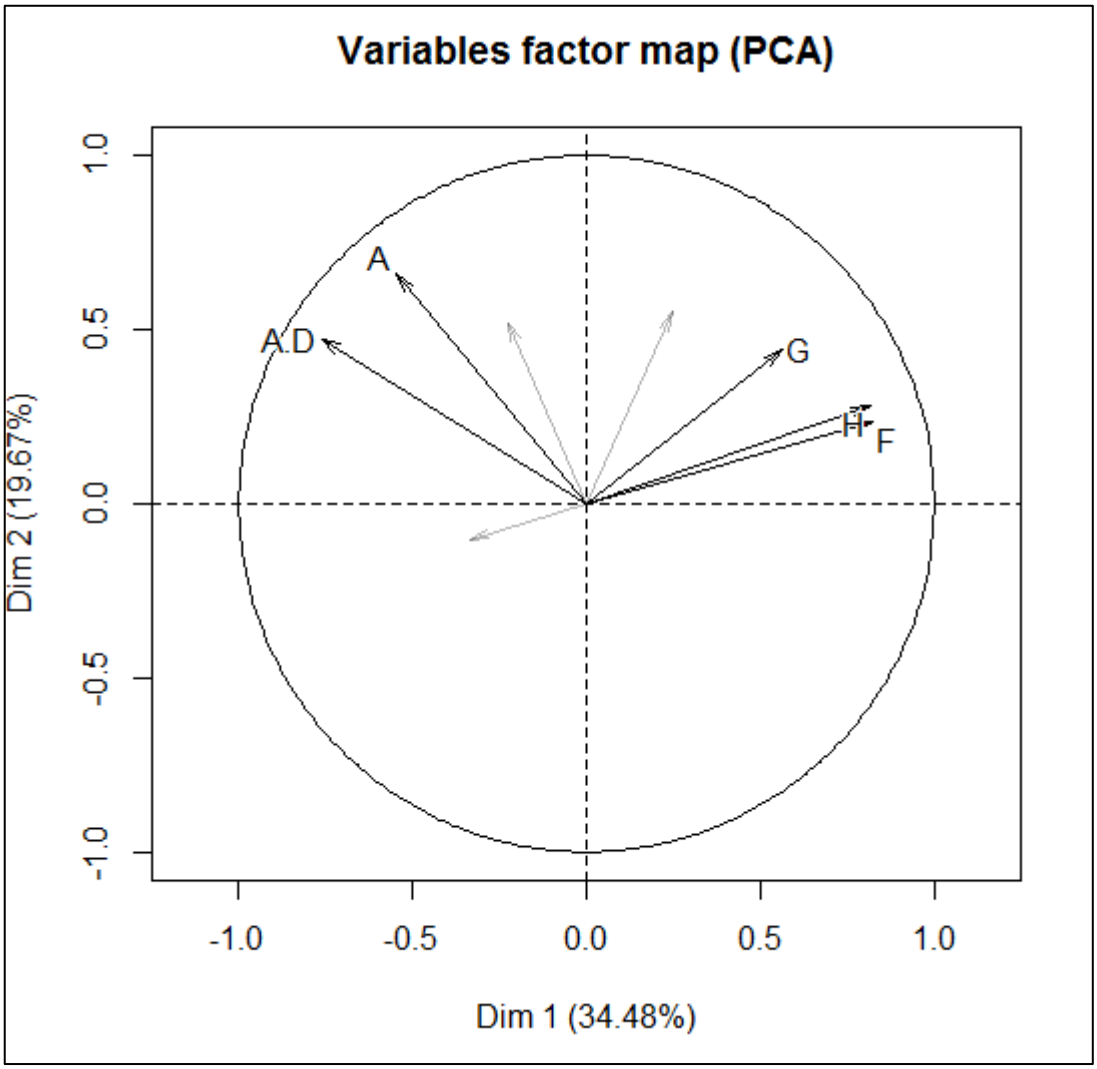


Figure 6:16: Correlation graph showing the first five variables that account for most of the variance in the north-west European dataset based on the subsistence variables: Hunting (H), Fishing (F), Agriculture (A), Gathering (G) and Animal Domestication (AD).

Figure 6.16 presents the correlation circle received following PCA based on the subsistence variables. The correlation circle shows the first five variables that account for most of the variance in the data set in relation to the first two principal components. The first variable extracted via the PCA is hunting (H); which is recorded in terms of absence or presence on the database, as are all of the variables considered in this section. The result suggests that the use of hunting as a subsistence strategy accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is fishing (F). The third variable extracted by the PCA is agriculture (A). The fourth variable extracted by the PCA is animal domestication (A.D). The fifth variable extracted

by the PCA is gathering (G). Following the PCA we can assert that these five variables are responsible for the variance observed in the data set in relation to the first two principal components when we analyse the database based on the recorded subsistence variables.

The correlation circle demonstrates clearly two sets of highly correlated variables: (1) agriculture and domesticated animals; and (2) gathering, hunting and fishing. The agriculture and domesticated animals variables are highly positively correlated; as an acute angle (angle less than 20^0) between these two variables suggests that the cosine of the angle is close to 1(r close to 1). This result demonstrates that a number of site-phases that indicate agriculture, also have archaeological evidence of the presence of domesticated animals. Similarly, the gathering, hunting and fishing variables are highly positively correlated with an acute angle (r close to 1) between any pair of these variables indicating a high degree of co-occurrence in the site-phases analysed. An acute angle (angle less than 20^0) between the hunting and gathering variables indicates they are decidedly positively correlated. Similarly, the fishing and gathering variables are highly positively correlated. The hunting and fishing variables are, almost, superimposed indicating a high level of co-occurrence in the dataset. To further examine the correlation between these variables, I calculated the Pearson product-moment correlation coefficient (PPMCC) between variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the hunting and fishing variables, the correlation was estimated to be 0.738949 with 95% confidence bounds (0.5319, 0.8265), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 1.71* 10^ (-8)]; thus the null hypothesis that the hunting and fishing variables are uncorrelated was

overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables.

Over all, the results suggest that in a significant number of site-phases from the north-west European archaeological dataset, hunting fishing and gathering co-occur in a joint food procurement strategy. The correlation circle shows an angle just less than 90^0 between the gathering and the agriculture variables. This result allows us to assert that these variables are weakly correlated; indicating that, in a substantial number of cases, there is very little co-occurrence between these variables. The correlation circle shows an obtuse angles (> 90◦) between the gathering and domesticated animals variables. This result allows us to assert that these variables are negatively correlated (r close to -1); indicating that, in the dataset analysed, there is no co-occurrence between the presences of these variables. Similarly, the correlation circle shows obtuse angles (> 90◦) between the hunting and fishing and variables and the agriculture and domesticated animals variables. This result allows us to assert that these variables are negatively correlated (r close to -1); indicating that, in the dataset analysed, there is no co-occurrence between the presences of these sets of variables. In this regard we can state that, from the sample analysed, cultures engaged in gathering rarely engage in agriculture or have domestic animals. Similarly, cultures engaged hunting and fishing do not engage in agriculture or have fully domesticated animals—and vice versa.

From the correlation circle we can state that:

1. hunting and fishing are significantly positively correlated;
2. hunting and gathering are highly positively correlated;
3. hunting, gathering and fishing are significantly positively correlated;
4. agriculture and fully domesticated animals are highly positively correlated;
5. hunting is weakly correlated with agriculture;

6. hunting is negatively correlated with the presence of fully domesticated animals; and
7. fishing and gathering are negatively correlated with agriculture and the presence of fully domesticated animals.

The factor map confirms that the Mesolithic and the Neolithic cultures can, largely, be identified by the five identified subsistence variables. This result appears to confirm, what are often suggested, as the important factors in the divergence between Mesolithic and Neolithic cultures (Zvelebil and Dolukhanov 1991; Bogucki and Grygiel, 1993; Whittle 1996; 2007; Bentley *et al*. 2003; Bradley 2003; Gkiasta *et al*. 2003; Richards 2003; Bar-Yosef 2004; Rowley-Conwy 2004; Bellwood 2005; Cooney 2007; Thomas 2007). Unsurprisingly, the results highlight a separation between hunting, gathering and fishing, on the one hand, and agriculture with domesticated crops and animals, on the other. The distinction between the Mesolithic and Neolithic site-phases based on subsistence practices was, to a degree, an expected result in the context of the Neolithic transition. However, this result confirms two important aspects: (1) it demonstrates that the statistical techniques employed can differentiate between the site-phases based on this *known* change in subsistence practices used to define Mesolithic and Neolithic site-phases respectively; and (2) it shows that the separation/difference between the cultural phases is based on this distinction between hunter-gatherers versus agriculturalists. Although this is not a unique discovery of the analysis, it is a very important finding in the context of the thesis.

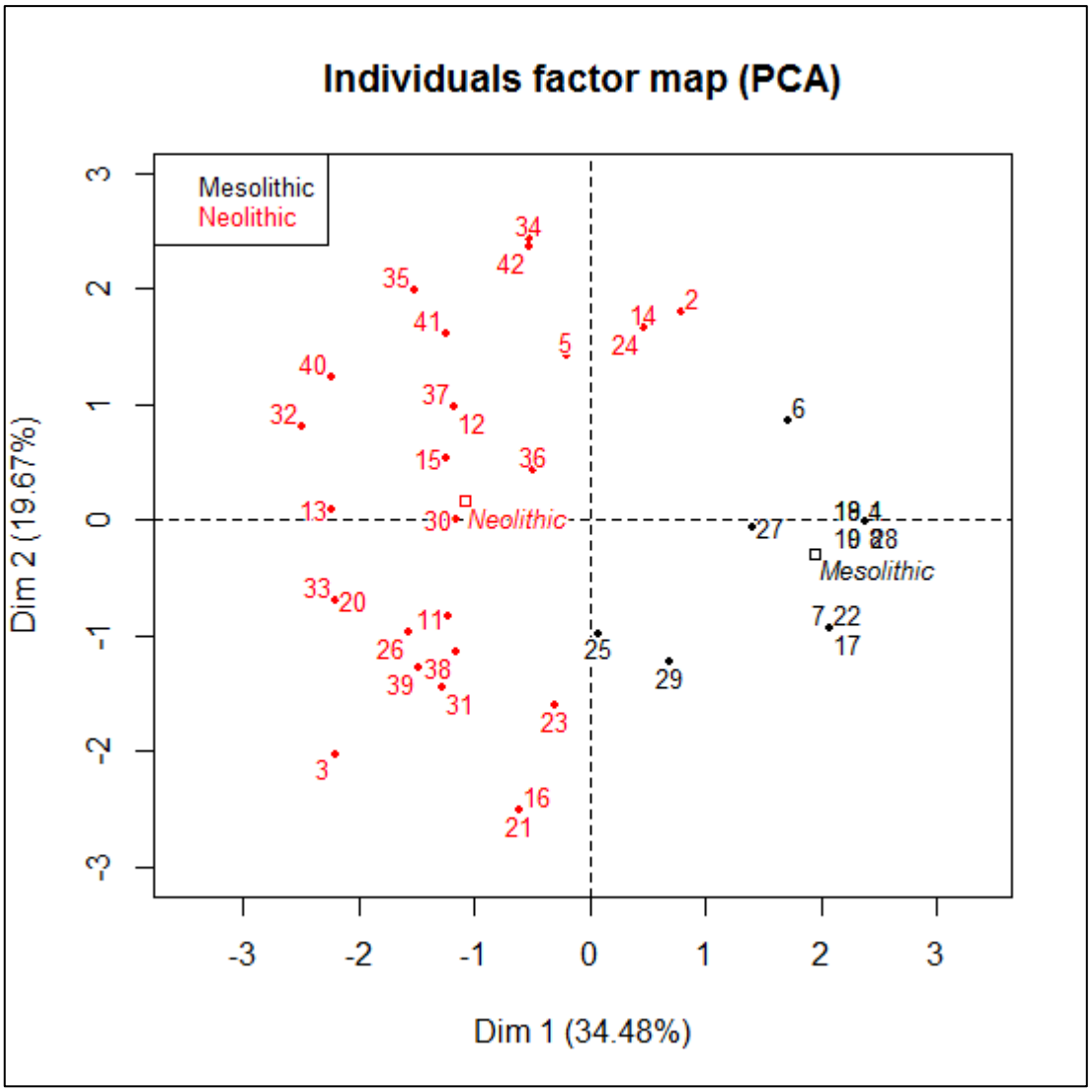


Figure 6:17: Individual factor map showing site-phases based on the subsistence variables following PCA analysis, with Neolithic site-phases in red and the Mesolithic site-phases in black, and the statistical centre of each cluster represented by a square

Figure 6.17 presents the site-phases plotted on a PCA individual factor map. The Mesolithic (black) site-phases group on the right-hand side around the Mesolithic centre and Neolithic site-phases (red) group on the left around the Neolithic centre; although, they are more dispersed than the Mesolithic site-phases. A number of the Mesolithic site-phases are superimposed upon each other—indicating a degree of homogeneity or shared subsistence strategy between these site-phases. There are no examples of Mesolithic site-phases close to the Neolithic centre and vice versa. Similar to the MDS analysis using the subsistence variables, Late Mesolithic Gortore (site no. 25) offers us the best example of a Mesolithic site-phase that is located closest (of the Mesolithic site-phases) to the

Neolithic site-phases. This is occurring as this site-phase provides us with evidence of gathering and food storage but no evidence of hunting of fishing (O'Donoghue 2010a; 2010b; Whitehouse *et al.* 2010; McClatchie *et al.* 2012). Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) offers us the best example of a Neolithic site-phase that is located closest (of the Neolithic site-phases) to the Mesolithic site-phases. This Early Neolithic phase of Clowanstown 1 produced no evidence of permanent settlement agriculture or domesticated animals (Mossop and Mossop 2009)—which is responsible for its location in relation to the Mesolithic site-phases. Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) and Late Mesolithic Gortore (site no. 25) were identified as representing site-phases in close proximity in the MDS plot based on the subsistence variables (sections 6.1.2). The factor map confirms that the Mesolithic and the Neolithic site-phases can, largely, be distinguished by the five identified subsistence variables. The PCA results parallel the MDS analysis by revealing similar examples of separation and overlap based on the subsistence evidence recorded.

6.3.2 Principal component analysis (PCA) based on the social complexity variables

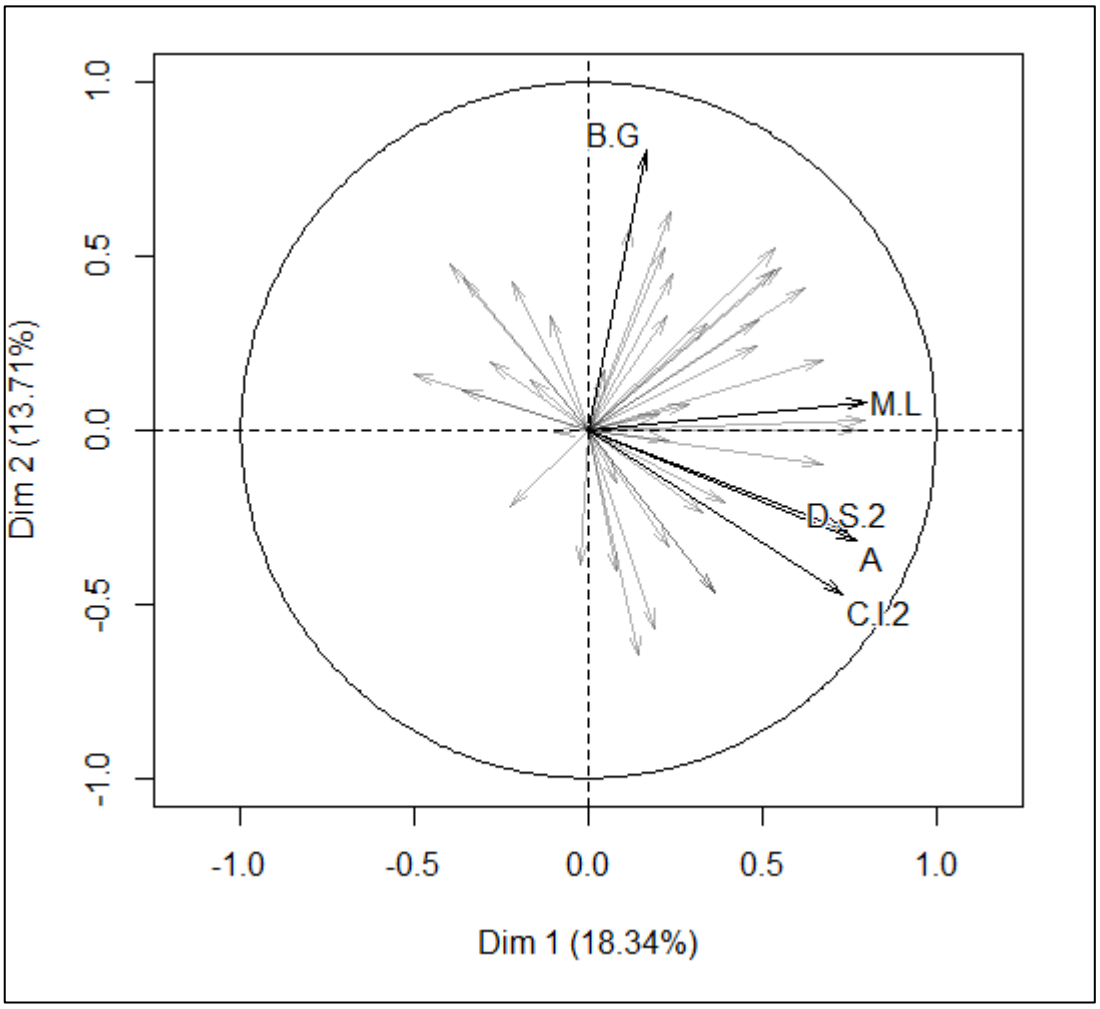


Figure 6:18: Correlation graph showing the first five variables that account for most of the variance in the north-west European dataset based on the social complexity variables: Crop Intensity at 2 (C.I.2), Monuments in Landscape (M.L), Degree of sedentism at 2 (D.S.2), Burial Goods (B.G) and Agriculture (A)

Figure 6.18 presents the correlation circle received following the PCA based on the social complexity variables. The correlation circle shows the first five variables that account for most of the variance in the data set in relation to the first two principal components. The first variable extracted by the PCA is crop intensity at level 2 (CI.2); crop intensity is measured on a Likert scale from 0 to 2 (0 = no evidence of cultivation, 1 = cultivation of non-staples and 2 = intensive cultivation/agriculture with domesticated staples). The result suggests that high crop intensity accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA is monuments in landscape (ML), which is recorded in terms of absence or presence on the database. The

third variable extracted by the PCA is degree of sedentism at 2 (D.S.2); measured on a Likert scale from 0 to 2 (0 = no sedentism, 1 = some sedentism, 2= fully sedentary communities). The fourth variable extracted by the PCA is burial goods (BG), which is recorded in terms of absence or presence in the database. The fifth variable extracted by the PCA is agriculture (A), which is recorded in terms of absence or presence on the database. Following the PCA we can assert that these five variables are responsible for the variance observed in the data set in relation to the first two principal components when we analyse the database based on the social complexity variables.

The correlation circle shows obtuse angles (> 90◦) between (1) the burial goods variable; and (2) the agriculture, crop intensity at 2 and degree of sedentism at 2 variables respectively. As the angle is greater than 90^0 between the burial goods variable and any of the other three variables, we can assert that these variables are negatively correlated (r close to -1); this indicates that there is no co-occurrence between the burial goods variable and the agriculture, crop intensity at 2 and degree of sedentism at 2 variables, in the dataset analysed. However, it should be noted that there are examples of Neolithic sites in north-western Europe where burial good have been used by groups engaged in agriculture—examples include Neolithic Knowth (Eogan 1968; Eogan 1974; Eogan 1968a; 1968b; Eogan, 1993; Eogan, 1994; Roche 1989; Eogan and Grogan 1991; Fenwick 1995; Eogan and Roche 1997a; 1997b) and the Early Neolithic phase at Dragsholm (Brinch Petersen 1973; 1974; 1979; Tauber 1981a; 1981b; Larsson 1991; Koch 1998; Persson 1998; Fischer 2002; Price *et al.* 2007). The burial goods and the monuments in landscape variables are weakly positively correlated; with an angle slightly less than 90^0. This result indicates that there is little co-occurrence between these variables, in the sample analysed. The four variables agriculture, crop intensity at 2, monuments in landscape and degree of sedentism at 2 are positively correlated. An acute angle (between any pair of these four variables indicates that the cosine of the angle

would be close to 1(r close to 1). This result demonstrates that, at a number of the recorded site-phases, these variables co-occur.

The variables agriculture and degree of sedentism at 2 are highly positively correlated. An acute angle (angle less than 10^0) between these two variables indicates that at almost all of site-phases where we find archaeological evidence of agriculture we have evidence for fully sedentary groups. Additionally, the Pearson product-moment correlation coefficient (PPMCC) between these variables was calculated. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For the degree of sedentism at 2 and agriculture variables, the correlation was estimated to be 0.8366476 with 95% confidence bounds (0.5575, 0.8502), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 2.677* 10^ (-8)]; thus the null hypothesis that the degree of sedentism at 2 (D.S.2) and agriculture (A) are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables; indicating that at a substantial number of sites where we find archaeological evidence of agriculture we have evidence for a high intensity use of crops.

From the correlation circle we can state that:

1. the degree of sedentism at 2 and agriculture 2 are significantly correlated;
2. the degree of sedentism at 2 is highly positively correlated with agriculture and crop intensity at 2;
3. the presence of monuments in landscape is positively correlated with agriculture, crop intensity at 2 and the degree of sedentism at 2;

4. the use of burial goods is negatively correlated with the agriculture, crop intensity at 2 and the degree of sedentism at 2; and
5. the presence of monuments in landscape is weakly correlated with the use of burial goods

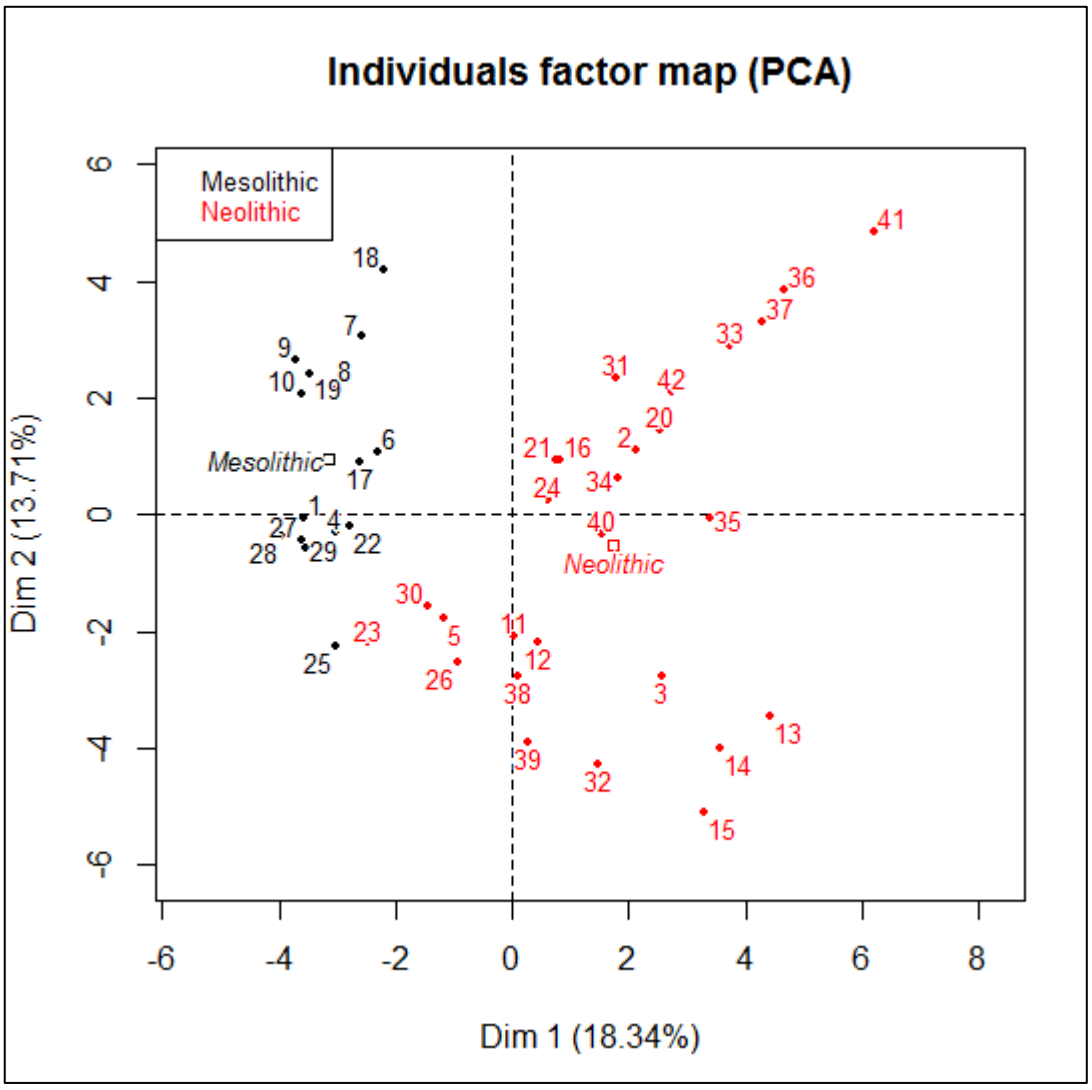


Figure 6:19: Individual factor map showing site-phases based on the social complexity variables following PCA analysis, with Neolithic site-phases in red and the Mesolithic site-phases in black, and the statistical centre of each cluster represented by a square

Figure 6.19 presents the site-phases plotted on a PCA individual factor map. On the factor map, the Mesolithic site-phases are located in the left section and the Neolithic site-phases are mainly located on the right of the factor map. Similarly to the PCA based on the ritual variables, Middle Neolithic Brú Na Bóinne Complex (Newgrange) (site-phase no. 41) provides us with an example of an extreme case. The distance from it to the

Mesolithic site-phases in the PCA matrix is based upon aspects of social complexity such as the presence of monumental architecture.

On Figure 6.19, there are no Mesolithic site-phases close to the Neolithic centre or Neolithic site-phases close to the Mesolithic centre. However, we can observe a number of Neolithic and Mesolithic site-phases close to each other, in the lower middle to left section of the factor map; with the closest sites being Late Mesolithic Gortore (site-phase no.25), Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) and Early Neolithic Ballynagilly (site no. 30). Gortore provides us with evidence of gathering and food storage but no evidence or hunting of fishing. Early Neolithic Clowanstown 1 (F17/F22) offers us no evidence of permanent settlement agriculture or domesticated animals. Although Ballynagilly offers us evidence of forest clearance and agriculture, this Early Neolithic site-phase, also, offers us no evidence of a long term storage strategy. The Early Neolithic site-phases of Clowanstown 1 (F17/F22) and Ballynagilly provide us with no archaeological evidence of burial goods or megalithic monuments. Therefore, we can see how the identified social complexity variables are causing a number of the Mesolithic and Neolithic site-phases to be located in close proximity. The factor map confirms that the Mesolithic and the Neolithic site-phases can, largely, be distinguished by the five identified social complexity variables. The PCA results parallel the MDS analysis (section 6.1.3) by revealing similar examples of separation and overlap based on the social complexity variables recorded.

6.3.3 Principal component analysis (PCA) based on all variables

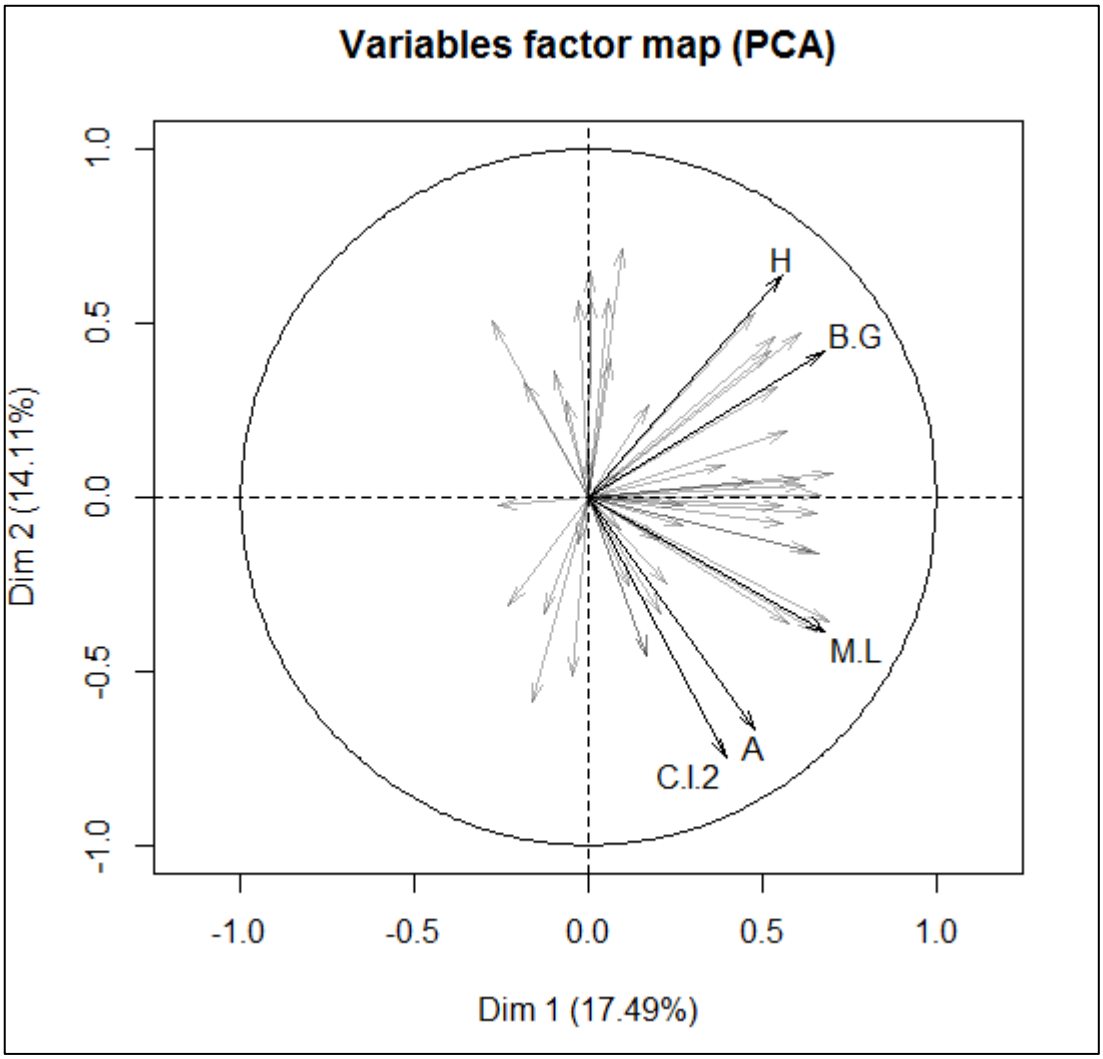


Figure 6:20: Correlation graph showing the first five variables that account for most of the variance in the north-west European dataset based on all variables: Burial Goods (BG), Hunting (H), Crop Intensity at 2 (CI.2), Agriculture (A) and Monuments in the Landscape (ML),

Figure 6.20 presents the correlation circle received following the PCA based on all variables. The first variable extracted via the PCA is crop intensity at level 2 (CI.2). The result suggests that high level crop intensity accounts for the maximal amount of total variance of the observed variables. The second variable extracted by the PCA, is hunting (H) which is recorded in terms of absence or presence on the database, as are the remaining three variables identified. The third variable extracted by the PCA is the presence of monuments in the landscape (ML). The fourth variable extracted by the PCA is agriculture (A). The fifth variable extracted by the PCA is burial goods (BG).

Following the PCA we can assert that these five variables are responsible for the variance observed in the data set in relation to the first two principal components when we analyse the database using the identified variables following PCA based on all the recorded variables (ritual, subsistence and social complexity variables).

On the correlation circle, the vectors for the variables burial goods and hunting are far from the centre. An acute angle (angle less than 20^0) between these two variables suggests that the cosine of the angle would be close to 1 (r close to 1). This result indicates that the burial goods and hunting variables are highly positively correlated. Similarly, the variables crop intensity at level 2 and agriculture form an acute angle (angle less than 20^0). This acute angle enables us to assert that these variables are highly positively correlated; showing a high level of co-occurrence. However, autocorrelation in relation to these two variables must be acknowledged in this instance; although you can have agriculture without it being of high intensity, it is impossible to have high intensity crop usage without agriculture. To further examine the relationship between these variables I calculated the Pearson product-moment correlation coefficient (PPMCC) between these two variables. PPMCC measures the linear correlation between two variables by giving a value between +1 and −1 inclusive, where 1 represents a completely positive correlation, 0 is no correlation, and −1 represents a completely negative correlation. For these two variables, the correlation was estimated to be 0.7339528 with 95% confidence bounds (0.7428, 0.9192), showing that these variables are extremely highly correlated. A formal test of the null hypothesis that the correlation was zero gave a p-value of 0.0000 (zero to 4 places of decimals) [p-value of 6.528* 10^ (-8)]; thus the null hypothesis that the crop intensity at 2 (C.I.2) and agriculture (A) variables are uncorrelated was overwhelmingly rejected. This result shows that there is clearly a significant co-occurrence between the two variables and indicates that at a substantial number of the site-phases analysed we have evidence of high intensity agriculture.

The presence of monuments in the landscape is positively correlated with the agriculture and high crop intensity variables. This received positive correlation result suggests that at a number of site-phases there is a co-occurrence between engaging in high intensity crop cultivation and the presence of monuments in the landscape. Hunting and the presence of monuments in the landscape are positive but weakly correlated—with the angle close to 90^0; indicating a low level of co-occurrence.

The burial goods and the presence of monuments in the landscape variables are positively but weakly correlated. Given this result we can assert that in the sample, there is a very limited degree of co-occurrence between these variables in the site-phases recorded. The burial goods and the agriculture variables are weakly correlated. An angle of almost 90^0 between the burial goods and the agriculture variables demonstrates that there is little correlation between these variables, in the site-phases sampled. An angle of greater than 90^0 between burial goods and the crop intensity at 2 variables indicates that these variables are negatively correlated (r close to -1); there is no co-occurrence between these variables. Obtuse angles (> 90◦) between the hunting variable and the crop intensity at 2 and the agriculture variables respectively indicates that these variables are negatively correlated (r close to -1). Given this result we can assert that in the sample analysed, there is no co-occurrence between these variables—cultures engaged in hunting do not engage in intensive agriculture as a food procurement strategy.

From the correlation circle we can state that:

1. burial goods and hunting are highly positively correlated;
2. agriculture and high crop intensity are significantly positively correlated;
3. agriculture and high crop intensity are positively correlated with the presence of monuments in the landscape;
4. hunting is weakly correlated with the presence of monuments in the landscape;

5. burial goods is positive but weakly correlated with the presence of monuments in the landscape;
6. burial goods is highly weakly correlated with agriculture;
7. burial goods is not correlated with high crop intensity; and
8. hunting is negatively correlated agriculture and high crop intensity

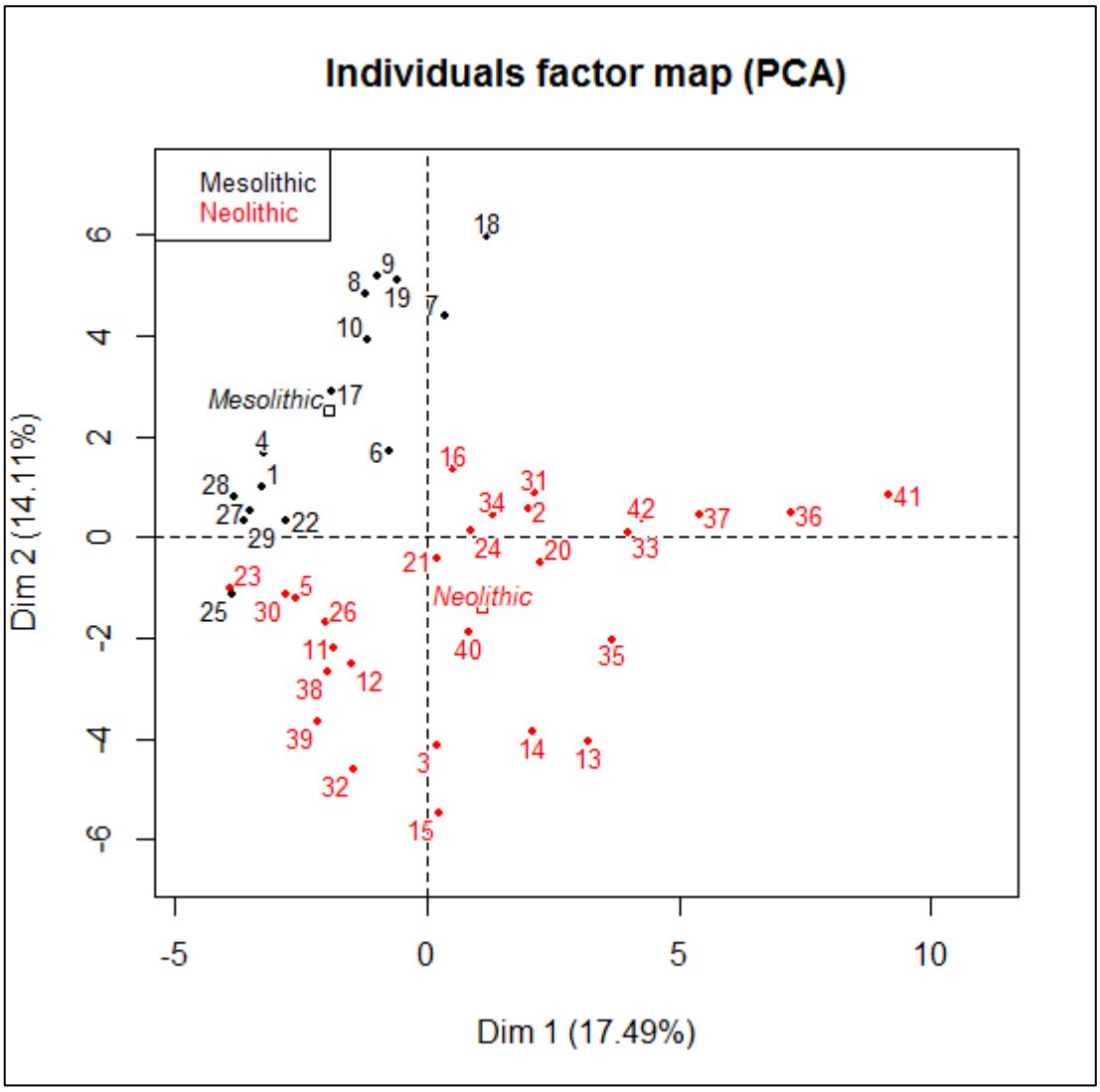


Figure 6:21: Individual factor map showing site-phases based on all variables following PCA analysis, with Neolithic site-phases in red and the Mesolithic site-phases in black, and the statistical centre of each cluster represented by a square

Figure 6.21 presents the site-phases plotted on a PCA factor map. The Neolithic and Mesolithic site-phases form two relatively distinctive groups on the factor map; with the Mesolithic (black) clustering on the upper left-hand side around the Mesolithic centre and

Neolithic cultures (red) grouping on the lower left to middle of the plot; with a number of site-phases located close to the Neolithic centre. Similarly to the PCA based on the ritual and social complexity variables, Middle Neolithic Brú Na Bóinne Complex (Newgrange) (site-phase no. 41) provides us with an example of an extreme case. The distance from it to the Mesolithic site-phases in the PCA matrix is based on social complexity evidence as this site-phase reflects a fully sedentary community, with a subsistence strategy centring on domesticated crops, domesticated animals and food storage with ritual activity including the presence of monumental architecture and an associated and a set of burial practices Thus, we can assert that material culture indicative of agriculture and ritual activity focused on monumental architecture is responsible for the statistical distance between the Brú Na Bóinne Complex and the Mesolithic site-phases.

In fact, the more interesting site-phases are the Neolithic site-phases that group in close proximity to the Mesolithic site-phases, in the left section of the factor map. In this case the Neolithic site-phases which are grouping nearest the Mesolithic site-phases are Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23), Early Neolithic Norsminde (site-phase no. 5) and Early Neolithic Ballynagilly (site no. 30). It is asserted that aspects of identified subsistence strategy are, mainly, causing these Neolithic site-phases to be located in close proximity to the Mesolithic site-phases on the factor map. For instance, Early Neolithic Clowanstown 1 (F17/F22) offers us no evidence of agriculture or domesticated animals (Mossop and Mossop 2009). Early Neolithic Clowanstown 1 (F17/F22) (site-phase no. 23) was identified as a site-phase in close proximity to a number of Mesolithic site-phases in the MDS plot based on the combination of all the variables (sections 6.1.4). Early Neolithic Norsminde provides us with evidence of gathering and agriculture at a crop intensity level 1 (Andersen 1976; Andersen and Johansen 1987; Andersen 1989; Enghoff 1989; Laurie 2008; Brouwer 2009). Early Neolithic Ballynagilly provides us with evidence of gathering, agriculture at a crop intensity level 1 and no evidence of a long term storage strategy (Pilcher 1968: 1972;

ApSimon 1969; 1971; 1976; Chapple *et al*. 2007; Chapple 2008a; 2008b; Chapple et al. 2009; Whitehouse *et al.* 2010; McClatchie *et al.* 2012). Also, the identified Early Neolithic site-phases provide us with no evidence of monuments or megalithic architecture. Therefore, we can see how aspects of subsistence and ritual material culture are causing the identified Neolithic sites to be located in close proximity to a number of Mesolithic site-phases. The factor map confirms that the Mesolithic and the Neolithic cultures can, largely, be distinguished by the five identified variables resulting from analysis of all the variables recorded from the European site-phases. The PCA result parallels the MDS analysis by revealing similar examples of separation and overlap based on the material culture recorded.

6.3.4 General PCA summary

The PCA demonstrates that the Neolithic and Mesolithic site-phases show the clearest separation when analysed on the basis of subsistence variables only. The Neolithic and Mesolithic site-phases also show a high degree of separation when analysed based on the social complexity and a combination of all variables. The Neolithic and Mesolithic site-phases show the weakest separation when analysed on the basis of ritual variables. It should be noted that the subsistence variables account much of the identified variance in relation to the analysis of the social complexity and the combination of all the variables. The PCA of the north-west European data shows similar trends to the PCA of the south-west Asian site-phases: both sets of archaeological data show the greatest separation based on the subsistence variables, and the most overlap based on the ritual variables. The extent to which each set of variables identified via PCA of the archaeological site-phases can be employed to predict the mode of religiosity is examined in chapter 7.

Chapter 7: Problem-oriented analysis of ethnographic and archaeological data

7 Introduction

This chapter describes the predictor analysis and percentage probabilities generated using Generalised Linear Modelling (GLM). A total of four GLMs were performed of each of the three datasets. First, a GLM was performed based on the five ritual variables identified via PCA of each of the three datasets. Secondly, GLMs based on the five subsistence and social complexity variables extracted by PCA were carried out. Lastly, a GLM based on the variables identified by PCA following analysis of each of the three datasets in their entirety (ritual, subsistence and social complexity combined) was performed. As explained in Chapter 4, section 4.6.3.3, the GLMs used a binary matrix based on the *known* eHRAF cultures to: (1) identify which set of variables extracted by the PCA represent the best predictor of mode of religiosity, for both the *known* eHRAF and the *unknown* archaeological samples; and (2) to determine the percentage probability associated with the classification of each archaeological site-phase as imagistic or doctrinal. The GLMs were tested using receiver operator characteristic (ROC) curves. The ROC curves provide a method to assess the GLM's performance by (1) examining the false rate versus the true rate; (2) calculating the area under the ROC curve (AUC); and (3) calculating the percentage of cases classified correctly. The most *fit for purpose* models used to classify the *unknown* archaeological cases were additionally tested using half normal Q-Q plots, after the method described by Collett (2003) as explained in chapter 3 section 3.9.3.

7.1 Generalised linear models (GLM) and receiver operating characteristic (ROC) curves for the eHRAF cultures

7.1.1 ROC Curve for the GLM based on the PCA identified ritual variables

The five ritual variables accounting for the most variance in the eHRAF sample were identified by PCA (Chapter 4, section 4.3.1). The variables identified were: Secondary Burial Practices (SBP), Grave Disturbance (GD), Anthropomorphic Figurines (AF), Communal Ritual Structures (CRS) and Cemeteries (C). The ROC curve for the GLM based on the five PCA identified ritual variables for the ethnographic (eHRAF) cultures is shown in Figure 7.1.

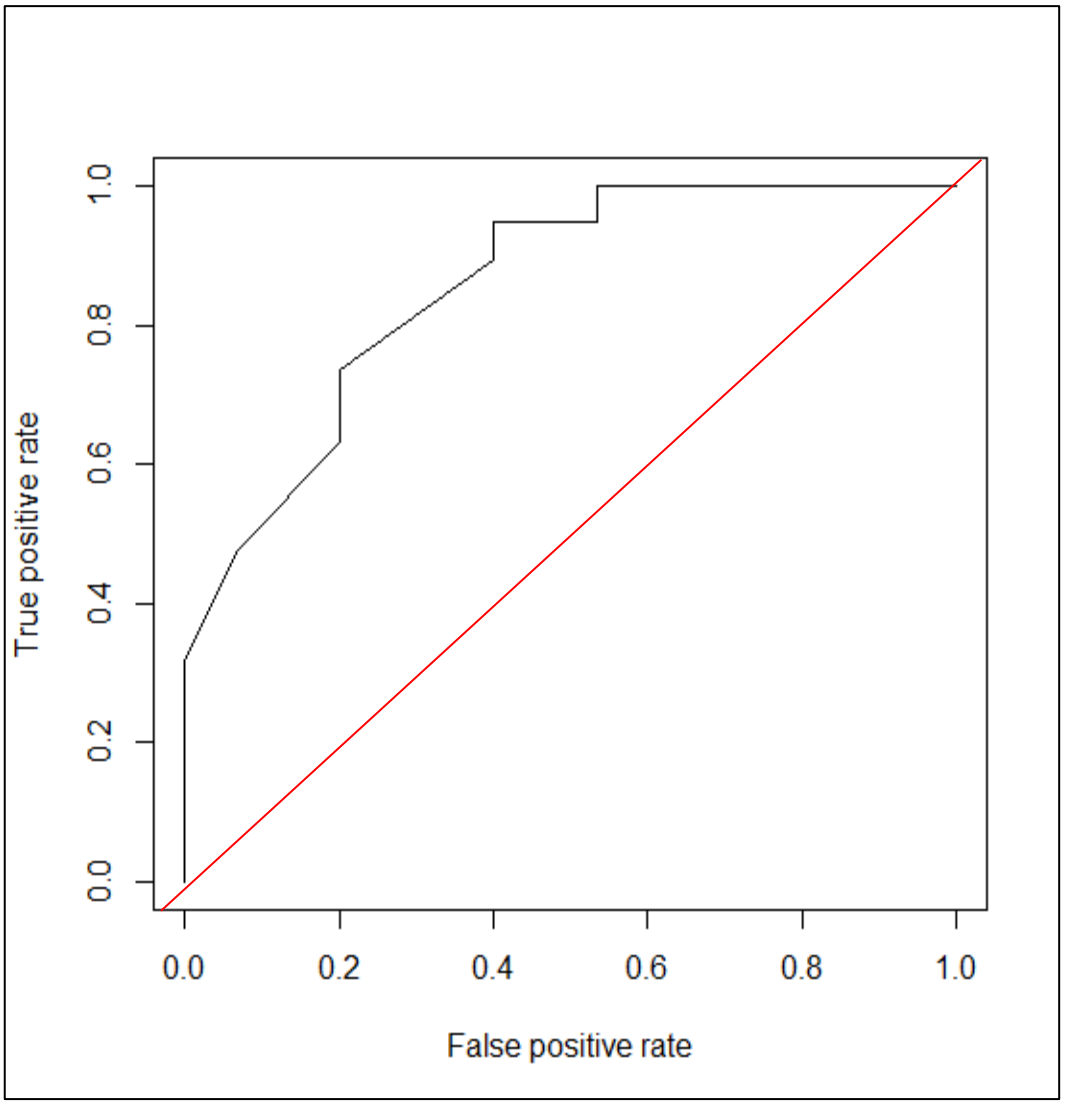


Figure 7:1: ROC curve for the GLM based on the ritual variables identified via PCA of the eHRAF cultures

From the ROC curve it can be observed that: (1) at a false positive of 0% the true positive rate is 32%; (2) at a false positive of 20 % the true positive rate is 75%; and (3) at a false positive of 55% the true positive rate is 100%. The red diagonal line (0, 0 to 1, 1) illustrates the ROC curve that would be generated following random classification of the cases by the GLM model. In Figure 7.1 it is apparent that the ROC curve generated is distanced from this diagonal line, indicating the GLM is generating far better results than a model producing random classifications. In other words, the true positive rate exceeds the false positive rate, meaning that, in the majority of cases, the GLM used the identified set of ritual variables to classify the ethnographic cultures correctly. The area under the

curve (AUC) for the ROC curve was calculated at 0.77; indicating that 77% of the *known* eHRAF cases were classified correctly, using the identified ritual variables. The ROC curve results demonstrate that the GLM used is *fit for purpose* for generating reliable predictions based on the ritual variables identified via the PCA of the eHRAF cultures.

7.1.2 ROC Curve for the GLM based on the PCA identified subsistence variables

The set of subsistence variables accounting for the most variance in the eHRAF data were identified by PCA (Chapter 4, section 4.3.2). The variables identified were: Hunting (H), Gathering (G), Crop intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS.3) and Agriculture (A). The ROC curve for the GLM based on the identified subsistence variables for the ethnographic (eHRAF) cultures is shown in Figure 7.2.

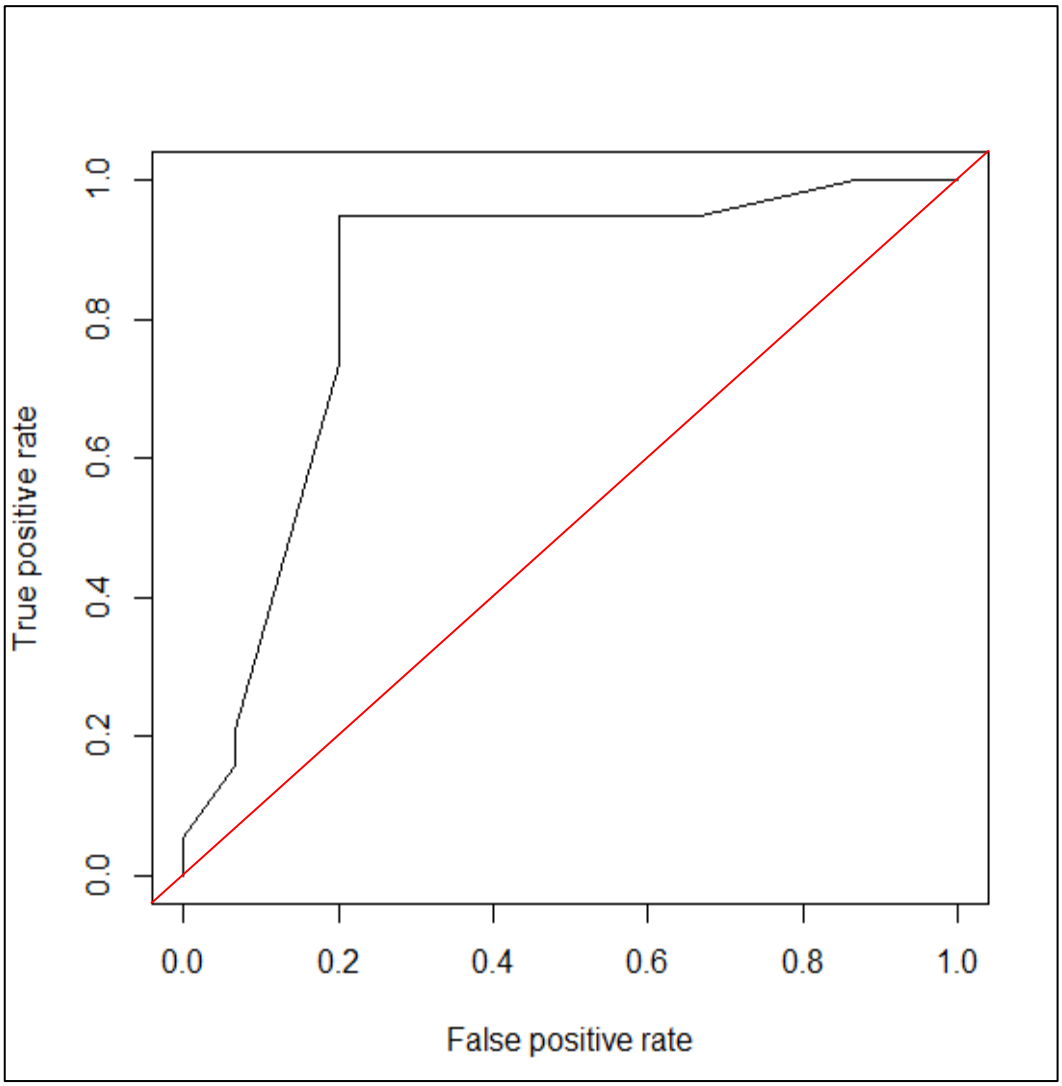


Figure 7:2: ROC curve for the GLM based on the subsistence variables identified via PCA of the eHRAF cultures

The ROC curve shows that: (1) at a false positive of 6% the true positive rate is 20%; and (2) at a false positive of 20% the true positive rate is 95%. In Figure 7.2, it is apparent that the curve is distanced from the diagonal line (illustrating the ROC curve that would be generated following the random classification of the cases by the GLM) and, therefore, that the GLM is superior to a random model. The true positive rate far exceeds the false positive rate. The area under the curve (AUC) for the ROC curve was calculated at 0.80, indicating that 80% of the *known* eHRAF cases were classified correctly, using the identified subsistence variables. The ROC curve results demonstrate that the GLM produced correct predictions based on the subsistence variables identified via the PCA

and represents a *fit for purpose* predictor model for classifying the *known* eHRAF cultures.

7.1.3 ROC Curve for the GLM based on the PCA identified the social complexity variables

The social complexity variables accounting for the variance in the eHRAF sample were identified via PCA (Chapter 4, section 4.3.3). The variables identified were: Degree of Sedentism at 2 (DS.2), Private Food Storage (PFS), Private Cooking (PC), Food Storage Strategy at 3 (FSS.3) and Resource Monopolization (RM). The ROC curve for the GLM based on the identified social complexity variables for the ethnographic (eHRAF) cultures is shown in Figure 7.3.

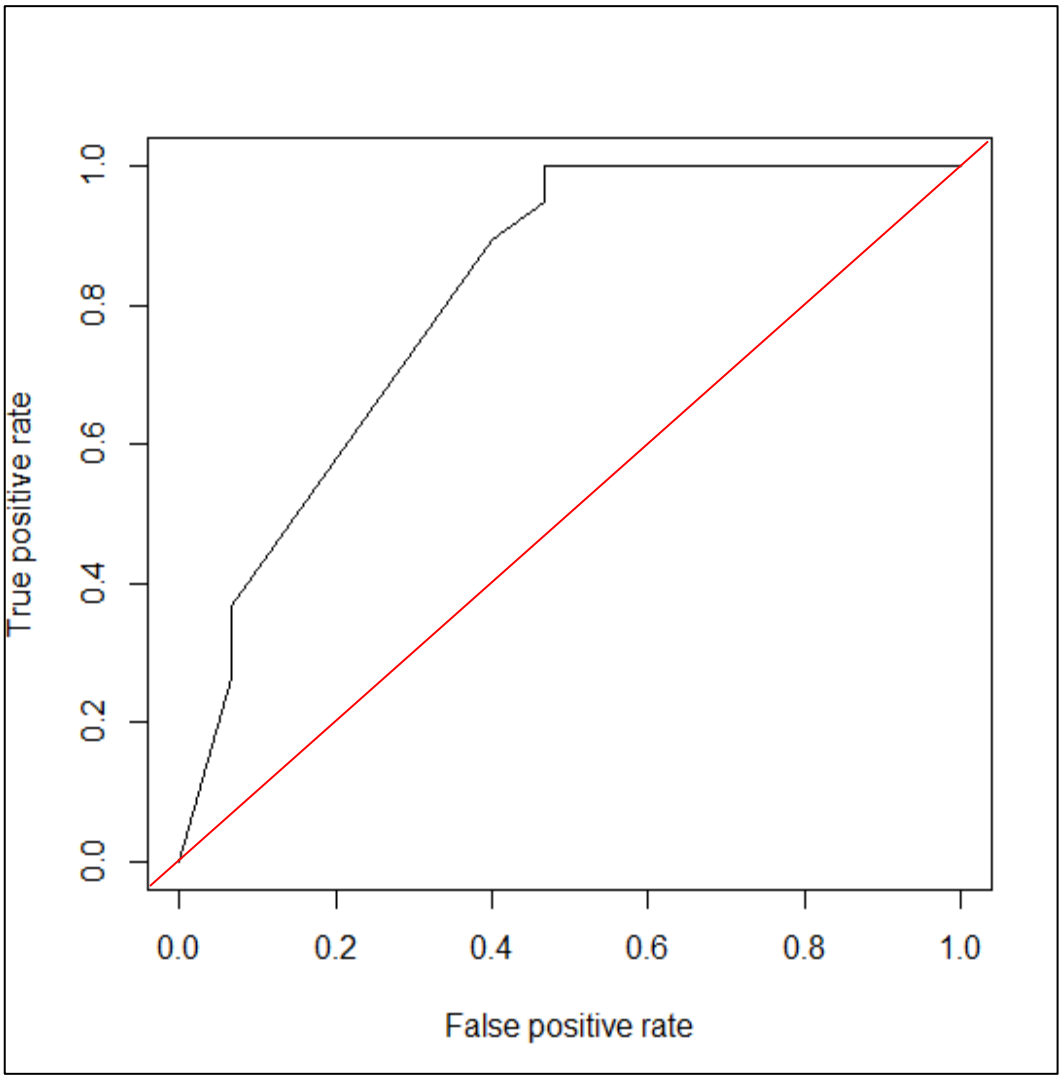


Figure 7:3: ROC curve for the GLM based on the social complexity variables identified via PCA of the eHRAF cultures

From the ROC curve it can be observed that: (1) at a false positive of 55% the true positive rate is 37%; (2) at a false positive of 32% the true positive rate is 77%; and (3) at a false positive of 46% the true positive rate is 100%. Thus, the true positive rate exceeds the false positive rate. The ROC curve is distanced from the diagonal line (in red) going from (0, 0 to 1, 1), indicating that the GLM utilised is superior to a model generating random classifications. The area under the curve (AUC) for the ROC curve was calculated at 0.77, indicating that 77% of the *known* eHRAF cases were classified correctly. The ROC curve results demonstrate that this GLM is *fit for purpose* for generating true predictions based on the social complexity variables identified via the PCA of the eHRAF cultures.

7.1.4 ROC Curve for the GLM based on the PCA identified variables following analysis of all variables

The variables accounting for the variance in the entire eHRAF sample (ritual, subsistence and social complexity combined) were identified via PCA (Chapter 4, section 4.3.4). The identified variables were: Agriculture (A), Crop intensity at 2 (CI.2), Food Storage Strategy at 3 (FSS. 3), Private Food Storage (PFS) and Degree of Sedentism at 2 (DS.2). The ROC curve for the GLM based on the identified variables received from the PCA of the eHRAF dataset, using all variables is shown in Figure 7.4.

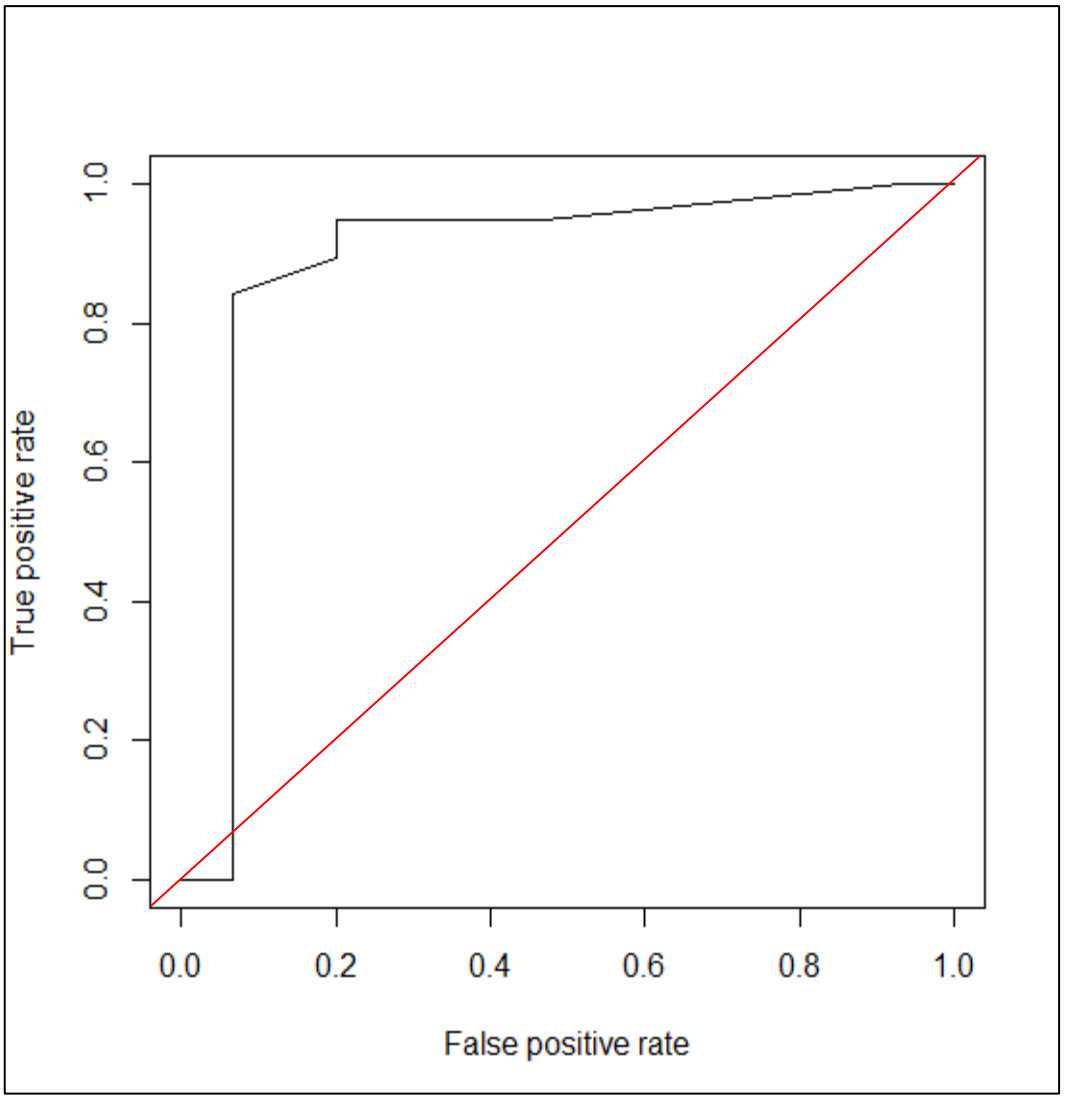


Figure 7:4: ROC curve for the GLM based on the variables identified via PCA of all variables, for the eHRAF cultures

From the ROC curve it can be observed that: (1) at a false positive of 8% the true positive rate is 84%; and (2) at a false positive of 20% the true positive rate is 90%. Thus, the true positive rate exceeds the false positive rate. In Figure 7.4, it is apparent that the curve is superior to a model producing random classifications. Testing of the GLM resulted in an ROC curve with an AUC of 0.82, indicating that 82% of the *known* eHRAF cases were correctly classified using the variables identified flowing analysis of the entire eHRAF dataset. This result demonstrates that this GLM represents a more *fit for purpose* model than using the PCA identified ritual or social complexity variables (both with an AUC of 0.77) and a marginally more *fit for purpose* than the GLM using only the subsistence variables (with an AUC of 0.80).

7.1.5 Comparing models

The ROC curves for the GLM based on the identified subsistence variables and the GLM based on the variables identified following PCA using all variables resulted in (1) a similar AUC; and (2) a shared a number of subsistence variables (Table 7.1).

GLM	AUC	Identified variables	Shared variables
based on PCA analysis of the subsistence variables	0.80	1. hunting 2. gathering 3. crop intensity at 2 4. food storage strategy at 3 5. agriculture	1. agriculture 2. crop intensity at 2 3. food storage strategy at 3
based on PCA analysis of all variables	0.82	1. agriculture 2. crop intensity at 2 3. food storage strategy at 3 4. private food storage 5. degree of sedentism at 2	

Table 7:1: showing AUC and shared subsistence variables for the two GLMs with the highest AUC's

To further examine the correlation between the two sets of variables, canonical correlation analysis was performed. Canonical correlation is an additional procedure for assessing the relationship between sets of variables. Canonical correlation analysis is used to identify and measure the associations among two sets of variables, making it possible to examine variability both within and between sets of variables. It identifies and measures the strength of association between two sets of variables, taking into account variability and correlation within each set. The correlation between the identified subsistence variables and the set of variables identified following PCA of the entire eHRAF dataset was calculated as 0.806, which is a very high correlation (as a perfect correlation would be 1.0). The result shows that the two sets of variables have 80% of variance in common. Following the canonical correlation analysis, it can be asserted that the two sets of variables are highly correlated as they contain much of the same information. However, the model based on the PCA analysis of the entire eHRAF dataset

produced a slightly better AUC (0.82), and so it is this model that will be used to assess the percentage probabilities associated with the classification the *known* eHRAF cases in terms of mode of religiosity (section 7.2.2).

7.1.6 Summary of the GLMs for the eHRAF cultures

It is apparent that mode of religiosity can be inferred reliably from different combinations of variables. While all four GLMs are considered *fit for purpose* models in terms of correctly distinguishing between *known* imagistic and doctrinal cultures, the ROC curve results show that the model based on the identified variables following analysis of the entire eHRAF dataset is the most successful, with 82% of cases correctly classified. It should be noted that this set of variables is dominated by subsistence variables, indicating that the subsistence variables are important for distinguishing between modes of religiosity in the *known* eHRAF sample (Table 7.1). The results from the ROC curves support assertions by Whitehouse (2004) and Atkinson and Whitehouse (2011) regarding potential connections between the modes of religiosity and subsistence practices and covariance among ritual variables and other socio-cultural variables in relation to the two modes of religiosity.

7.2 Percentage probability classification of eHRAF cultures

7.2.1 Percentage probability classification of eHRAF cultures based on the PCA identified ritual variables

As ritual activity is central to the modes of religiosity theory, a GLM using the five ritual variables identified using PCA was employed to assess the percentage probability that each *known* eHRAF culture was classified as an imagistic or doctrinal. This was undertaken to examine the classification of the *known* sample based on ritual information other than frequency and dysphoric arousal data. The GLM was tested using an ROC curve—which demonstrated that it was *fit for purpose* (Figure 7.1). The GLM generated a percentage probability classification for each culture (Table 7.2). The GLM yielded an output that presents:

1. the culture;
2. the original classification (after Atkinson and Whitehouse 2011);
3. the GLM classification (imagistic or doctrinal);
4. the percentage probability of the culture being a representative of the particular classifier mode of religiosity; and
5. the percent error given by the GLM

The percentage tolerance levels for GLM results are as follows: (1) a result of 40 to 59% is considered an indeterminate result as the culture cannot be considered positively as one of the two classifier cases (imagistic or doctrinal culture); (2) a result of 60% or above is considered a positive result as the culture has been classified as one of the two classifier cases with an acceptable percentage level; and (3) a result above 80% is considered a highly positive result as the culture has been classified as one of the two classifier cases with an high percentage probability (after McCullagh and Nelder 1989 Guisan *et al.* 2002). The output from the GLM (Table 7.2) presents the percentage probability that each individual eHRAF culture was classed as doctrinal or imagistic based on the ritual variable identified via PCA. In the majority of cases, the imagistic and doctrinal cultures were correctly classified: with 67% of imagistic cultures categorised correctly and 79% of doctrinal cultures classified correctly.

Table 7.2 shows that three of the imagistic cultures have been categorised as doctrinal with an uncertain percentage probabilities (between 40 and 59%, inclusive). The three cultures are the Wolof, Hausa and Ojibwa. The Hausa and Wolof cultures were identified as an overlapping culture when MDS and PCA were carried out using all variables (Chapter 4, sections 4.1.4 and 4.3.4). Two of the imagistic cultures were misclassified as doctrinal cultures with acceptable percentage probabilities (above 60%). The two cultures were the Lozi, and Dogon cultures. The Lozi and Dogon cultures were classified by the GLM with a 69% probability of reflecting doctrinal cultures (Table 7.2). The Lozi culture was identified as an overlapping culture when PCA was performed using the ritual

variables (Chapter 4, section and 4.3.1). The Dogon were identified as an overlapping case when MDS and PCA were performed based on the ritual variables and the combination of all variables (Chapter 4, sections 4.1.4 and 4.3.4). A number of the imagistic cultures were correctly classified with an extremely high percentage probability. For example, the Andaman culture was classed as having a 99% probability of being imagistic (Table 7.2). The Andaman culture was identified as an outlier or extreme case when MDS and PCA were performed for the ritual, subsistence, social complexity and combination of all variables (Chapter 4, sections 4.1 and 4.3). Three of the 19 doctrinal cultures were misclassified as imagistic cultures: the Ifugao, Seminole and the Trobriander islanders. The Ifugao and Seminole cultures were misclassified as imagistic cultures, with probabilities between 40% and 59% (an indeterminate result) (Table 7.2). The Trobrianders were misclassified with a 66% probability of reflecting an imagistic culture. The Trobrianders were identified as an overlapping culture when PCA was performed based on the ritual variables (Chapter 4, section 4.3.1). A number of the doctrinal cultures were correctly classified with particularly high percentage probabilities. For example, the Central Thai culture was classed as having a 99% probability of being a doctrinal culture. The Central Thai culture was identified as an outlier or extreme case when MDS and PCA were performed based on the ritual, subsistence, social complexity and combination of variables (Chapter 4, sections 4.1. and 4.3). The GLM output (Table 7.2) parallels the MDS and PCA results as a number of the outlier and overlapping cultures that were identified by MDS and PCA of the eHRAF were, also, identified with high percentage probabilities or misclassified by the GLM.

Table 7:2: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the ritual variables identified via PCA of eHRAF cases

eHRAF culture	Original mode classification #	GLM classification	Percentage probability	Percentage Error
Banyoro	Imagistic	Imagistic	68%	+/- 4.15%
Lozi	Imagistic	Doctrinal	69%	+/- 1.70%
Hausa	Imagistic	Indeterminate	58% doctrinal	+/- 1.72%
Dogon	Imagistic	Doctrinal	69%	+/- 1.70%
Tiv	Imagistic	Imagistic	99%	+/- 0.30%
Wolof	Imagistic	Indeterminate	59% Doctrinal	+/- 1.72%
Andamans	Imagistic	Imagistic	99%	+/- 0.30%
Eastern Toraja	Imagistic	Imagistic	65%	+/- 1.80%
Ojibwa	Imagistic	Indeterminate	58% Doctrinal	+/- 1.70%
Aranda	Imagistic	Imagistic	69%	+/- 3.47%
Kapauku	Imagistic	Imagistic	98%	+/- 1.92%
Jivaro	Imagistic	Imagistic	98%	+/- 1.92%
Tukano	Imagistic	Imagistic	98%	+/- 1.92%
Yanoama	Imagistic	Imagistic	98%	+/- 1.92%
Bororo	Imagistic	Imagistic	98%	+/- 1.92%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

Table 7.2: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the ritual variables identified via PCA of eHRAF cases (continued)

eHRAF culture	Original mode classification #	GLM classification	Percentage probability	Percentage Error
Somali	Doctrinal	Doctrinal	98%	+/- 1.92%
Lepcha	Doctrinal	Doctrinal	84%	+/- 3.50%
Korean	Doctrinal	Doctrinal	70%	+/- 1.70%
Iban	Doctrinal	Doctrinal	69%	+/- 1.72%
Ifugao	Doctrinal	Indeterminate	52% imagistic	+/- 3.08%
Central Thai	Doctrinal	Doctrinal	99%	+/- 0.30%
Bosnian Muslim	Doctrinal	Doctrinal	79%	+/- 1.72%
Palestinians	Doctrinal	Doctrinal	86%	+/- 1.72%
Iroquois	Doctrinal	Doctrinal	82%	+/- 1.77%
Seminole	Doctrinal	Indeterminate	54% Imagistic	+/- 3.16%
Pawnee	Doctrinal	Doctrinal	89%	+/- 2.28%
Croats	Doctrinal	Doctrinal	99%	+/- 0.30%
Hopi	Doctrinal	Doctrinal	98%	+/- 1.92%
Trobrianders	Doctrinal	Imagistic	66%	+/- 3.08%
Tikopia	Doctrinal	Doctrinal	60%	+/- 3.09%
Tongan	Doctrinal	Doctrinal	75%	+/- 1.80%
Saramaka	Doctrinal	Indeterminate	50%	+/- 3.18%
Aymara	Doctrinal	Doctrinal	75%	+/- 1.80%
Guaraní	Doctrinal	Doctrinal	75%	+/- 1.89%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

7.2.2 Percentage probability classification of eHRAF cultures based on the identified variables following PCA of all variables

A GLM using the set of five variables extracted via PCA based on all variables was identified as the most *fit for purpose* model (section 7.1.5). The GLM was tested using an ROC curve (Figure 7.4), which indicated that 82% of the *known* eHRAF cases were re-classified correctly. Therefore, this GLM was used to examine the extent of the correct classification for each of the *known* eHRAF cultures. The output from the GLM (Table 7.3) shows the percentage probability that the *known* individual eHRAF cultures were classed as doctrinal or imagistic, based on the identified variables. In the vast majority of cases, the imagistic and doctrinal cultures were correctly classified, with 87% of imagistic cultures categorised correctly and 86% of doctrinal cultures classified correctly. Table 7.3 shows that two of the imagistic cultures were classed as doctrinal with an uncertain probability (40% to 59%). The two misclassified cultures were the Wolof and the Hausa. The Hausa was identified as an imagistic culture that overlapped with a number of the doctrinal cultures following MDS and PCA based on the combination of all variables. Although classed as an imagistic culture, the Wolof was located in close proximity to the doctrinal cultures when MDS and PCA were carried-out using all variables (Chapter 4, sections 4.1.4 and 4.3.4). The Wolof and the Hausa cultures were classified with uncertainty when GLM was carried based on the ritual variables from the analysis of the eHRAF cultures (Table 7.3). One of the doctrinal cultures (Seminole) was misclassified as imagistic with an uncertain percentage probability (Table 7.3). The Seminole culture was classified as imagistic with uncertainty when GLM was performed based on the ritual variables from the PCA of the eHRAF cultures. Only one of the 19 doctrinal cultures was misclassified as an imagistic culture with a high percentage probability—the Guaraní with a 91% probability. The Guaraní culture was recorded as a doctrinal culture that clustered with a number of imagistic cultures when MDS was carried out using the subsistence variables and when PCA was undertaken using the subsistence and all variables (Chapter 4, sections 4.1.2, 4.3.2 and 4.3.4). The remainder of the cultures have

been classified correctly as doctrinal or imagistic [after Atkinson and Whitehouse (2011)].

The GLM and associated ROC curve results demonstrate that the religious mode of a culture can be predicted by a GLM based on a set of variables extracted via PCA of all the material correlate variables recorded from the *known* eHRAF cultures. The GLM output (Table 7.3) parallels the MDS and PCA results as a number of the outlier and overlapping cultures that were identified by MDS and PCA of the eHRAF cultures were, also, identified as such by this GLM.

Table 7:3: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on variables identified via PCA of all variables for the eHRAF cultures

eHRAF culture	**Original mode classification #**	**GLM classification**	**Percentage probability**	**Percentage Error**
Banyoro	Imagistic	Doctrinal	68%	+/- 4.81%
Lozi	Imagistic	Imagistic	60%	+/- 1.77%
Hausa	Imagistic	Indeterminate	54% Doctrinal	+/- 1.20%
Dogon	Imagistic	Imagistic	67%	+/- 1.77%
Tiv	Imagistic	Imagistic	90%	+/- 1.77%
Wolof	Imagistic	Indeterminate	53% Doctrinal	+/- 1.20%
Andamans	Imagistic	Imagistic	97%	+/- 1.91%
Eastern Toraja	Imagistic	Imagistic	90%	+/- 1.77%
Ojibwa	Imagistic	Imagistic	90%	+/- 1.74%
Aranda	Imagistic	Imagistic	96%	+/- 1.91%
Kapauku	Imagistic	Imagistic	73%	+/- 3.82%
Jivaro	Imagistic	Imagistic	90%	+/- 1.31%
Tukano	Imagistic	Imagistic	90%	+/- 1.33%
Yanoama	Imagistic	Imagistic	90%	+/- 2.92%
Bororo	Imagistic	Imagistic	90%	+/- 1.31%

 # Original Mode Classification after (Atkinson and Whitehouse 2011)

Table 7.3: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on variables identified via PCA of all variables for the eHRAF cultures (continued)

eHRAF culture	Original mode classification #	GLM classification	Percentage probability	Percentage Error
Somali	Doctrinal	Doctrinal	90%	+/- 4.81%
Lepcha	Doctrinal	Doctrinal	73%	+/- 1.20%
Korean	Doctrinal	Doctrinal	88%	+/- 1.20%
Iban	Doctrinal	Doctrinal	88%	+/- 1.20%
Ifugao	Doctrinal	Doctrinal	96%	+/- 1.20%
Central Thai	Doctrinal	Doctrinal	99%	+/- 0.31%
Bosnian Muslim	Doctrinal	Doctrinal	98%	+/- 1.20%
Palestinians	Doctrinal	Doctrinal	88%	+/- 1.20%
Iroquois	Doctrinal	Doctrinal	70%	+/- 1.20%
Seminole	Doctrinal	Indeterminate	53% Imagistic	+/- 2.66%
Pawnee	Doctrinal	Doctrinal	87%	+/- 2.20%
Croats	Doctrinal	Doctrinal	98%	+/- 1.20%
Hopi	Doctrinal	Doctrinal	88%	+/- 2.20%
Trobrianders	Doctrinal	Doctrinal	89%	+/- 4.81%
Tikopia	Doctrinal	Doctrinal	90%	+/- 4.31%
Tongan	Doctrinal	Doctrinal	73%	+/- 3.86%
Saramaka	Doctrinal	Doctrinal	87%	+/- 2.20%
Aymara	Doctrinal	Doctrinal	88%	+/- 1.20%
Guaraní	Doctrinal	Imagistic	91%	+/- 1.31%

 # Original Mode Classification after (Atkinson and Whitehouse 2011)

7.3 GLMs and ROC curves for the south-west Asian archaeological site-phases

For the south-west Asian archaeological data, a GLM matrix combining the *known* doctrinal and imagistic cultures from the eHRAF sample and the *unknown* south-west Asian archaeological data was created. The categorised eHRAF cultures were used to construct a matrix of binary (0, 1) responses representing doctrinal or imagistic indicators. GLMs were performed using the *known* eHRAF sample in the GLM matrix to (1) examine how well each set of variables (ritual, subsistence, social complexity and a set of variables received following the analysis of the entire dataset) identified via PCA of the south-west Asian archaeological data could be utilised to (1) correctly classify the *known* doctrinal and imagistic cultures from eHRAF; and (2) generate a percentage probability (of reflecting an imagistic or doctrinal mode of religiosity) for each south-west Asian archaeological site-phase. The GLMs for each set of PCA identified variables were tested using ROC curves (Figures 7.11 to 7.14). In addition, the most *fit for purpose* GLM was tested using a half normal Q-Q plot—following the method described by Collett (2003).

7.3.1 ROC Curve for the GLM based on the PCA identified ritual variables

The five ritual variables accounting for the variance in the south-west Asian archaeological sample were identified via PCA (Chapter 5, section 5.3.1). The identified variables were: Ritual Buildings (RB), Burial Goods (BG), Special Treatment (ST), Flexed Burials (FB) and Individual Burials (IB). The ROC curve for the GLM based on the ritual variables received from the PCA of the south-west Asian archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.5.

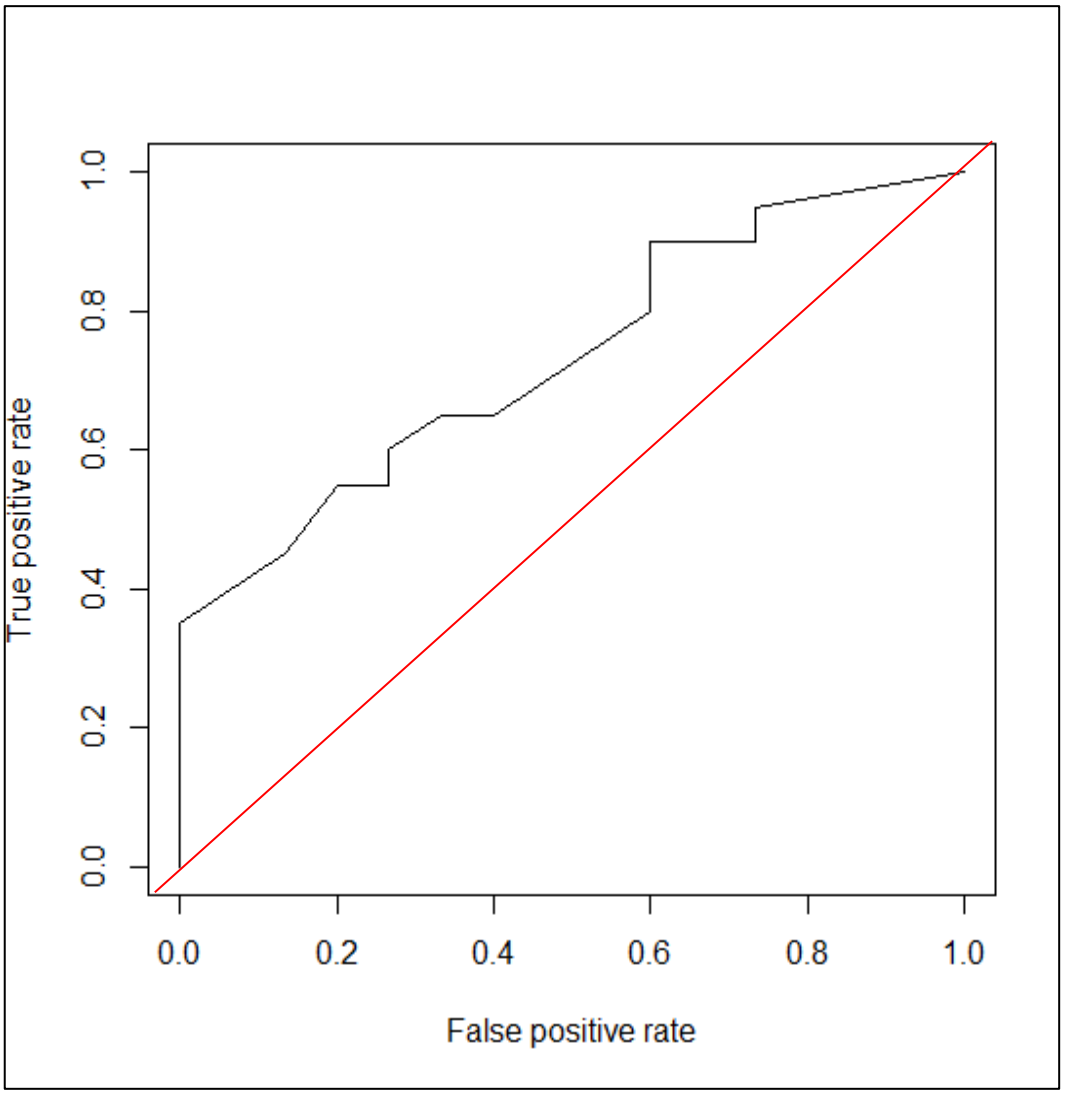


Figure 7:5: ROC curve for the GLM based on the ritual variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 20% the true positive rate is 55%; (2) at a false positive of 50% the true positive rate is 75%; and (3) at a false positive of 75% the true positive rate is 95%. The ROC curve demonstrates that the true positive rate exceeds the false positive rate; in many cases, the GLM has correctly classed the *known* doctrinal and imagistic cultures. The red diagonal line from (0, 0 to 1, 1) illustrates the ROC curve that would be generated following random classification of the cases by the GLM. When we compare the received ROC curve to the location of the diagonal line, we can observe that the received ROC curve is distanced from the diagonal line—showing that it has more than half the positives classified

correctly and it is superior to a model producing random classifications. Although the ROC curve demonstrates that the true positive rate exceeds the false positive rate, we can see that this is not an ideal ROC curve. The area under the curve (AUC) for the ROC was calculated at 0.59, indicating that 59% of the *known* eHRAF cases were classified correctly using the ritual variables extracted via the PCA of the south-west Asia site-phases. Although this is a relatively low percentage result, it indicates that the GLM results are better than randomly generated classifications. The ROC curve results demonstrates that, in the absence of ritual frequency and dysphoric arousal level evidence, the ritual variables identified via PCA of the south-west Asia dataset provides us with a GLM that can, to a relatively marginal degree, be used to correctly classify the *known* eHRAF cultures in relation to each of two modes of religiosity. However, the AUC result indicates that this model does not represent a reliable model for categorising the *unknown* south-west Asia site-phases in terms of the imagistic or doctrinal mode of religiosity.

7.3.2 ROC Curve for the GLM based on the PCA identified subsistence variables

The subsistence variables accounting for the variance in the south-west Asian archaeological sample were identified via the PCA (Chapter 5, section 5.3.2). The Identified variables were: Agriculture (A), Animal Domestication at 2 (A.D.2), Crop intensity at 2 (CI.2), Hunting (H) and Gathering (G). The ROC curve for the GLM based on the subsistence variables received from the PCA of the south-west Asian archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.6.

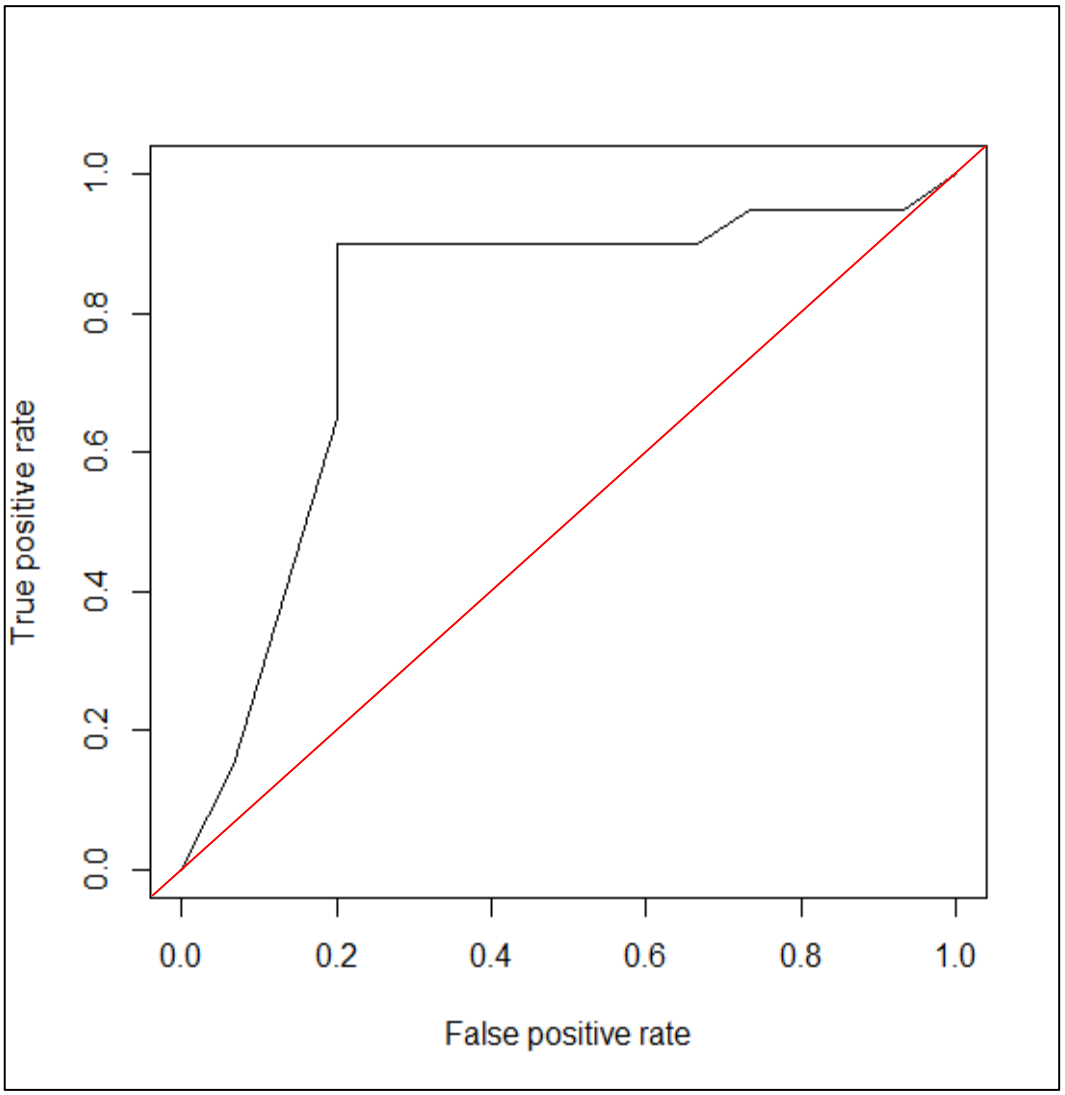


Figure 7:6: ROC curve for the GLM based on the subsistence variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 20% the true positive rate is 90%; and (2) at a false positive of 75% the true positive rate is 95%. From Figure 7.6 we can see that the ROC curve is a distance from the diagonal line (in red) going from (0, 0 to 1, 1) indicating that the GLM produced is superior to a model generating random classifications. This ROC curve result demonstrates that the true positive rate far exceeds the false positive rate; showing that, in the vast majority of instances, the GLM is utilizing the subsistence variables to correctly classify the *known* eHRAF cultures. The area under the curve (AUC) for the ROC curve was calculated at 0.78, indicating that 78% of the *known* eHRAF cases were classified correctly using the

subsistence variables extracted via the PCA of the south-west Asia site-phases. The ROC curve results demonstrate that the model is a good fit. The ROC curve results demonstrates that the subsistence variables identified via PCA of the south-west Asia dataset provides us with an appropriate GLM that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of the two modes of religiosity; and (2) can be utilised to categories the *unknown* south-west Asia site-phases in terms of the imagistic or doctrinal mode of religiosity.

7.3.3 ROC Curve for the GLM based on the PCA identified social complexity variables

The social complexity variables accounting for the variance in the south-west Asian archaeological sample were identified via the PCA (Chapter 5, section 5.3.3). The Identified variables were: Burial Goods (BG), Special Treatment (ST), Individual Burials (IB), Communal Structures (CS) and Storage of Cultural Knowledge (SCK). The ROC curve for the GLM based on the social complexity variables received from the PCA of the south-west Asian archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.7.

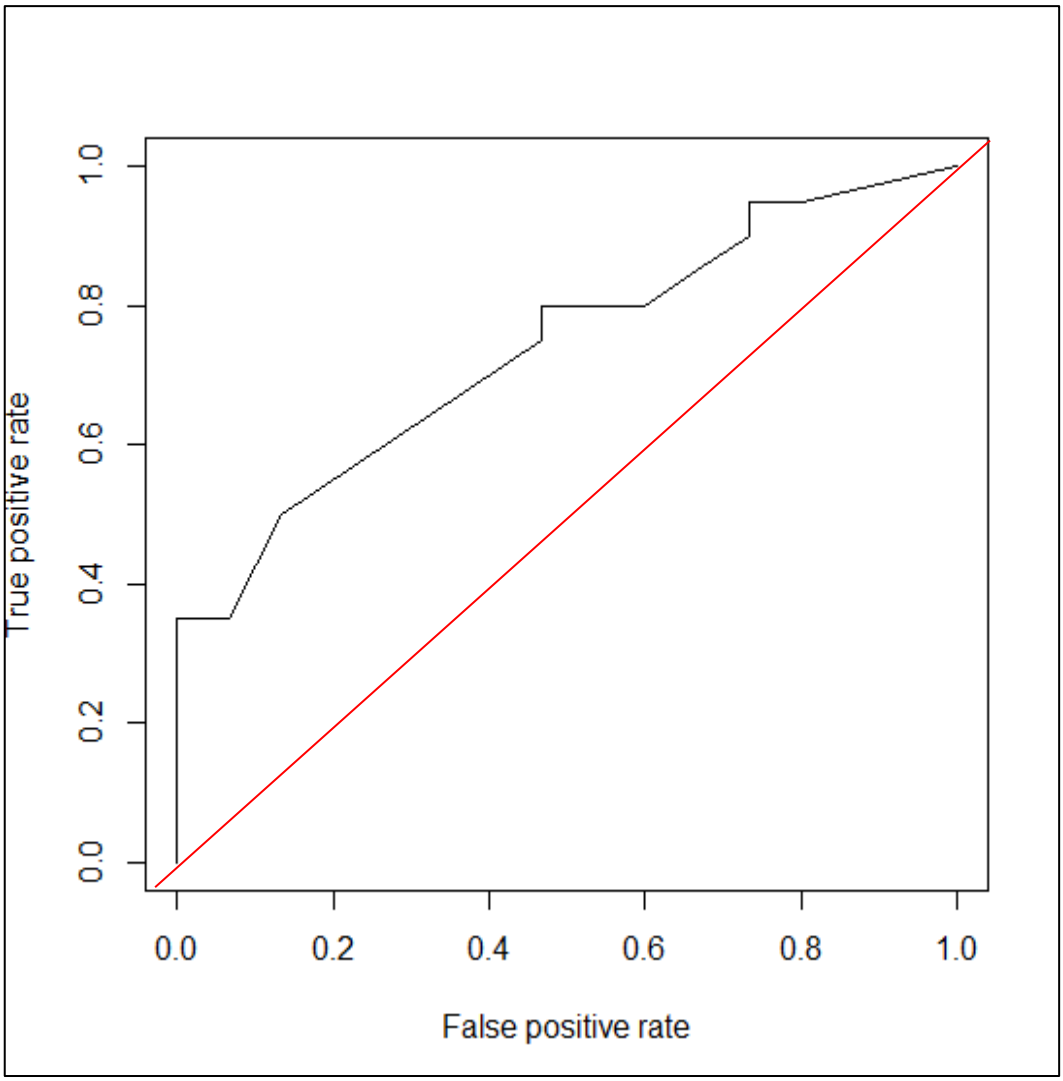


Figure 7:7: ROC curve for the GLM based on the social complexity variables identified via PCA of the south-west Asian site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 20% the true positive rate is 57%; (2) at a false positive of 50% the true positive rate is 80%; and (3) at a false positive of 80% the true positive rate is 95%. When we compare the received ROC curve to the location of the red diagonal line, we can observe that the received ROC curve is a distance from the diagonal line—showing that it has classified more than half the positives cases correctly. Although the ROC curve demonstrates that the true positive rate exceeds the false positive rate, we can see that this is not an ideal ROC curve. The area under the curve (AUC) for the ROC was calculated at 0.60, indicating that 60% of the *known* eHRAF cases were classified correctly using the social complexity variables

extracted via the PCA of the south-west Asia site-phases. The ROC curve demonstrates that the social complexity variables identified via PCA of the south-west Asia dataset provides us with a GLM that can, to a limited extent, be used to correctly classify the *known* eHRAF cultures in relation to each of two modes of religiosity. However, the AUC result indicates that this GLM cannot be used for categorising the *unknown* south-west Asia site-phases in terms of the imagistic or doctrinal mode of religiosity with a high degree of reliability.

7.3.4 ROC Curve for the GLM based on the PCA Identified variables following analysis of all variables

The ROC curve for the GLM based on the five identified variables extracted from the PCA of the entire south-west Asian archaeological dataset and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.8. The Identified variables were: Flexed Burials (FB), Special Treatment (ST), Individual Burials (IB), Degree of Sedentism at 2 (DS.2) and Burial Goods (BG) (Chapter 5 section 5.3.4).

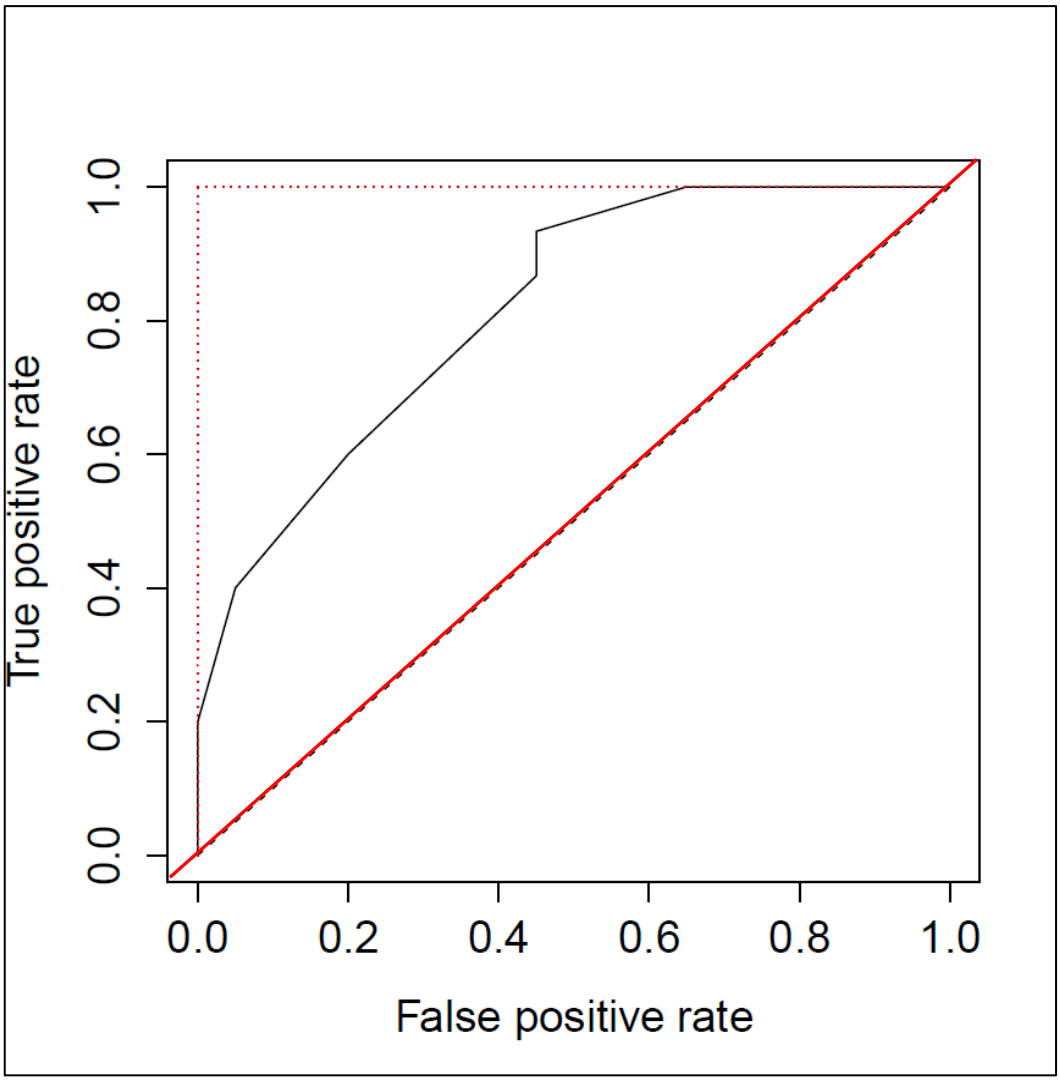


Figure 7:8: ROC for the GLM based on the variables identified via PCA of all variables, for the south-west Asian site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 45% the true positive rate is 92%; and (2) at a false positive of 63% the true positive rate is 100%. This ROC curve result demonstrates that the true positive rate exceeds the false positive rate; showing that, in the vast majority of instances, the GLM is utilizing the variables to correctly classify the *known* eHRAF cultures. In Figure 7.8 the ROC curve is distanced from the diagonal line (in red) from (0, 0 to 1, 1); indicating that the GLM generated a ROC curve that is far better than a model producing random classifications. The area under the curve (AUC) for the ROC curve is 0.73, indicating that 73% of the *known* eHRAF cases were classified correctly using the variables extracted via the PCA of the south-west Asia site-phases. The true positive versus false positive rate and the AUC

result demonstrate that the variables identified via PCA of the entire south-west Asia dataset provides us with a *fit for purpose* GLM that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of the two modes of religiosity; and (2) can be utilised to categories the *unknown* south-west Asia site-phases in terms of the imagistic or doctrinal mode of religiosity.

7.3.5 Summary of the GLMs for the for the south-west Asian site-phases

From the ROC curves generated for each GLM, we can state that the variables identified through the PCA of the south-west Asian archaeological site-phase resulted in a range of predictor models (GLMs) with variable success rates for correctly classifying the *known* eHRAF cultures in terms of the recorded mode of religiosity. The ROC curve results show that the GLM based on the subsistence variables is the most appropriate model. The GLM using the subsistence variables resulted in an AUC for the ROC curve of 0.78, indicating that 78% of the *known* eHRAF cases were classified correctly. The ROC curve for the variables identified following PCA using all variables (ritual, subsistence and social complexity) resulted in an ROC curve with an area under the curve (AUC) of 0.73, indicating that 73% of the *known* eHRAF cases were classified correctly. The GLMs based on the ritual variables and the social complexity variables display lower success rates. The GLM based on the social complexity variables resulted in an AUC of 0.60 (60% of cases classed correctly) and the GLM based on the ritual variables resulted in an AUC of 0.59 (59% of cases classed correctly).

The results from the analysis of each GLM using the ROC curves parallels the MDS and PCA results for the south-west Asian site-phases, which showed the greatest statistical separation for the south-west Asian Neolithic (PPNA-PN) and Epipalaeolithic site-phases when the subsistence variables were used. As we can see, the GLM using the subsistence variables resulted in the greatest GLM predictor model (using the *known* eHRAF cultures). This suggests that a GLM based on a set of key subsistence variables represents

the best predictive model for determining mode of religiosity for the *unknown* archaeological site-phases.

7.4 Percentage probability classifications

7.4.1 Percentage probability classification of the known eHRAF cultures based on the subsistence variables identified via PCA of the south-west Asian site-phases

A GLM based on the subsistence variables extracted via the PCA of the south-west Asian site-phases was used to generate the percentage probability that each of the *known* eHRAF culture was classified in terms of the two modes. The GLM based on the PCA identified set of subsistence variables was used as, when all the potential models were examined via ROC curves, it was identified as the most *fit for-purpose* predictor model (section 7.3.2). This approach enabled me (1) to examine in more detail the extent to which the most *fit for purpose* model (using the archaeologically recorded subsistence variable) classified the *known* imagistic and doctrinal cultures; and (2) identify which eHRAF culture would be misclassified using the subsistence variable recorded from the south-west Asian site-phases.

From the GLM output (Table 7.4) we can see that the majority of the imagistic and doctrinal cultures were correctly classified, with 67% of imagistic cultures categorised correctly and 85% of doctrinal cultures classified correctly. Table 7.4 demonstrates that five imagistic cultures (33%) were misclassified as doctrinal. The five misclassified cultures were the Dogon, Wolof, Eastern Toraja, Banyoro and the Hausa. The Dogon, Wolof, Eastern Toraja and the Hausa cultures each produced a result showing a 65% probability of these cultures representing doctrinal cultures. The Dogon were identified as an overlapping case when MDS was performed for the ritual and the combination of all variables (Chapter 4, section 4.1.1 and 4.1.3). The Wolof culture was identified as an overlapping culture when MDS and PCA were carried-out using all variables. The Wolof culture was categorised as doctrinal with an uncertain percentage probability when GLM

was carried out using the ritual and the combined variables for the analysis of the eHRAF cultures (sections 7.2.1 and 7.2.2). The Hausa culture was noted as an overlapping culture for the MDS and PCA of based on all variables (Chapter 4, section 4.1.4 and 4.3.4). The Hausa culture was categorised as doctrinal with an uncertain percentage probability when GLM was preformed using the ritual and combined variables for the eHRAF cultures (sections 7.2.1 and 7.2.2). The Banyoro culture was misclassified as a doctrinal culture with a high percentage probability (73%). The Banyoro culture was identified as an overlapping culture when MDS and PCA were carried out based on the subsistence variables for the eHRAF cultures (Chapter 4, section 4.1.2 and 4.3.2).

Table 7.4, shows that, of the 19 doctrinal cultures, two (10 %) were classified as imagistic and one culture (5%) was classified as indeterminate. The Tongan culture was classified as indeterminate as the GLM produced a 54% probability of it being a doctrinal culture. The Trobriander culture was classified as an imagistic culture with a 67% probability. For the Guaraní, the GLM produced an 86% probability of this culture being an imagistic culture. The Guaraní culture was recorded as a doctrinal culture that clustered with a number of imagistic cultures when MDS was carried out using the subsistence variables and when PCA was undertaken using the subsistence and the combination of all identified variables (Chapter 4, sections 4.1.2, 4.3.2 and 4.3.4). The Guaraní culture was misclassified as imagistic when a GLM was performed based on the ritual variables from the analysis of the eHRAF cultures (section 7.2.1). The remainder of the doctrinal cultures (85%) were classified correctly [after Atkinson and Whitehouse (2011)]. This result shows that, the GLM model based on the subsistence variables extracted via PCA of the south-west Asian site-phases, can be used, for the most part, to correctly classify a majority of *known* imagistic and doctrinal cultures—particularly the doctrinal cultures. The result demonstrates that the GLM is *fit for purpose* and can be applied to the south-west Asian archaeological site-phases to generate a percentage probability that each site-phase represents an imagistic or a doctrinal culture.

Table 7:4: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the identified subsistence variables identified via PCA of south-west Asian archaeological site-phases

eHRAF culture	Original mode classification #	GLM classification	Percentage probability	Percentage Error
Banyoro	Imagistic	Doctrinal	83%	+/- 7.27%
Lozi	Imagistic	Imagistic	75%	+/- 1.96%
Hausa	Imagistic	Doctrinal	65%	+/- 1.16%
Dogon	Imagistic	Doctrinal	65%	+/- 1.96%
Tiv	Imagistic	Imagistic	67%	+/- 1.96%
Wolof	Imagistic	Doctrinal	65%	+/- 1.16%
Andamans	Imagistic	Imagistic	84%	+/- 2.39%
Eastern Toraja	Imagistic	Doctrinal	65%	+/- 1.96%
Ojibwa	Doctrinal	Indeterminate	54% imagistic	+/- 2.69%
Aranda	Imagistic	Imagistic	62%	+/- 3.56%
Kapauku	Imagistic	Imagistic	80%	+/- 3.84%
Jivaro	Imagistic	Imagistic	80%	+/- 1.30%
Tukano	Imagistic	Imagistic	87%	+/- 1.79%
Yanoama	Imagistic	Imagistic	87%	+/- 1.79%
Bororo	Imagistic	Imagistic	87%	+/- 1.79%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

Table 7.4: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the identified subsistence variables identified via PCA of south-west Asian archaeological site-phases (continued)

eHRAF culture	Original mode classification #	GLM classification	Percentage probability	Percentage Error
Somali	Doctrinal	Doctrinal	83%	+/- 7.27%
Lepcha	Doctrinal	Doctrinal	65%	+/- 1.16%
Korean	Doctrinal	Doctrinal	68%	+/- 1.16%
Iban	Doctrinal	Doctrinal	65%	+/- 1.16%
Ifugao	Doctrinal	Doctrinal	65%	+/- 1.16%
Central Thai	Doctrinal	Doctrinal	89%	+/- 1.16%
Bosnian Muslim	Doctrinal	Doctrinal	65%	+/- 1.16%
Palestinians	Doctrinal	Doctrinal	65%	+/- 1.16%
Iroquois	Doctrinal	Doctrinal	69%	+/- 1.16%
Seminole	Doctrinal	Doctrinal	83%	+/- 2.46%
Pawnee	Doctrinal	Doctrinal	78%	+/- 2.30%
Croats	Doctrinal	Doctrinal	83%	+/- 1.16%
Hopi	Doctrinal	Doctrinal	83%	+/- 2.46%
Trobrianders	Doctrinal	Imagistic	67%	+/- 7.27%
Tikopia	Doctrinal	Doctrinal	83%	+/- 7.27%
Tongan	Doctrinal	Indeterminate	54%	+/- 3.84%
Saramaka	Doctrinal	Doctrinal	76%	+/- 2.30%
Aymara	Doctrinal	Doctrinal	68%	+/- 1.16%
Guaraní	Doctrinal	Imagistic	86%	+/- 1.30%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

7.4.2 Percentage probability classification of the south-west Asian archaeological site-phases based on the identified subsistence variables

Similar to section 7.4.1, a GLM based on of the subsistence variables extracted via the PCA of the south-west Asian site-phases was used to generate the percentage probability for each site-phase of reflecting an imagistic or doctrinal culture. As explained in the previous section, this GLM was used as, when all the potential models were examined via ROC curves, it was identified as the most *fit for-purpose* predictor model (section 7.3.2 and 7.3.5). The subsistence variables identified following PCA analysis of the south-west Asian site-phases were applied in a GLM matrix containing the *known* eHRAF cultures and the *unknown* south-west Asian archaeological site-phases. The *known* eHRAF cultures were used in the GLM matrix to classify the south-west Asian archaeological data as doctrinal or imagistic based on the variables identified. Using the method of maximum probability, the GLM yielded a percentage probability (of reflecting a doctrinal or imagistic mode) for each south-west Asian archaeological site-phase. The GLM provides an output (Table 7.6) that shows:

1. the archaeological site-phase;
2. the archaeological period;
3. the percentage probability of that site-phase being a representative of the particular mode of religiosity; and
4. the percent error given by the GLM

7.4.3 Additional model testing using a half-normal Q-Q plot

In addition to generating an ROC curve, the GLM used to classify the *unknown* south-west Asian site-phases (using the subsistence variables) was further tested using a half-normal Q-Q plot, using the method described by Collett (2003) (Figure 7.9). Collett (2003) recommends calculating the deletion residuals and plotting the means of the residuals against a solid line representing the mean. The minima and maxima are plotted as dotted lines to provide a 95% confidence envelope; thus, all points (simulations) are plotted in relation to this 95% confidence envelope (dotted line) (Figure 7.9). A half

normal Q-Q plot provides an addition critical validation method to (1); assess if the simulated points (produce Pearson residuals from the fitted model) are within the 95% confidence interval; (2) examine the simulated points in relation to a mean; and (3) identify any outliers. In the half normal Q-Q plot generated (Figure 7.9): (1) the points show the simulations; (2) the solid line shows the means of the simulations; and (3) the dotted line displays the limits of the 95% confidence envelope. This half normal Q-Q plot shows that all the simulations (the points generated) lie within the 95% confidence envelope and, for the most part, are close to the mean line. Also, it shows that none of the simulated points are outliers. The half normal Q-Q plot has provides us with a critical validation of the model; demonstrating that the model based on the subsistence variables is *fit for purpose* to classify the *unknown* archaeological site-phases in terms of the two modes.

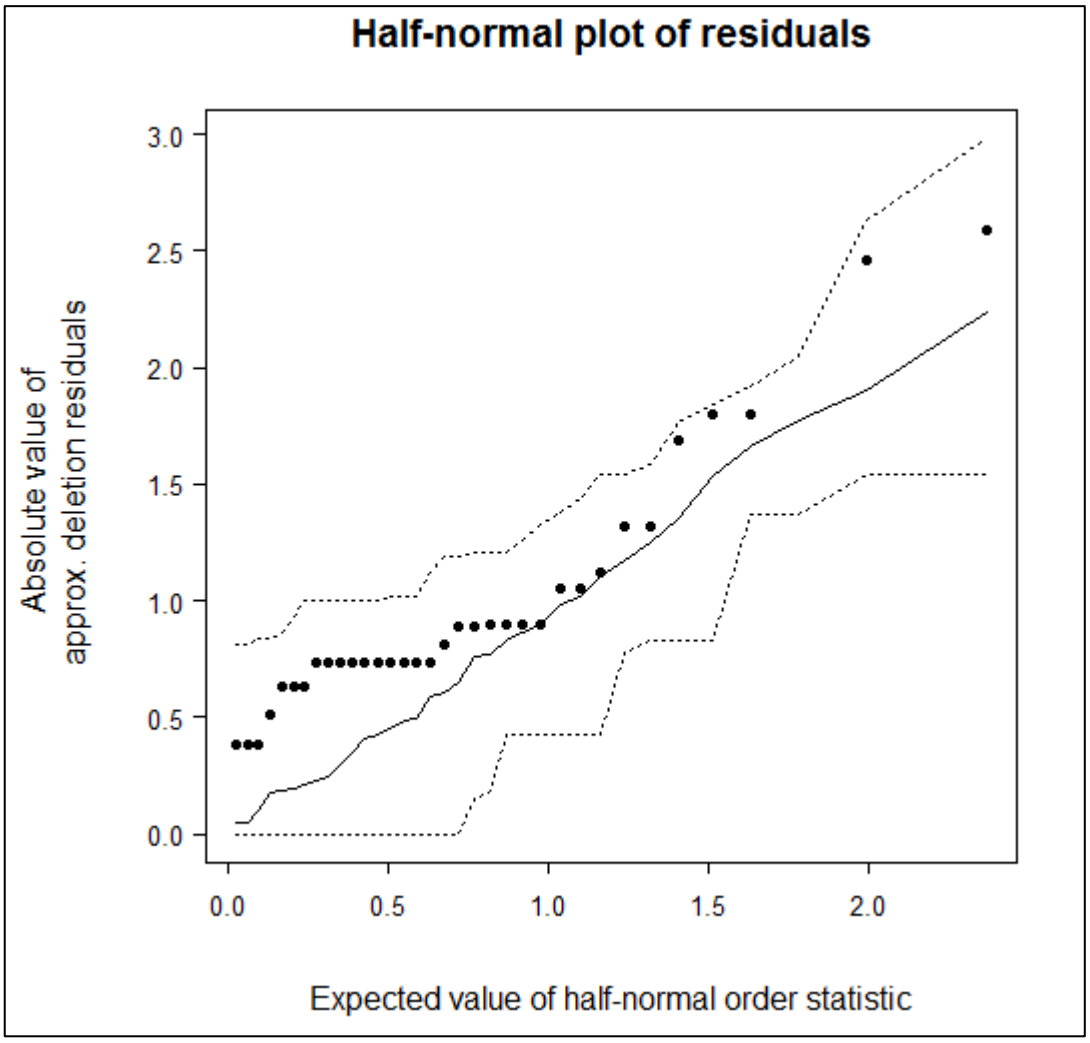


Figure 7:9: Half-normal Q-Q plot for the GLM of the south-west Asian site-phases based on the identified subsistence variables

7.4.4 GLM output results

The GLM output (Table 7.6) shows that all 15 of the Epipalaeolithic site-phases were classed as imagistic (Tables 7.5, 7.6 and Figure 7.10). Five Epipalaeolithic site-phases (33%) were classed as imagistic with a 90% probability; these were: Ohalo II, Hilazon Tachtit, Beidha I, Neve David and Kharaneh IV. From the Neolithic sample, 69% of 34 site-phases were identified as doctrinal, 27% of the site-phases were classed as imagistic and 4% of the site-phases were classed as indeterminate. Of the 16 PPNA site-phases, six (38%) were identified as reflecting doctrinal cultures and ten site-phases (62%) were identified as imagistic (Tables 7.5, 7.6 and Figure 7.10). The PPNA sample included a number of site-phases with high percentage probabilities of being imagistic or doctrinal;

examples include: Çayönü I with an 87% probability of representing a doctrinal culture and Netiv Hagdud with an 86% probability of representing an imagistic culture.

Of the 23 PPNB site-phases, 18 (78%) were identified as doctrinal cultures, three (13%) as imagistic culture and two site-phases (9%) were classified as indeterminate (Tables 7.5, 7.6 and Figure 7.10). A total of 11 PPNB site-phases (52%) provided us with percentage probabilities of being doctrinal above 80%; examples in include: Early PPNB Beidha II with a 83% probability of being a doctrinal culture, Middle PPNB Yiftahel with a 88% probability of being a doctrinal culture and Late PPNB Ain Ghazal II with a 83% probability of being a doctrinal culture (Table 7.5). The three PPNB site-phases that were categorized as imagistic were Early PPNB Dja'de with a 70% probability of reflecting an imagistic culture, Middle PPNB Khirbet Hammam with an 80% probability of reflecting an imagistic culture and Late PPNB Tel el-Kerkh I with a 65% probability of representing an imagistic culture (Table 7.6). The two PPNB site-phases that were classed as indeterminate were Middle PPNB Kfar Hahoresh with a 52% probability of representing a doctrinal culture and Late PPNB Cafer Höyük with a 53% probability of it reflecting a doctrinal culture (Table 7.6). In terms of the PPNB sub-periods, five of the Early PPNB site-phases (83%) were classified as doctrinal and one site-phase (17%) was classified as imagistic. Of the 12 middle PPNB site-phases, one site-phase (8.3%) was classed as imagistic, a total of 10 (83%) of the MPPNB site-phases were categorised as doctrinal and one site-phase (8.3%) was classified as indeterminate. Of the five Late PPNB site-phases, three site-phases (60%) were classified as doctrinal, one site-phase (20%) was classed as imagistic, and one site-phase (20%) was classified as indeterminate (Table 7.6). All three PPNC site-phases were identified as reflecting doctrinal cultures (Tables 7.6). PPNC Shu'eib II, with an 83% probability, provides us with an example of a PPNC site-phase that had a high percentage probability of being doctrinal (Table 7.6). Similarly, all seven PN site-phases in the sample were classified as doctrinal (Tables 7.5, 7.6 and Figure 7.10). The PN samples presents two example of a site-phase that had a percentage

probability of being doctrinal; as both Ain Ghazal II and Ain Rahub had an 83% probability of being doctrinal cultures.

Table 7:5: percentages and number of sites-phases classed via the GLM of the south-west Asian site-phases based on the identified subsistence variables

Period	% of site-phases classed as imagistic	No. classed as imagistic	% of site-phases classed as doctrinal	No. classed as doctrinal
Epipalaeolithic	100%	15	0%	0
PPNA	62%	10	38%	6
PPNB	13%	3	78%	18
PPNC	0%	0	100%	3
PN	0%	0	100%	7

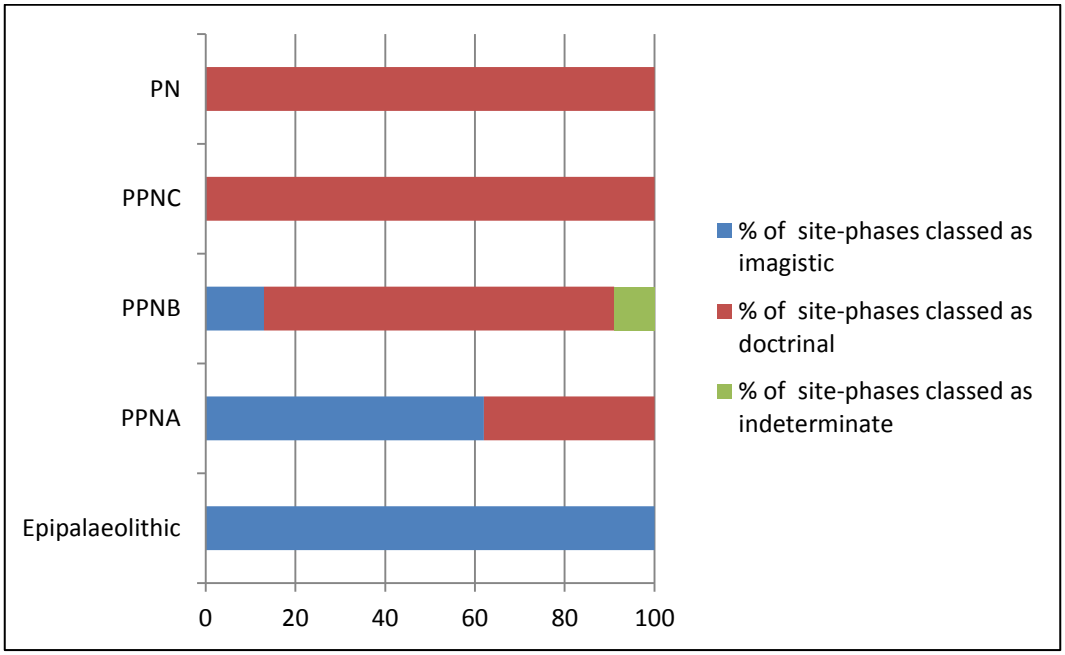


Figure 7:10: percentages of sites-phases classed via the GLM of the south-west Asian site-phases based on the identified subsistence variable

Table 7:6: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of south-west Asian archaeological site-phases

Site-phase	Archaeological Period	GLM classification	% Probability	Percentage Error
Ein Gev I	Early Epipalaeolithic	Imagistic	75%	+/- 2.39
Ohalo II	Early Epipalaeolithic	Imagistic	90%	+/- 2.39
Hilazon Tachtit (cave)	Middle Epipalaeolithic	Imagistic	90%	+/- 2.39
Beidha I	Midddle Epipalaeolithic	Imagistic	90%	+/- 2.39
Neve David	Midddle Epipalaeolithic	Imagistic	90%	+/- 2.39
Kharaneh IV	Middle Epipalaeolithic	Imagistic	90%	+/- 2.39
Hayonim Cave I (cave)	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Hayonim Cave II (cave)	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Hayonim Terrace	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Hatoula I	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Mureybit I	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Mureybit II	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Wadi Hammeh 27	Late Epipalaeolithic	Imagistic	62%	+/- 2.39
Abu Hureyra I	Late Epipalaeolithic	Imagistic	75%	+/- 2.39
Ain Mallaha	Late Epipalaeolithic	Imagistic	60%	+/- 2.39

Table 7:6: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of south-west Asian archaeological site-phases (continued)

Site-phase	Archaeological Period	GLM classification	% Probability	Percentage Error
Çayönü I	PPNA	Doctrinal	87 %	+/- 2.94
Dhra	PPNA	Doctrinal	72%	+/- 5.20
Gilgal I	PPNA	Imagistic	86%	+/- 1.79
Göbekli Tepe I	PPNA	Doctrinal	77%	+/- 5.85
Hallan Cemi	PPNA	Imagistic	64%	+/- 2.45
Hatoula II	PPNA	Imagistic	74%	+/- 2.39
Iraq Ed-Dubb	PPNA	Doctrinal	73%	+/- 5.10
Jerf el Ahmar	PPNA	Imagistic	73%	+/- 1.79
Jericho I	PPNA	Doctrinal	85%	+/- 5.10
Kortik	PPNA	Imagistic	72%	+/- 5.63
Mureybit III	PPNA	Imagistic	86%	+/- 1.79
Netiv Hagdud	PPNA	Imagistic	86%	+/- 1.79
Tell 'Abr	PPNA	Imagistic	86%	+/- 1.79
Tell Qaramel	PPNA	Doctrinal	72%	+/- 5.10
Tell Ramad I	PPNA	Imagistic	80%	+/- 1.30
Wadi Faynan (WF 16)	PPNA	Imagistic	72%	+/- 5.10
Beidha II	EPPNB	Doctrinal	83%	+/- 2.46
Çayönü II	EPPNB	Doctrinal	83%	+/- 2.46
Dja'de	EPPNB	Imagistic	70%	+/- 4.06
Göbekli Tepe II	EPPNB	Doctrinal	87%	+/- 5.85
Jericho II	EPPNB	Doctrinal	65%	+/- 1.96
Nevali Cori	EPPNB	Doctrinal	83%	+/- 2.46
Abu Hureyra II	MPPNB	Doctrinal	83%	+/- 3.14
Ain Ghazal I	MPPNB	Doctrinal	65%	+/- 1.96

Table 7:6: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of south-west Asian archaeological site-phases (continued)

Site-phase	Archaeological Period	GLM classification	% Probability	Percentage Error
Aşıklı Höyük/Musular	MPPNB	Doctrinal	83%	+/- 2.46
Buncuklu	MPPNB	Doctrinal	65%	+/- 1.96
Catalhöyuk I	MPPNB	Doctrinal	75%	+/- 1.96
Kfar Hahoresh	MPPNB	Indeterminate	52%	+/- 4.67
Khirbet Hammam	MPPNB	Imagistic	80%	+/- 1.30
Mureybit IV	MPPNB	Doctrinal	83%	+/- 2.46
Tell Aswad II	MPPNB	Doctrinal	83%	+/- 2.46
Tell Halula	MPPNB	Doctrinal	80%	+/- 1.84
Tell Ramad II	MPPNB	Doctrinal	60%	+/- 3.79
Yiftahel	MPPNB	Doctrinal	88%	+/- 2.46
Ain Ghazal II	LPPNB	Doctrinal	65%	+/- 1.96
Basta	LPPNB	Doctrinal	65%	+/- 1.96
Cafer Höyük	LPPNB	Indeterminate	53%	+/- 2.69
Shu'eib I	LPPNB	Doctrinal	83%	+/- 3.14
Tell el-Kerkh I	LPPNB	Imagistic	65%	+/- 1.96
Ain Ghazal III	PPNC	Doctrinal	65%	+/- 1.96
Atlit Yam	PPNC	Doctrinal	75%	+/- 2.30
Shu'eib II	PPNC	Doctrinal	83%	+/- 3.14
Ain Ghazal IV	PN	Doctrinal	83%	+/- 2.46
Ain Rahub	PN	Doctrinal	83%	+/- 2.46
CatalhöyukII	PN	Doctrinal	65%	+/- 1.96
Jebe Abu Thwwab	PN	Doctrinal	78%	+/- 7.02
Shu'eib III	PN	Doctrinal	65%	+/- 4.64
Tell Ramad III	PN	Doctrinal	65%	+/- 1.96
Tell el-Kerkh II	PN	Doctrinal	65%	+/- 1.96

In relation to the hypothesis central to this thesis, the percentages generated via GLM appear to show a shift from an imagistic to a more doctrinal mode of religiosity associated with the agricultural transition in south-west Asia. As the agricultural transition progresses we can observe a decrease in imagistic classifications and an increase in doctrinal classification for the site-phases. The highest percentage of doctrinal classifications occurs in the PPNC and PN site-phases—both cultural phases with 100% of site-phases classified as doctrinal. The high classification of the PPNB site-phases as doctrinal (particularly the MPPNB at 83%) is interesting as the MPPNB period is connected with a dramatic population increase, high intensity agriculture and proto-urbanisation typified by the development of the *mega sites* (Bar-Yosef and Rollefson 1998; Harris 2002; Kuijt and Goring-Morris 2002; Peters 2004; Bellwood 2005; Fuller *et. al* 2011; Asouti and Fuller 2012). This result parallels the change from hunter-gathering to agriculture directly associated with the agricultural transition in in south-west Asia. However, as the set of *known* eHRAF cultures were used in the GLM matrix to classify the *unknow*n archaeological site-phases, the result suggests a relationship between the imagistic and doctrinal modes respectively and different subsistence strategies. This may indicate that an important part of the social change(s) across the agricultural transition relates to social cohesion generated via more doctrinal rituals, as the transition progresses. The relationship between subsistence strategy and the modes is discussed in Chapter 8.

7.5 GLMs and ROC curves for the north-west European archaeological site-phases

For the north-west European archaeological data, a GLM matrix combining the *known* doctrinal and imagistic cultures from the eHRAF sample and the *unknown* north-west European archaeological data was created. The categorised eHRAF cultures were used to construct a matrix of binary (0, 1) responses representing doctrinal or imagistic indicators. GLMs were performed using the *known* eHRAF sample in the GLM matrix to examine how well each set of variables (ritual, subsistence, social complexity and the five variables received following the analysis of the entire dataset) identified via PCA of the north-west European archaeological data could be utilised: (1) to correctly classify the *known* doctrinal and imagistic cultures from the eHRAF and (2) to generate a percentage probability (of reflecting an imagistic or doctrinal mode of religiosity) for each north-west European archaeological site-phase. The GLMs for each set of PCA identified variables were tested using ROC curves (Figures 7.11 to 7.14). In addition, the most *fit for purpose* GLM was tested using a half normal Q-Q plot—following the method described by Collett (2003).

7.5.1 ROC Curve for the GLM based on the PCA identified ritual variables

The ritual variables accounting for the variance in the north-west European archaeological sample were identified by PCA (Chapter 6, section 6.3.1). The Identified variables were Burial Goods (BG), Burial Associated with Animals (BA), Inhumation (I), Monuments in the landscape (ML) and Monumental Burials (MB). The ROC curve for the GLM based on the ritual variables received from the PCA of the European archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.11.

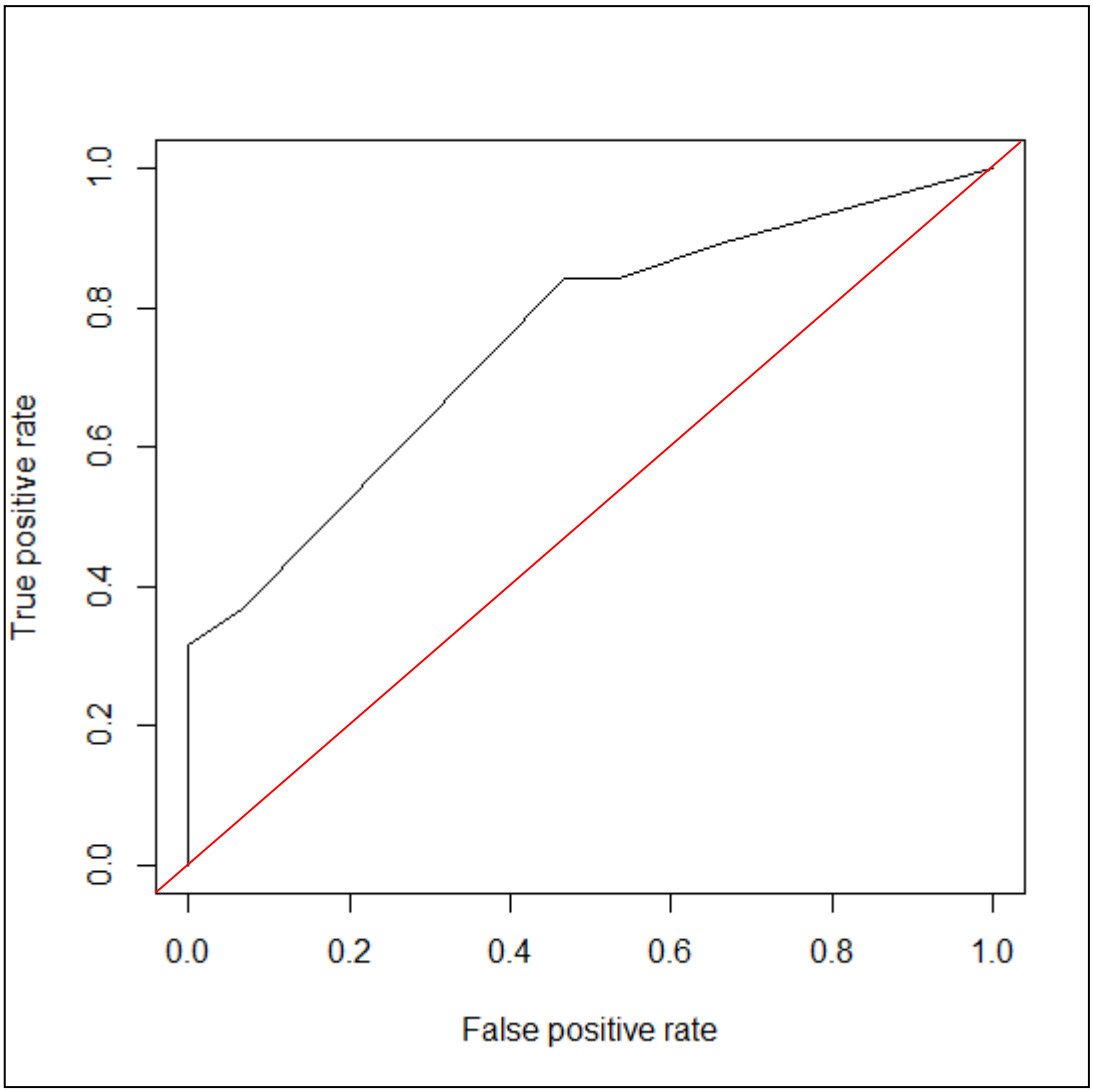


Figure 7:11: ROC curve for the GLM based on the ritual variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 0% the true positive rate is 31%; (2) at a false positive of 50% the true positive rate is 83%; and (3) at a false positive of 99% the true positive rate is 100%. The red diagonal line from (0, 0 to 1, 1) illustrates the ROC curve that would be generated following random classification of the cases by the GLM. When we compare the received ROC curve to the location of the diagonal line, we can observe that the ROC curve is a distance away from the diagonal line—showing that it has considerably more than half the positives classified correctly. The ROC curve demonstrates that the true positive rate exceeds the false positive rate; that in many of cases, the GLM has correctly classed the *known* doctrinal and imagistic cultures. The area under the curve (AUC) for the ROC was calculated at 0.74, indicating

that 74% of the *known* eHRAF cases were classified correctly using the ritual variables extracted via the PCA of the north-west European site-phases. The AUC result demonstrates that, for a substantial number of eHRAF cultures the GLM produced correct predictions regarding mode of religiosity based on the ritual variables identified in the north-west European dataset. The ROC curve results demonstrates that, in the absence of ritual frequency and dysphoric arousal level evidence, the ritual variables identified via PCA of the north-west European dataset provides us with a *fit for purpose* GLM that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of two modes of religiosity; and (2) can be applied to the north-west European archaeological site-phases to generate a percentage probability that each site-phase represents an imagistic or a doctrinal culture.

7.5.2 ROC Curve for the GLM based on the PCA identified subsistence variables

The subsistence variables accounting for the variance in the north-west European archaeological sample were identified via the PCA (Chapter 6, section 6.3.2). The Identified variables were Hunting (H), Fishing (F), Agriculture (A), Gathering (G) and Animal Domestication (AD). The ROC curve for the GLM based on the subsistence variables received from the PCA of the north-west European archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.12.

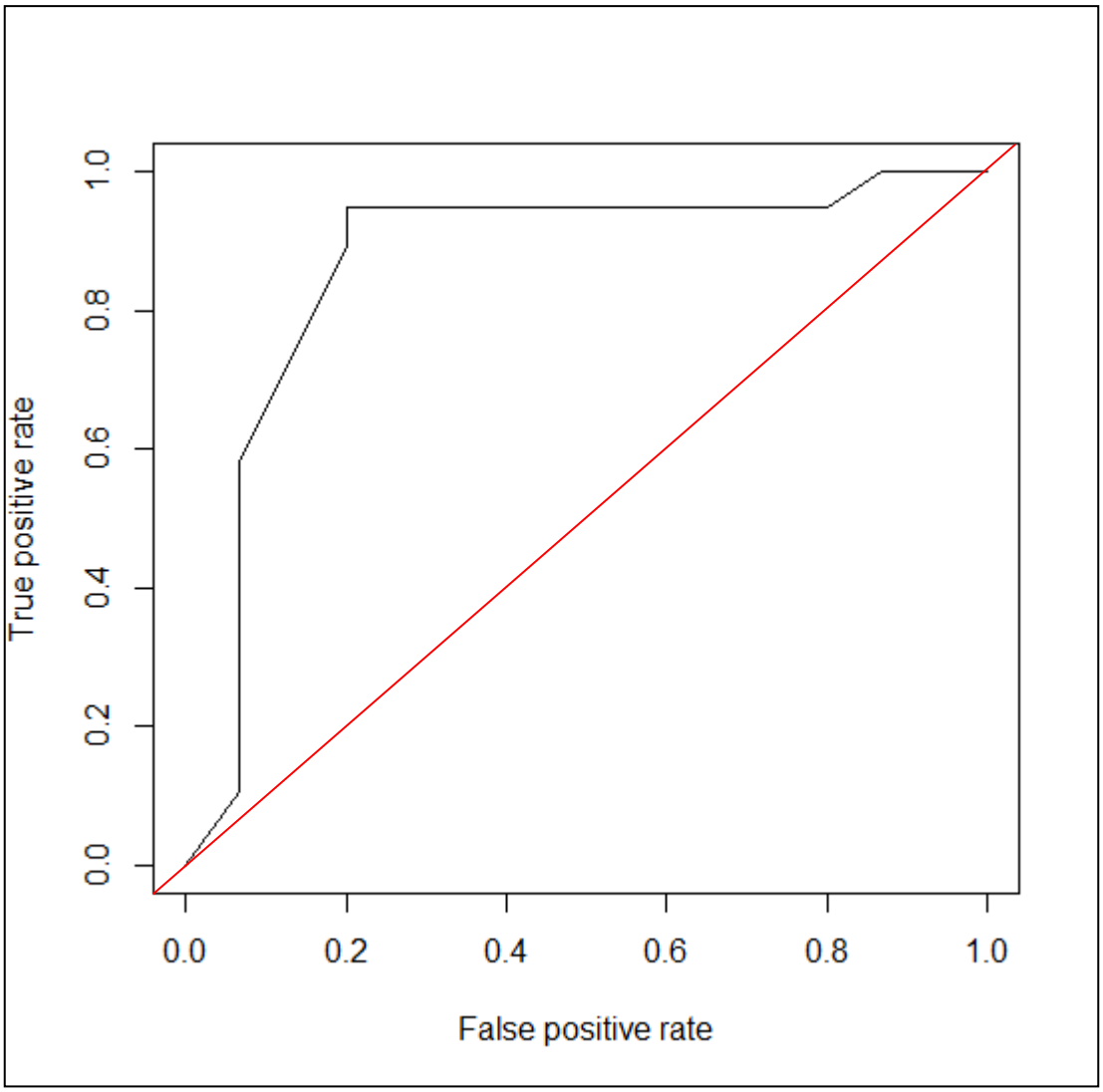


Figure 7:12: ROC curve for the GLM based on the subsistence variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 7% the true positive rate is 58%; (2) at a false positive of 20% the true positive rate is 95%; and (3) at a false positive of 86% the true positive rate is 100%. The ROC curve demonstrates that the true positive rate exceeds the false. The ROC curve is distanced from the diagonal line (in red) going from (0, 0 to 1, 1), indicating that the GLM generated is superior to a GLM producing random classifications. The area under the curve (AUC) for the ROC curve was calculated at 0.84, indicating that 84% of the *known* eHRAF cases were classified correctly using the subsistence variables extracted via the PCA of the north-west European site-phases. The ROC curve results demonstrates that the identified subsistence variables from the north-west European site-phases provides us with an appropriate GLM

that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of the two modes of religiosity; and (2) can be used to generate a percentage probability that each site-phase represents an imagistic or a doctrinal culture.

7.5.3 ROC Curve for the GLM based on the PCA identified social complexity variables

The social complexity variables accounting for the variance in the north-west European archaeological sample were identified by PCA (Chapter 6, section 6.3.3). The Identified variables were Crop intensity at 2 (C.I.2), Monuments in Landscape (M.L), Degree of sedentism at 2 (D.S.2), Burial Goods (B.G) and Agriculture (A). The ROC curve for the GLM based on the social complexity variables received from the PCA of the European archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.13.

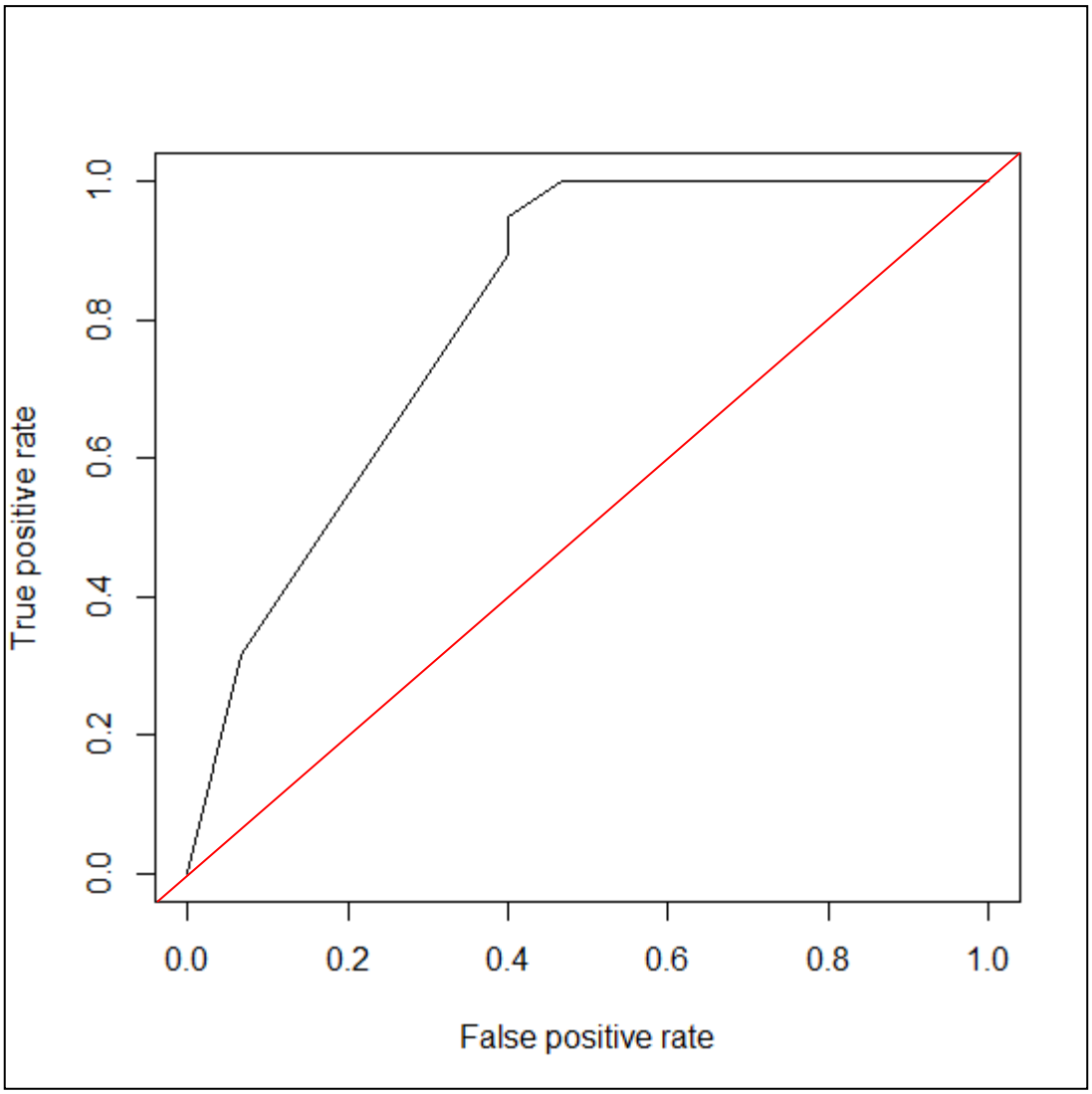


Figure 7:13: ROC curve for the GLM based on the social complexity variables identified via PCA of the north-west European site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 20% the true positive rate is 55%; (2) at a false positive of 40% the true positive rate is 88%; and (3) at a false positive of 47% the true positive rate is 100%. The ROC curve demonstrates that the true positive rate exceeds the false positive rate and that, in most instances, the GLM has properly classed the *known* doctrinal and imagistic cultures. When we compare the received ROC curve to the location of the diagonal line (in red), we can observe that the ROC curve is a distance away from the diagonal line—showing that the GLM utilised is considerably superior to a model generating random classifications.

The area under the curve (AUC) for the ROC curve was calculated at 0.79, indicating that 79% of the *known* eHRAF cases were classified correctly using the social complexity variables extracted via the PCA of the north-west European site-phases. This result indicates that the recorded social complexity variables provides us with a *fit for purpose* GLM that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of the two modes of religiosity; and (2) can be utilised to categories the *unknown* north-west European archaeological site-phases in terms of a percentage probability of reflecting a culture with an imagistic or a doctrinal mode of religiosity.

7.5.4 ROC Curve for the GLM based on the PCA Identified variables following analysis of all variables

The ROC curve for the GLM based on the five identified variables extracted from the PCA of the entire north-west European archaeological site-phases and applied to the *known* doctrinal and imagistic cultures from the eHRAF is shown in Figure 7.14. The Identified variables were: Burial Goods (BG), Hunting (H), Crop intensity at 2 (CI.2), Agriculture (A) and Monuments in Landscape (ML) (Chapter 6 section 6.3.4).

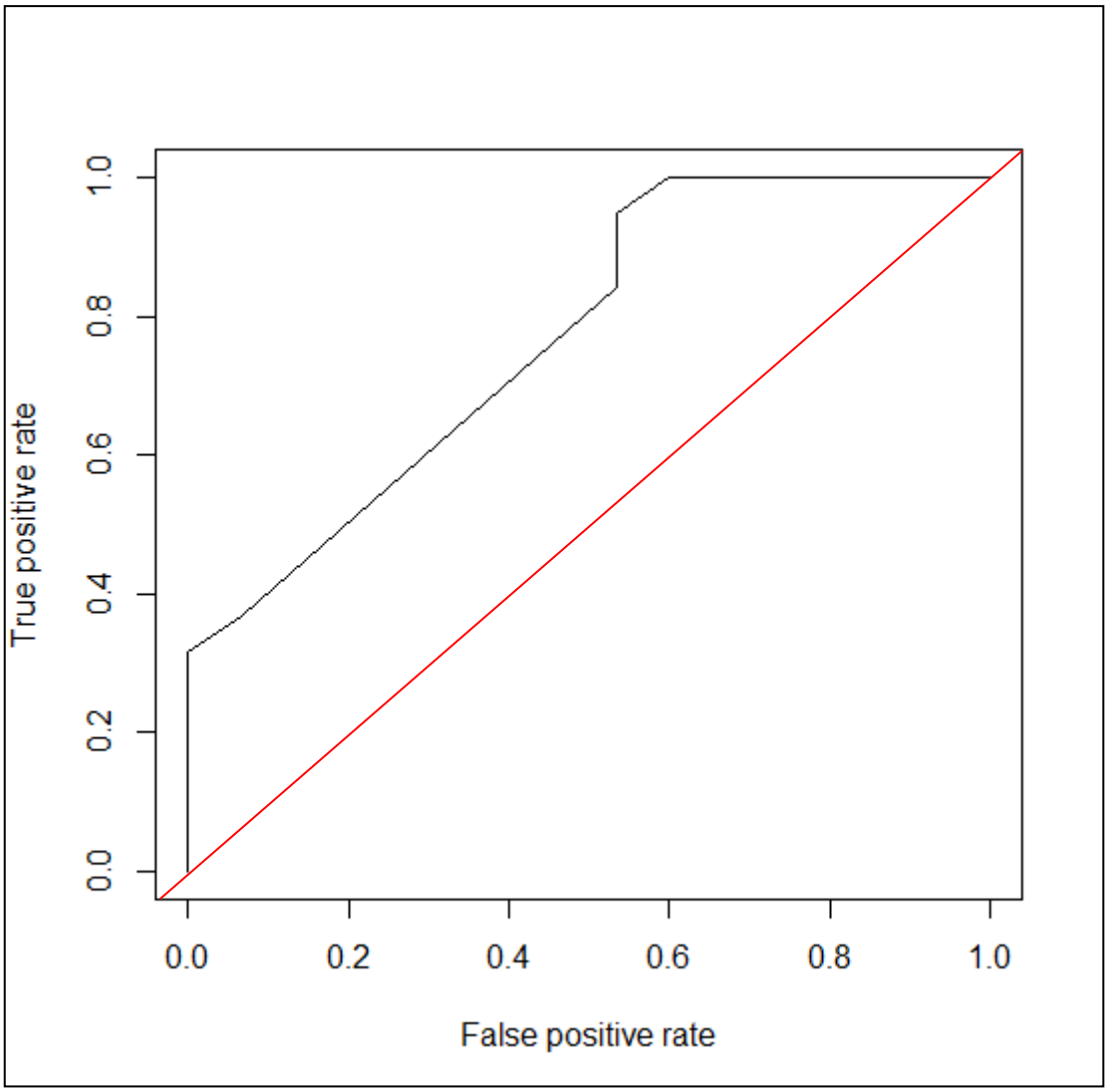


Figure 7:14: ROC for the GLM based on the variables identified via PCA of all variables, for the north-west European site-phases and applied to the known eHRAF cases.

From the ROC curve it can be observed that: (1) at a false positive of 0% the true positive rate is 33%; (2) at a false positive of 55% the true positive rate is 95%; and (3) at a false positive of 60% the true positive rate is 100%. The ROC curve demonstrates that the true positive rate exceeds the false positive rate and, in the majority of cases, the GLM has correctly classed the *known* doctrinal and imagistic cultures. The ROC curve is distanced from the diagonal line (in red) going from (0, 0 to 1, 1) indicating that the GLM utilised is considerably superior to a model generating random classifications. The area under the curve (AUC) for the ROC curve based on the variables was calculated at 0.77, indicating that 77% of the *known* eHRAF cases were classified correctly using the variables extracted via the PCA of the entire north-west European site-phases. The AUC result

demonstrates that, for a substantial number of eHRAF cultures, the GLM produced correct predictions regarding the mode of religiosity (after Atkinson and Whitehouse 2011) based on the variables identified via the PCA of the north-west European site-phases. The ROC curve results indicate that the identified variables provides us with an appropriate GLM that (1) can be used to correctly classify the *known* eHRAF cultures in relation to each of the two modes of religiosity; and (2) can be utilised to categories the *unknown* north-west European archaeological site-phases in terms of the imagistic or doctrinal mode of religiosity.

7.5.5 Summary of the GLMs for the north-west European site-phases

The ROC curve results demonstrate that all four GLMs produce appropriate models for correctly categorising the *known* (imagistic and doctrinal) eHRAF cultures using the four sets of variables identified via the PCA of the north-west European archaeological sample. We can assert that each of the four GLMs can be used (to varying degrees) to classify the *unknown* north-west European archaeological site-phases in terms of the imagistic or doctrinal mode of religiosity. However, it should be noted that the ROC curves identified different success rates for the four GLMs. The ROC curve results demonstrated that a GLM based on the PCA identified subsistence variables represents the best model for (1) correctly categorising the *known* eHRAF cases—with 84% of the *known* classified correctly; and (2) classifying the *unknown* north-west European archaeological site-phases in terms of a percentage probability of reflecting an imagistic or a doctrinal mode culture. The next most appropriate model was the GLM based on the social complexity variables (with an AUC indicating that 79% of the *known* eHRAF cases were classified correctly). The next most appropriate model was the GLM based on the variables identified following PCA of the entire north-west European archaeological database (with an AUC indicating that 77% of the *known* eHRAF cases were classified correctly). The identified ritual variables produced the least appropriate model with an AUC indicating that 74% of the *known* eHRAF cases were classified correctly. From the

ROC curves created for each GLM, we can state that, when tested on the *known* eHRAF cultures, the set of PCA identified subsistence variables represent the best set of variables that can be applied to the sample of north-west European archaeological site-phases to predict and classify the them in terms of the two modes of religiosity.

7.6 Percentage probability classifications

7.6.1 Percentage probability classification of known eHRAF cultures based on the subsistence variables identified via PCA of the north-west European site-phases

A GLM based on the subsistence variables extracted via the PCA of the north-west European site-phases was used to generate the percentage probability that each of the *known* eHRAF culture was classified in terms of the two modes. The GLM based on the PCA identified set of subsistence variables was used as, when all the potential models were examined via ROC curves, it was identified as the most *fit for-purpose* predictor model (section 7.4.2 and 7.5.5). This approach enabled us to (1) examine in more detail the extent to which the most *fit for purpose* model (using the archaeologically recorded subsistence variable) classified the *known* imagistic and doctrinal cultures; (2) identify which eHRAF cultures would be misclassified using the subsistence variable recorded from the north-west European site-phases.

From the GLM output we can see that 53% the imagistic cultures were correctly classified and 95% of doctrinal cultures were categorised correctly. Of the 15 imagistic cultures, eight (53%) were correctly classified as imagistic with high percentage probabilities (Table 7.7). The Andamans provides us with an example of a culture that was correctly classified as imagistic with a 100% probability, based on the subsistence variables identified via the PCA of the north-west European site-phases (Table 7.7). Two of the imagistic (13.3%) cultures were classified as indeterminate; these were the Tiv with a 52% probability of being a doctrinal culture and the Ojibwa with a 58% probability of reflecting a doctrinal culture. A total of five of the imagistic cultures

(33.3%) were categorised as doctrinal cultures; Banyoro, Hausa, Dogon, Wolof and Eastern Toraja (Table 7.7). The Hausa, Dogon, Wolof and Eastern Toraja produced a result showing a 67% probability of these cultures being doctrinal. The Banyoro culture was misclassified as a doctrinal culture with a high percentage probability (72%). It is interesting to note that when the GLM was performed using the subsistence variables identified via the PCA of the south-west Asian site-phases, the same five imagistic cultures were misclassified as doctrinal, with similar percentage probabilities (section 7.4.1). In section 7.4.1, the Banyoro, Hausa, Dogon, Wolof and Eastern Toraja were misclassified with a 65% probability of these cultures representing doctrinal cultures and the Banyoro culture was misclassified as a doctrinal culture with 73% probability. In addition, the Hausa and Wolof cultures were classified as indeterminate when GLMs were performed based on the ritual and the combination of variables identified from PCA of the eHRAF cultures (sections 7.2.1, 7.2.2). Only one of the doctrinal cultures was misclassified as an imagistic culture. This misclassified doctrinal culture was the Guaraní; for which the GLM produced a result indicating an 80% probability of this culture being an imagistic culture (Table 7.7). The Guaraní culture was misclassified when GLM was performed based on (1) the subsistence variables identified from the PCA of the south-west Asian site-phases; and (2) all the variables from the analysis of the eHRAF cultures (sections 7.2.2 and 7.4.2). Also, the Guaraní culture was recorded as an overlapping culture when MDS and PCA were performed based on the subsistence variables and the combination of all variables, for the eHRAF cultures (Chapter 4, sections 4.1 and 4.3). The remainder of the cultures were classified correctly as doctrinal or imagistic [after Atkinson and Whitehouse (2011)] (Table 7.7).

The GLM demonstrates that the percentage probability of a culture being doctrinal or imagistic can, to a great extent, be predicted correctly based on the identified subsistence variables from the PCA of the north-west European archaeological site-phases. This result, in combination with the received ROC curve, demonstrates that the GLM model is

fit for purpose and can be applied to the north-west European archaeological site-phases to generate a percentage probability that each archaeological site-phase represents an imagistic or doctrinal culture.

Table 7:7: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the subsistence variables identified via PCA of the European archaeological site-phases

eHRAF culture	Original mode classification #	GLM classification	% probability	Percentage Error
Banyoro	Imagistic	Doctrinal	72%	+/- 3.77%
Lozi	Imagistic	Imagistic	84%	+/- 1.49%
Hausa	Imagistic	Doctrinal	67%	+/- 3.29%
Dogon	Imagistic	Doctrinal	67%	+/- 2.28%
Tiv	Imagistic	Indeterminate	52% Doctrinal	+/- 2.28%
Wolof	Imagistic	Doctrinal	67%	+/- 7.29%
Andamans	Imagistic	Imagistic	100%	+/- 0.00%
Eastern Toraja	Imagistic	Doctrinal	67%	+/- 2.28%
Ojibwa	Imagistic	Indeterminate	58% Doctrinal	+/- 3.33%
Aranda	Imagistic	Imagistic	98%	+/- 1.40%
Kapauku	Imagistic	Imagistic	71%	+/- 2.74%
Jivaro	Imagistic	Imagistic	80%	+/- 1.08%
Tukano	Imagistic	Imagistic	80%	+/-1.70%
Yanoama	Imagistic	Imagistic	80%	+/- 1.70%
Bororo	Imagistic	Imagistic	80%	+/- 1.70%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

Table 7:7: GLM output showing percentage probabilities and mode classification for eHRAF cultures based on the subsistence variables identified via PCA of the European archaeological site-phases (Continued)

eHRAF culture	Original mode classification #	GLM classification	% probability	Percentage Error
Somali	Doctrinal	Doctrinal	72%	+/- 6.61%
Lepcha	Doctrinal	Doctrinal	67%	+/- 4.29%
Korean	Doctrinal	Doctrinal	67%	+/- 2.20%
Iban	Doctrinal	Doctrinal	67%	+/- 3.20%
Ifugao	Doctrinal	Doctrinal	67%	+/- 4.20%
Central Thai	Doctrinal	Doctrinal	88%	+/- 3.29%
Bosnian Muslim	Doctrinal	Doctrinal	67%	+/- 2.29%
Palestinians	Doctrinal	Doctrinal	67%	+/- 3.29%
Iroquois	Doctrinal	Doctrinal	67%	+/- 2.20%
Seminole	Doctrinal	Doctrinal	77%	+/- 3.32%
Pawnee	Doctrinal	Doctrinal	92%	+/- 4.22%
Croats	Doctrinal	Doctrinal	74%	+/- 1.29%
Hopi	Doctrinal	Doctrinal	92%	+/- 3.32%
Trobrianders	Doctrinal	Imagistic	92%	+/- 2.77%
Tikopia	Doctrinal	Doctrinal	92%	+/- 5.77%
Tongan	Doctrinal	Indeterminate	67%	+/- 3.26%
Saramaka	Doctrinal	Doctrinal	86%	+/- 4.22%
Aymara	Doctrinal	Doctrinal	67%	+/- 3.29%
Guaraní	Doctrinal	Imagistic	80%	+/-1.08%

#Original Mode Classification after (Atkinson and Whitehouse 2011)

7.6.2 Percentage probability classification of the north-west European archaeological site-phases based on Identified subsistence variables

As in section 7.5.1, a GLM based on of the subsistence variables extracted via the PCA of north-west European site-phases was used to generate the percentage probability for each site-phase reflecting an imagistic or doctrinal culture. As explained in the previous section, this GLM was used as, when all the potential models were examined via ROC curves, it was identified as the most *fit for-purpose* predictor model (section 7.5.2). The subsistence variables identified following PCA analysis of the north-west European site-phases were applied in a GLM matrix containing the *known* eHRAF cultures and the *unknown* north-west European archaeological site-phases. The *known* ethnographic cultures were used in the GLM matrix to classify the north-west European archaeological data as doctrinal or imagistic based on the subsistence variables identified. Using the method of maximum probability, the GLM yielded a percentage probability (of reflecting a doctrinal or imagistic mode) for each north-west European archaeological site-phase. The GLM provides output (Table 7.9) that shows:

1. the archaeological site-phase;
2. the archaeological period;
3. the percentage probability of that site-phase being a representative of the particular mode of religiosity; and
4. the percent error given by the GLM

7.6.3 Additional model testing using a half-normal Q-Q plot

In addition to the ROC curve, the predictor model (GLM) using the identified subsistence variables was further tested using a half-normal Q-Q plot (Figure 7.15). To examine and verify the ability of the model to use the identified subsistence values to classify the *unknown* archaeological site-phases, a half normal Q-Q plot was generated for the model using the method described by Collett (2003); providing us with a formal diagnostic assessment of the models' *goodness of fit*. In the half normal Q-Q plot (Figure 7.15) all the simulated points lie within the 95% confidence envelope and, for the most part, are

close to the mean line. Also, none of the simulated pints are outliers. The half normal Q-Q plot has demonstrates that the GLM using the subsistence variables is *fit for purpose* to classify the *unknown* archaeological site-phases in terms of the two modes.

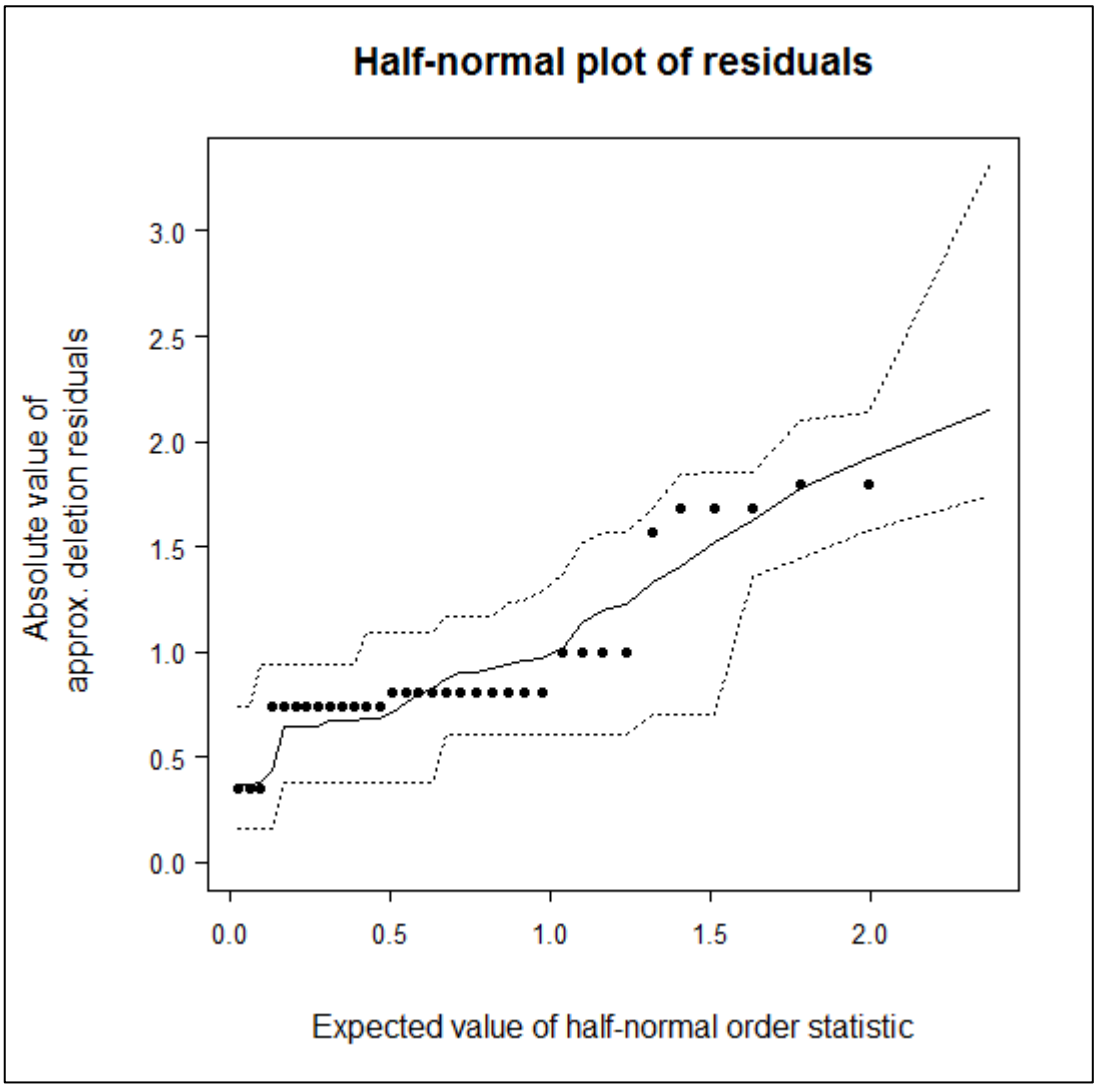


Figure 7:15: Half-normal Q-Q plot for the GLM of the European site-phases based on the identified subsistence variables

7.6.4 GLM output results

The result from the GLM (Tables 7.8, 7.9 and Figure 7.16) shows that all 15 of the Mesolithic site-phases (100%) were classed as imagistic. Moreover, all of the Mesolithic site-phases indicated particularly high percentage probabilities of being imagistic; with 12 site-phases (80%) providing us with an extremely high percentage probability of representing an imagistic culture (98% or above), based on the identified subsistence variables (Table 7.9). Examples include Early Mesolithic Mount Sandel and Late

Mesolithic Bjørnsholm. The overall result indicates that the Mesolithic site-phases recorded reflect cases in which the subsistence evidence is similar to that of the imagistic cultures identified in the eHRAF dataset (Atkinson and Whitehouse 2011). Of the 27 Neolithic site-phases, 15 (56%) were classed as doctrinal cultures and 9 (33%) as imagistic (Tables 7.8, 7.9 and Figure 7.16). A total of three (11%) of the Neolithic site-phases were categorised as indeterminate (as their percentage probability were in the 40 to 59% range). In terms of sub-periods we can see, from Tables 7.8, 7.9 and Figure 7.16, that of the Early Neolithic site-phases, eight (57%) were identified as doctrinal, five (36%) of the Early Neolithic site-phases were identified as imagistic and one (7%) of the Early Neolithic site-phases was categorised as indeterminate. Of the ten Middle Neolithic site-phases, five (50%) were identified as doctrinal, three site-phases (30%) were identified as Imagistic and two site-phases (20%) were categorised as indeterminate (Table 7.9). All of the Late Neolithic site-phases were identified as doctrinal. A total of six (22%) of the Neolithic site-phases provide us with high percentage probabilities of being imagistic (Table 7.9). The site-phases with a high percentage probabilities of being imagistic were; three of the Early Neolithic site-phases and three of the Middle Neolithic site-phases. Examples include:

1. Early Neolithic phases Clowanstown 1 (F11/F22): with has a 96% probability for the site-phase representing an imagistic culture (Table 7.9).
2. Middle Neolithic Lindebjerg which has an 88% probability of the site-phase representing an imagistic culture (Table 7.9).

A total of 4 (15%) of the Neolithic site-phases resulted in a high percentage probability of being a doctrinal culture—one Early Neolithic and three Middle Neolithic site-phases. The site-phases with high percentage probabilities of being doctrinal include:

1. Early Neolithic Ballintaggart which has a 96% probability of the site-phase representing a doctrinal culture.

2. Middle Neolithic Sarup III which indicates an 82% probability of the site-phase representing a doctrinal culture.
3. Middle Neolithic Brú Na Bóinne Complex which indicates a 82% probability of the site-phase representing a doctrinal culture.

Table 7:8: percentages and numbers of European sites-phases classed via the GLM based on the identified subsistence variables

Period	% of site-phases classed as imagistic	No. classed as imagistic	% of site-phases classed as doctrinal	No. classed as doctrinal
Early Mesolithic	100%	2	0%	0
Middle Mesolithic	100%	2	0%	0
Late Mesolithic	100%	11	0%	0
Early Neolithic	36%	5	57%	8
Middle Neolithic	30%	3	50%	5
Late Neolithic	0%	3	100%	0

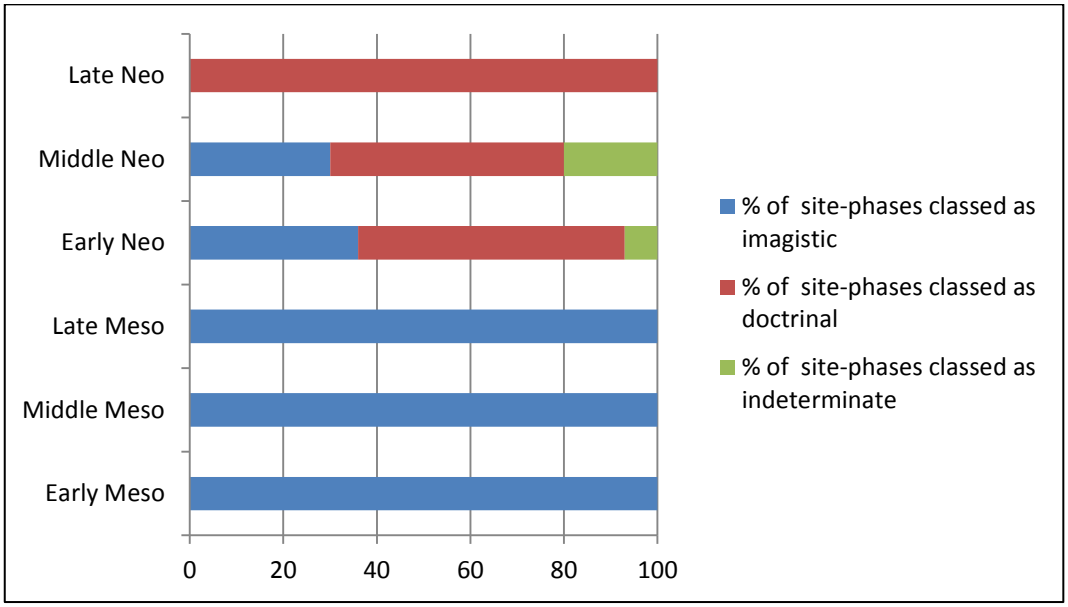


Figure 7:16: percentages of European sites-phases classed via the GLM based on the identified subsistence variables

Table 7:9: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of the European archaeological site-phases

Site	Phase	Sub- Phase	GLM Classification	% Probability	Percentage Error
Lough Boora	Mesolithic	Early Mesolithic	Imagistic	98%	+/- 0.00%
Mount Sandel	Mesolithic	Early Mesolithic	Imagistic	99%	+/- 0.30%
Tågerup	Mesolithic	Middle Mesolithic	Imagistic	88%	+/- 1.91%
Vedbaek	Mesolithic	Middle Mesolithic	Imagistic	98%	+/- 1.00%
Bjørnsholm	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Norsminde	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Stranvägen	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Tågerup	Mesolithic	Late Mesolithic	Imagistic	90%	+/- 1.71%
Vedbaek	Mesolithic	Late Mesolithic	Imagistic	90%	+/- 1.71%
Tybrind Vig	Mesolithic	Late Mesolithic	Imagistic	100%	+/- 0.00%
Skateholm II	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Skateholm I	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Clowanstown 1	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Gortore	Mesolithic	Late Mesolithic	Imagistic	90%	+/- 1.71%
New Ferry	Mesolithic	Late Mesolithic	Imagistic	98%	+/- 1.00%
Bjørnsholm	Neolithic	Early Neolithic	Imagistic	67 %	+/- 0.67%
Norsminde	Neolithic	Early Neolithic	Imagistic	67%	+/- 0.67%
Mosegården	Neolithic	Early Neolithic	Doctrinal	76%	+/- 7.59%
Sarup I	Neolithic	Early Neolithic	Doctrinal	76%	+/- 9.61%
Gransha (site 11 & 12)	Neolithic	Early Neolithic	Doctrinal	72%	+/- 9.35%
Ballintaggart	Neolithic	Early Neolithic	Doctrinal	96%	+/-7.26%
Brú Na Bóinne Complex	Neolithic	Early Neolithic	Doctrinal	52%	+/- 9.61%

Table 7.9: GLM output showing percentage probabilities and mode classification for the south-west Asian site-phases based on the subsistence variables identified via PCA of the European archaeological site-phases (continued)

Site	Phase	Sub- Phase	GLM Classification	% Probability	Percentage Error
Clowanstown 1 (Peat Layer F11/F22)	Neolithic	Early Neolithic	Imagistic	98%	+/- 1.00%
Clowanstown 1	Neolithic	Early Neolithic	Imagistic	93%	+/- 6.70%
Gortore	Neolithic	Early Neolithic	Imagistic	90%	+/- 1.91%
Ballynagilly	Neolithic	Early Neolithic	Imagistic	69%	+/- 3.07%
Tankardstown	Neolithic	Early Neolithic	Indeterminate	52%	+/- 7.00%
Ceide Fields System	Neolithic	Early Neolithic	Doctrinal	71%	+/- 0.67%
Carrowmore	Neolithic	Early Neolithic	Doctrinal	73%	+/- 6.10%
Karlsfält	Neolithic	Middle Neolithic	Indeterminate	52%	+/- 4.80%
Grøbygard	Neolithic	Middle Neolithic	Doctrinal	94%	+/- 6.86%
Sarup II	Neolithic	Middle Neolithic	Doctrinal	71%	+/- 6.17%
Sarup III	Neolithic	Middle Neolithic	Doctrinal	82%	+/- 8.24%
Lindebjerg	Neolithic	Middle Neolithic	Imagistic	88%	+/- 2.20%
Tustrup	Neolithic	Middle Neolithic	Doctrinal	65%	+/- 6.51%
Ferslev	Neolithic	Middle Neolithic	Imagistic	90%	+/- 1.72%
Ashley Park	Neolithic	Middle Neolithic	Imagistic	83%	+/- 1.91%
Poulnabrone	Neolithic	Middle Neolithic	Indeterminate	52%	+/- 4.80%
Brú Na Bóinne Complex	Neolithic	Middle Neolithic	Doctrinal	82%	+/- 5.24%
Lyles Hill	Neolithic	Late Neolithic	Doctrinal	83%	+/- 2.74%
Lough Gur	Neolithic	Late Neolithic	Doctrinal	73%	+/- 5.24%
Brú Na Bóinne Complex	Neolithic	Late Neolithic	Doctrinal	68%	+/-2.74%

In relation to the hypothesis central to this thesis, the percentages generated via the GLM based on the PCA identified subsistence variables appear to show a general shift from an imagistic to a more doctrinal mode of religiosity associated with the agricultural transition in north-western Europe. The GLM shows that 100% of the Mesolithic site-phases were categorised as imagistic cultures (Tables 7.8 and 7.9). As the agricultural transition progresses we can observe a decrease in imagistic classifications and an increase in doctrinal classifications for the site-phases. The highest percentage of doctrinal classifications occurs in the Late Neolithic site-phases; this set of classifications is interesting as this period is connected with increased consolidation of resources, more intensive agriculture and the spread of megalithic monuments in north-western Europe (Whittle 1996; Bradley 2003; Cooney 2007). As with the GLM analysis of the south-west Asia site-phases, the result from the north-western Europe dataset parallels the change from hunter-gathering to agriculture directly associated with the agricultural transition. As the set of *known* eHRAF cultures were used in the GLM matrix to classify the *unknow*n archaeological site-phases, the results are, potentially, indicative of a connection between the imagistic and doctrinal modes and the subsistence strategy employed by a community. This may indicate that a central element of the agricultural transition relates to social cohesion generated through more doctrinal rituals. The relationship between subsistence strategy and the modes is discussed in Chapter 8.

7.7 Conclusions

7.7.1 Sets of variables as predictors

The GLMs and their associated ROC curves demonstrated some differences between the groups of predictor variables employed. It was demonstrated that, for the ethnographic sample, a GLM based on a combination of variables identified via PCA of the eHRAF cultures (Chapter 4, section 4.3.4) (Table 7.10) was the most *fit for-purpose* model for correctly predicting/indicating mode of religiosity. However, it should be noted that (1) the GLM based on the subsistence was the next most *fit for purpose* model; and (2) the

GLM based on all variables shared 80% of the variability of the GLM based on the subsistence variables (section 7.1.5). This result indicates that the subsistence variables, also, represent a good set of predictor variables in the *known* eHRAF cases (Table 7.10). The GLM based on the social complexity variables showed a good degree of appropriateness (with an AUC showing 77% of cases classed correctly). The GLM using ritual variables was recorded as the least suitable model; however, with an AUC showing 75% of cases classed correctly, this still represents a *fit for-purpose* model.

For the south-west Asian site-phases, it was demonstrated that the GLM based on the set of PCA identified subsistence variables represented the most *fit for-purpose* model for predicting the mode of religiosity (with an AUC showing 78% of cases classed correctly); followed by the GLM based on the PCA identified variables following the analysis of the entire database. The GLM based on the ritual variables was identified as the least appropriate model (with an AUC showing 59% of cases classed correctly, when applied to the *known* eHRAF cultures). Similarly, for the north-west European archaeological sample, the GLM based on subsistence variables was identified as most appropriate model for predicting mode of religiosity (with an AUC showing 84% of cases classed correctly, when applied to the *known* eHRAF cultures). The GLM based on the ritual variables was recorded as the least appropriate model (with an AUC showing 74% of cases classed correctly). Although the GLM utilizing the European ritual variables was noted as the least appropriate model, the use of the ritual variables resulted in a more *fit for purpose* model than the GLM based on the south-west Asian ritual variables. In relation to the ritual variables, the ROC results show that, in the absence of ritual frequency and dysphoric arousal level information: (1) the identified ritual variables resulted in a *fit for purpose* GLM for the ethnographic cultures, verifying that the ritual material correlates are a good predictor of the mode of religiosity; (2); the identified ritual variables resulted in a *fit for purpose* GLM for the north-west European site-phases; and (3) the identified ritual variables proved to be a less appropriate predictor of mode of

religiosity in the context of the south-west Asian archaeological datasets—compared to the eHRAF and European datasetss. Interestingly, the sets of identified ritual variables resulted in the lowest AUC and the least *fit for purpose* GLM for the eHRAF and both archaeological datasets—probably, indicating the importance of ritual frequency and arousal in distinguishing between the two modes. The ROC curves clearly demonstrated that GLMs based on the subsistence variables represent the most *fit for purpose* models for the archaeological datasets. The analysis showed that the identified subsistence variables rather than ritual variables appear to provide us with the best sets of variables to examine mode of religiosity in the recorded archaeological site-phases for south-west Asia and north-western Europe; this is an issue that I will develop in the discussion Chapter.

A number of ethnographic cultures were misclassified when the GLMs were performed for each of the three datasets. More specifically, three ethnographic cultures were repeatedly misclassified when the GLMs were performed—the Banyoro (imagistic), the Eastern Toraja (imagistic) and the Guaraní (doctrinal). The Banyoro culture was classified as an imagistic culture based on the frequency and arousal level of their rituals (Atkinson and Whitehouse 2011). However, their economy is focused on agriculture, with the majority of Banyoro considered sedentary farmers. Thus, it is their subsistence practices that are, mainly, the cause of the misclassification as doctrinal. The Eastern Toraja are sedentary dry rice cultivators that live in villages of 40 to 200 inhabitants. The Eastern Toraja engage in a number of "imagistic" ritual practices such as secondary burial practices. However, their religion reflects a number of prescribed practices associated with a number of well-defined Gods. Eastern Toraja religion is directly associated with agriculture practices; seasonality and agricultural yields. The Eastern Toraja engage in large-scale construction tasks such as barns for storage and temples. It is probable that a combination of their intensive rice-based agricultural system and the organised nature of their religion that is responsible for their misclassification as doctrinal. Lastly, the

Guaraní culture's subsistence practices are responsible for it being misclassified as imagistic. For instance, their mixed subsistence strategy includes hunting as the prime method of adding meat to their diet—their reliance on hunting is a factor that results in the Guaraní culture being classified as imagistic. The reliability of subsistence as a predictor of mode of religiosity in relation to all three datasets add support (in the context of the archaeological evidence recorded in this research) to the assertion by Atkinson and Whitehouse (2011) regarding the relation between the modes of religiosity and subsistence practices.

In relation to the hypothesis central to this thesis, the percentages generated via the GLMs based on the sets of subsistence variables point to a a shift from an imagistic to a more doctrinal mode of religiosity in association with the agricultural transition in both south-west Asia and north-western Europe. While the results for the south-west Asian and the north-west European data suggest similar shifts in religious mode across the agricultural transition, the possible dynamics of the transition in each region will be discussed in Chapter 8.

Chapter 8: Discussion

8 Introduction

The hypothesis central to this research is that the solidarity generating effect of ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in south-west Asia and north-west Europe. This chapter discusses first the limitations and strengths of the methodology presented in this thesis as a framework for examining the modes of religiosity theory in the context of the archaeology of the agricultural transition. Secondly, this chapter interprets and contextualises the results from the statistical analysis of the ethnographic and archaeological datasets in order to discuss their implications for the central hypothesis. Thirdly, this chapter discusses the connection between the imagistic and doctrinal modes and social cohesion across the Neolithic transition, drawing on the wider cognitive literature as well as discussion of "Neolithic religion" in both study regions.

8.1 Assessment of the methodological approach

8.1.1 Limitations of the approach

The limitations and biases associated with data collection and analysis in cross-cultural studies have been discussed by a number of researchers (Naroll 1956; 1967; 1965; Mace *et al.* 1994; Postgate *et al.* 1995; Levinson and Malone 2000; Nettle 2009; Denton 2007; Dobson and Gelade 2012; Powell 2012; Currie 2013; Pollet *et al.* 2014). For example, the use of limited analogy to draw inference has been highlighted as a major methodical issue in cross-cultural research (Murdock 1949; Naroll 1965, 1967, 1965; Ross and Homer 1976; Lagacé 1979; Baines 1983; Mace *et al.* 1994; Postgate *et al.* 1995; Levinson and Malone 2000; Nettle 2009; Denton 2007; Dobson and Gelade 2012; Powell 2012; Currie 2013; Mullins 2014; Pollet *et al.* 2014). The problem of limited analogy centres on the use of observations recorded in the context of a limited set of cultures or a specific culture

and application of models developed from the recorded observations to other cultures. To avoid the problem of limited analogy, Levinson and Malone (2000) advocate the integrated use of large data sources and statistics for the purpose of hypothesis testing in cross-cultural research.

Similarly, Pollet *et al*. (2014) highlight the limitations associated with the *ecological fallacy*, which can have an effect on the results generated from cross-cultural research. The ecological fallacy occurs when statistical patterns recorded at one level of analysis are presumed to generalize to other levels of analyses. For example, the ecological fallacy becomes relevant if particular cultural practices, identified as statistically significant in relation to a culture in a specific geographical region, are assumed to be equally important practices in cultures from other geographic regions. Statistical non-independence or *Galton's Problem* has been identified as another potential limiting factor in cross-cultural research (Naroll 1965; Ross and Homer 1976; Mace and Pagel 1994; Herkenrath 2002; Eff 2004; Nettle 2009; Pollet *et al.* 2014). Statistical non-independence is a product of shared culture between groups within larger geographical clusters, for historical or socio-cultural reasons. For example, because of shared history, cuisine and language, it is suggested that a geographical cluster of North Americans may be more similar to a cluster of Europeans than to sub-Saharan Africans (Pollet *et al.* 2014). Issues resulting from limiting factors such as the ecological fallacy and non-independence of observations can affect the degree to which inferences can be made based on observations and results from cross-cultural studies. However, the effects of limiting factors such as the ecological fallacy and statistical non-independence can be addressed by (1) designing or using existing databases that cover data on multiple levels [including individual and macro level cultural data (such as environmental information)]; and (2) recording data in a standardized manner from a wide range of global cultures and across different points in time (*Ibid*). There are a number of common potential biases in research using archaeologically recovered material culture (Binford 1964; Beck and Jones 1989; Taylor

2000). These include biases resulting from limited access to archaeological sites, biases towards areas of popular interest over time and bias as a result of the lack of recovery of perishable materials.

Apart from these more general biasing factors associated with cross-cultural ethnographic and archaeological studies, there are specific potential limiting factors that relate to this research project and its design. For instance, a number of authors have commented on limitations associated with cognitive approaches in archaeology (Abarmuik 2012). For example, Searle (1984) suggests that at the base of cognitive models are analogies between the human mind and computers. Searle (1984) argues that proponents of cognitivism characterises the brain at the level of its function as an information processing system, rather than at the level of conscious mental states. Many social scientists consider cognitive models as a way to understand the relationship between the mind and the brain—analogous to the relationship between computer programmes and computer hardware, and that cognitivism hastily attempts to equate the human mind to the latest technology—in this case computer hard ware.

In the context of examining 111 archaeological site-phases for this project, a central problem encountered was variation in available material culture among site-phases due to factors such as (1) the extent of the excavation and reporting; (2) the material identified and recorded; (3) the preservation at site-phases; and (4) the type of site-phase excavated (permanent settlement, base camp, small-scale site and mega-site). For example, in the context of the Irish Mesolithic, there are a limited number of sites with settlement and subsistence information but ritual data are often absent. In relation to the Neolithic in south-west Asia, what could be considered as 'cultural' discrepancies were also encountered; whereas Çatalhöyük has yielded a lot of ritual evidence as well as subsistence and social complexity data, another central Anatolian site, Asliki Höyük, has yielded good subsistence evidence but little pertaining to ritual. Perhaps the most important limiting factor is that ritual activity is difficult to access in the archaeological

record (as outlined in Chapter 2, section 2.5.2). Moreover, as this study centres on examining modes of religiosity across the agricultural transition, a more specific limiting factor associated with the archaeological component in this study was that ritual frequency and dysphoric arousal are difficult to discern in prehistoric archaeological contexts (Chapter 2, section 2.4.2 and Chapter 3, section 3.7.4). Following the pilot study, it was decided to employ a targeted sampling approach to generate as large a sample as possible by utilising (1) a specific set of material correlates grounded in eHRAF data; (2) a sample of well published and researched site-phases; and (3) a select number of sites that had evidence of occupation from a number of cultural phases—for example, Mureybit, which presented archaeological evidence of human activity for the Epipalaeolithic, PPNA and PPNB periods.

As with any cross cultural study, there are inherent limitations in relation to the sets of variables used in this study. As this research sought to integrate a sample of 34 eHRAF cultures and a sample of 111 archaeological site-phases from across the agricultural transition, there were a number of limitations associated with the variables that could be used. Given the requirement to achieve an integrated archaeological and ethnographic material correlates approach, it was necessary to identify sets of ritual, subsistence and social complexity material correlates that could be utilised in statistical analysis—particularly in an integrated GLM. To achieve this goal the research was limited to relatively generalised variables—for example, I used hunting in general as opposed to hunting particular taxa.

Since ritual frequency and arousal level data (used to for the *known* eHRAF) could not be used to examine ritual behaviour in the archaeological samples, alternative material correlates were used. This limitation may help to explain why the ritual variables did not result in the most appropriate GLMs for correctly classifying the *known* eHRAF samples as imagistic or doctrinal. The "weakness" of the GLM results using the ritual variables is a direct reflection of the ritual variables used in this research: variables that are quite

generalized but accessible in the context of a meta-analysis of 111 site phases to be integrated with ethnographic material.

Other limitations, discussed in chapter 3 section 3.6, are associated with estimating population size in archaeology. For instance, a range of potential methods have been presented for the purpose of estimating population sizes and modelling the demographics of archaeological populations based on different information available in the archaeological record. As population size represented a potential manner to explore the mode of religiously across the agricultural transition, it was necessary to estimate population size for the site-phases used in this research. For this reason, it was necessary to use a standardized population calculation method that would work for all the samples. The main potential limitations of population estimation in the research were:

(1) the difficulty in establishing a cross-cultural population estimation method

(2) identifying factor(s) that should be utilised to estimate population

(3) defining a site or given area used by a population

(4) estimating population given the extent of a site-phase excavated and surveyed

(5) distinguishing between population and community. For example, in hunter-gatherer groups, the site-phase surveyed and excavated may reflect a base camp but the group at this site may only represent a fraction of the wider community.

Both local population and the wider network are important in relation to the modes theory. However, as outlined previously, I used local population at a site-phase as (1) it is accessible in the archaeological data and (2) population networks at a site-phase level are important factors in relation to the modes theory as establishing a connection between the size of the population engaged in a particular set of ritual practices and associated with certain subsistence practices and levels of social complexity the enable us to comment on

the potential expressions of the imagistic or doctrinal modes in different populations facing different collective action problems.

As outlined in Chapter three, section 3.6, to estimate the population for each site-phase, it was decided to concentrate on the mathematical relationship between population size and site area, and to use site population size as an estimate of community size—with area taken to be the dated excavated, surveyed and reported upon occupation/settlement area in the sources, not just the areas of the excavation trenches. There are limitations with this approach as it does not enable us to consider the entire, extended community and it is dependent on extrapolation from the area of the site-phase excavated and surveyed.

Despite these limitations, the population estimation method proved feasible in relation to each site-phase (and the eHRAF cultures) and provides a method for comparing many site-phases across a region or between regions. Relating population to the estimated area of site-phase (exacted and surveyed rather than just the excavated trenched) involved minimal assumptions about agents interacting in terms of a larger community network. To compensate for this limitation regarding population, this thesis did examine evidence of exchange networks at each site-phase (appendix 1). It is important to note that the method for estimating population (the two formulae) were checked in relation to (1) the population size estimates provided by the literature for the archaeological site-phases and (2) the recorded ethnographic information regarding population estimates in a given area supplied for via the eHRAF database (as demonstrated in chapter 3 section 3.6). In this sense, a uniform and usable method for estimating population was archived in relation to the 111 site-phase that were utilized in this research. However, it is accepted that there are a number of limitation associated with using this general method of population estimation that could be avoided by building a larger social network analysis and modelling project.

A key result of this research is that subsistence variables proved to be the best predictors of mode of religiosity for the eHRAF cultures, using material correlates that were broadly

accessible archaeologically. The subsistence variables identified in both archaeological datasets produced fit for purpose GLMs when applied to the *known* eHRAF cultures, with 78% correctly classified (south west Asian variables) and 84% correctly classified (north-west European variables). The subsistence variables identified in the eHRAF dataset produced a fit for purpose GLM for the *known* eHRAF cultures (with 80% correctly classified) and a set of subsistence variables proved to be a major component of the most fits for purpose model for the *known* eHRAF cultures, the set of variables identified following PCA of the entire eHRAF dataset (Chapter 4 section 4.3.4). Canonical correlation analysis demonstrated that the correlation between the identified subsistence variables set of variables in the most fit for purposed model have 80% of variance in common—thus, the two sets of variables are highly correlated as they contain much of the same information (Chapter 7 section 7.1.5). The connection between the two modes of religiosity and subsistence practices is predicted by Whitehouse (2000; 2004), while linkages between the doctrinal mode and agriculturalists are identified in cross-cultural samples by Atkinson and Whitehouse (2011) and Whitehouse *et al.* (2015).

Apart from delineating between hunter-gatherers and agriculturalists in the archaeological datasets (which was expected in the context of the agricultural transition), this result supports a connection between subsistence evidence and religious mode in a *known* sample of imagistic and doctrinal cultures. The association between subsistence strategy and the modes aligns with previous predictions and assertions, a point that will be discuss in more detail in sections 8.6-8.8. However, it must be noted that the absence of equally or more successful GLMs based on ritual and/or social complexity variables means that subsistence itself becomes the argument for a shift in religious mode. A stronger argument could be advanced if there were other grounds, independent of subsistence itself, for a change in religious mode.

8.1.2 Advantages of the approach

8.1.2.1 General Advantages

Nevertheless, there are a number of advantageous or innovative elements to this research. Cognitivism has become an important tool in archaeology. The potential of cognitive archaeology in relation to our interpretation of the archaeological record is due to the crucial need to find models to explain the emergence of and use of unique aspects of human culture such as language, symbols and religious behaviour. Cognitive archaeology can be seen as a continuation of the multi-disciplinary nature of archaeology (Nowell 2001; Abramuik 2012). Archaeology has a long history of incorporating theories, data and methodologies from other disciplines. Cognitive archaeology uses material culture to both describe and understand the emergence of human culture. Crucial to the study of human culture is the development of modern cognitive abilities. Therefore, to investigate culture, it is essential that we develop and examine various cognitive models. One of the critiques of cognitive archaeology is that it is considered as a logical successor to processualism (Nowell 2001; Abramuik 2012) and that the goals of cognitive archaeology have little in common with the goals of post-processualism. However, processualism (generally) ignores the thought processes behind behaviours; processualist models are limited by the fact that they do not account for people's thoughts (Hodder 1982; Miller and Tilley 1984; Earle and Preucel 1987; Renfrew 1994; Johnson 1999; Thomas 2000; Hodder and Hutson 2003; Trigger 2006; Abramuik 2012). It is a contention of this research that cognitive archaeology offers a means of exploring human thoughts while retaining the essential components of the processual approach such as scientific objectivity. Similar to the view espoused by Flannery and Marcus (1993), its contention is that cognitive archaeology can be seen as common ground between both processual and post-processual approaches.

A number of aspects of this research project were designed to limit the potential problems and biases associated with cross-cultural ethnographic and archaeological research. In the

design of this project, it was decided to incorporate specific suggestions that have been proposed to improve the sampling and analysis strategies in cross-cultural research (Naroll 1965, 1967, 1965; Ross and Homer 1976; Lagacé 1979; Baines 1983; Ember and Otterbein 1991; Mace *et al.* 1994; Postgate *et al.* 1995; Levinson and Malone 2000; Herkenrath 2002; Eff 2004; Denton 2007; Ember and Ember 2009; Nettle 2009; Dobson and Gelade 2012; Powell 2012; Currie 2013; Pollet *et al.* 2014; Mullins 2014). For instance, Ember and Ember (2009) propose implementing a rigorous level of methodological consistency when engaging in large-scale cross-cultural research. They assert the necessity to collect a multitude of samples from different cultures and locations for the purpose of designing and performing systematically and statistically verifiable cross-cultural research and hypothesis testing. In relation to the problems of bias, Levinson and Malone (2000) suggest that research engaging in hypothesis testing using large-scale, cross-cultural datasets is inherently more objective than traditional ethnographic accounts as the person testing the theory or hypothesis and the original data collector are different individuals; taking this approach removes any subjectivity that could, potentially, affect the data collection process. In addition, Levinson and Malone (2000) advocate the use of large data sources (such as the eHRAF) for the purpose of diminishing the effect of subjectivity in relation to hypotheses testing using cross-cultural material.

Taking into account the suggestions by both Ember and Ember (2009) and Levinson and Malone (2000), specific sample selection, targeted data recording and analysis were essential criteria when designing this research project (to control for potential biases and limitations). Thus, the methodology central to this research included (1) standardising the data recording process for all samples, as much as possible; (2) using the eHRAF cross-cultural sample and archaeological samples (representing two different agricultural transitions), to get as large sample as was practical; and (3) using three separate but related multivariate statistical methods to test the specific hypothesis.

8.1.2.2 Specific Advantages

One of the advantages of this research is that a pilot study was carried out in its early stages to identify relevant material correlate variables that could be utilised to incorporate the archaeological and the eHRAF samples. The pilot study demonstrated that sets of ritual, subsistence and social complexity variables could be employed to examine ritual activity (i.e. mode) in the absence of frequency and arousal level. By engaging in the pilot study at the early stage of this research a number of decisions we taken to limit the potential bias associated with engaging in a study of ritual material culture. For example, to compensate for limitations regarding of ritual material culture in the Irish Mesolithic, a number of southern Scandinavian Mesolithic sites were added to the project. Through the pilot study, a set of ritual material correlate variables (other than frequency and arousal level) were identified that could be examined in the *known* eHRAF cultures and the *unknown* archaeological samples. The pilot study also informed the strategy for estimating population in a multi-site-phase project. The end result of the pilot study was the decision to implement the material correlates approach outlined in Chapter 2, section 2.4.2. However, the longer-term goal of this research is to engage in a *big data* (e.g. Varian 2014) study incorporating substantially more ethnographic material to identify a broader range of useful material correlates, along with an expanded set of archaeological site-phases.

Thus, a main advantage of the approach taken in this research is that it relates a large database of archaeological material culture to direct observations from the eHRAF. Different to previous examinations of the modes of religiosity using archaeological material, this research (1) utilises an ethnographic sample that has been independently classified as either imagistic or doctrinal as its comparative sample; (2) integrates targeted sets of archaeological and ethnographic material correlates; (3) expands the potential of material evidence of the modes beyond ritual material culture; and (4) enables us to examine proposed relationships between each of the two modes and aspects of

subsistence and social complexity evidence. For instance, both Mithen (2004) and Whitehouse and Hodder (2011) largely focused on intuitively identified and interpreted ritual material culture from particular sites with large assemblages of such material, e.g., Ain Ghazal and Çatalhöyük. By engaging in an integrated data gathering and analysis strategy, the findings in this DPhil research are based on observations from the *known* eHRAF sample. Moreover, the findings relate to a specific set of variables or behaviours that have been identified in the *known* eHRAF sample and examined in the archaeological data. Thus, by exploring the *known* ethnographic record to inform the archaeology, the potential of a number of methods additional to ritual frequency and arousal level for exploring the emergence and use two modes have been examined. For example, the statistical results have demonstrated that subsistence evidence offers one archaeologically accessible way to assess the use of the modes by different cultures. This observation supports the contention that different subsistence practices create a need for certain types of rituals to achieve required levels of social cohesion, a point that will be discussed in section 8.7.

8.2 General trends from the statistical results

The results from the MDS analysis of the eHRAF dataset demonstrated that the doctrinal and imagistic cultures show the greatest separation when analysed based on the ritual variables (Chapter 4 section 4.1). The PCA analysis of the eHRAF dataset demonstrated the greatest separation between the imagistic and doctrinal cultures when PCA was performed based on the identified variables following analysis of the entire eHRAF dataset—with a large component of subsistence variables. The MDS and PCA analysis of the south-west Asian and north-west European archaeological datasets demonstrated that utilizing the subsistence variables resulted in the greatest distinction between chronological groupings of the site-phases and that MDS and PCA based on ritual variables resulted in the greatest degree of overlap (Chapter 4 section, 4.3). The MDS and PCA analysis of the archaeological datasets showed the greatest separation between (1)

the Epipalaeolithic and PPNB site-phases (south-west Asia) and (2) the Early Mesolithic and a cluster of Middle and Late Neolithic site-phases (north-western Europe). In terms of population size, the results from the MDS analysis of the three datasets presented similar trends: (1) an association between population size and subsistence practice; (2) a connection between population size and ritual variables (eHRAF, PPNB and the north-west European Middle Neolithic); and (3) an association between the smallest population size category (< 150 people) and the social complexity variables (particularly for the north-west European site-phases).

The PCA identified the sets of variables that accounted for the greatest variance in each dataset (Table 8.3). For the eHRAF dataset, the imagistic and doctrinal cultures were distinguished (generally) in terms of (1) the imagistic groups that engaged in hunting and gathering and practised grave disturbance and secondary burial practices; and (2) the doctrinal cultures which were (mainly) sedentary groups that engaged in intensive farming and provide evidence of resource monopolization, a long-term storage strategy, private food cooking, communal ritual structures, cemeteries and anthropomorphic figurines (Chapter 4, section 4.3) (Table 8.3). Chronological groupings of site-phases from the south-west Asian dataset were mainly separated in terms of (1) the site-phases that provided evidence of hunting and gathering, individual burials and flexed burials; and (2) the site-phases that provided evidence of intensive agriculture (including domesticated animals), ritual buildings and storage of cultural knowledge (Chapter 5, section 5.3) (Table 8.3). These statistical distinctions generally characterise a separation between the Epipalaeolithic and the MPPNB site-phases. Chronological groupings of site-phases from the north-west European dataset were mainly separated in terms: (1) the site-phases with evidence of hunting gathering, fishing, inhumations, grave goods and burials associated with animals; and (2) those with evidence of intensive agriculture, a high level of sedentism and monuments in the landscape Chapter 6, section 6.3) (Table 8.3). The separation based on these identified variables generally reflected the distinction

between the Early Mesolithic and the Middle to Late Neolithic site-phases. A number of variables identified via PCA were common to the two archaeological datasets, and some were also common to the eHRAF dataset (Table 8.1). For the archaeology the common variables were hunting, gathering, communal ritual structures and burial goods. Common to all three datasets were hunting, gathering and communal ritual structures (Table 8.1).

Table 8:1: Variables identified via PCA and used in GLMs (showing the variables in common and the % of eHRAF cultures correctly classified using each set of variables)

Ritual	eHRAF	S.W Asia	N.W Europe	**Subsistence**	eHRAF	S.W Asia	N.W Europe	**Social Complexity**	eHRAF	S.W Asia	N.W Europe	**All Variables**	eHRAF	S.W Asia	N.W Europe
communal ritual structures (monuments)	**x**	**x**	**x**	hunting	**x**	**x**	**x**	degree of sedentism @ 2	**x**		**x**	agriculture	**x**		**x**
grave disturbance	x			gathering	**x**	**x**	**x**	private food storage	x			crop intensity@ 2	**x**		**x**
anthropomorphic figurine	x			agriculture	**x**	**x**	**x**	private cooking	x			food storage strategy @ 3	x		
secondary burial practices	x			food storage strategy @ 3	**x**	**x**		food storage strategy @ 3	x			private food storage	x		
cemeteries	x			crop intensity @ 2	x			resource monopolization	x			degree of sedentism @ 2	x	x	
burial goods		**x**	**x**	crop intensity @ 2	x			burial goods		**x**	**x**	burial goods		**x**	**x**
individual burials		x		fishing			x	communal structures (monuments)		**x**	**x**	special treatment		x	
special burial treatment		x						storage of cultural Knowledge		x		individual burials,		x	
flexed burials		x						special burial treatment		x		flexed burials		x	
burials associated with animals			x					individual burials		x		monuments in the landscape			x
inhumations			x					crop intensity @ 2			x	hunting			x
monumental burials			x					agriculture			x				
% of eHRAF correctly classified	**77**	59	74	**% of eHRAF correctly classified**	80	78	**84**	**% of eHRAF correctly classified**	77	60	**79**	**% of eHRAF correctly classified**	**82**	73	77

For the eHRAF dataset, the GLM and ROC curve results displayed commonalities with the PCA results, as both types of statistical analysis demonstrated that using a set of five variables selected from all categories was the most appropriate manner to distinguish between the imagistic and doctrinal cultures, with 82 % of the *known* eHRAF cultures correctly classified (Table 8.1 and 8.3). However, of the five PCA identified variables used in the GLM, three of the variables were subsistence variables—namely, hunting (H), crop intensity at 2 and agriculture. Canonical correlation analysis demonstrated that the two sets of variables are highly correlated as they contain much of the same information (Chapter 7 section 7.1.5). This result illustrates that subsistence variables represent a dominant set of distinguishing variables in the context of the *known* eHRAF cultures, a pattern that was also observed with slightly different combinations of variables in the archaeological datasets.

The assessment of the GLMs using the ROC curves for the south-west Asian archaeological dataset showed that a GLM based on a set of PCA identified subsistence variables represented the best predictor model for classifying the recorded archaeological site-phases in terms of the two modes, with 78 % of the *known* eHRAF cultures correctly classified (Table 8.1 and 8.3). The ROC curves for the north-west European dataset demonstrated that a GLM based on the subsistence variables likewise provides the best potential for classifying the recorded archaeological site-phases in terms of the two modes, with 84 % of the *known* eHRAF cultures correctly classified using the archaeologically identified set of subsistence variables (Table 8.1 and 8.3).

The three different statistical techniques demonstrated a great degree similarity—particularly when we consider the number of *known* eHRAF cases correctly classified by the GLMs using the sets of variables the identified via PCA (Chapter 7, sections 7.3.1, 7.3.2, 7.6.1 and 7.8.1).

The results from all three datasets demonstrate that, even in the absence of frequency and arousal data (1) the sets of ritual variables identified in this research can be employed, with varying degrees of success, to distinguish between a set of *known* imagistic and doctrinal mode cultures but are not the most fit for purpose models identified (Table 8.1, 8.2 and 8.3); (2) Following the analysis of the entire database, a set of social complexity and subsistence variables recorded in this research represent the most fit for purpose models to distinguish between the set of *known* imagistic and doctrinal mode cultures—as 82 % of the *known* eHRAF cultures were correctly classified using the set of combined variables recorded form the eHRAF sample (Table 8.1 and 8.3); and (3) that the subsistence variables recorded as part of this research represent the most archaeologically accessible models to distinguish between a set of *known* imagistic and doctrinal mode cultures (Table 8.1, 8.2 and 8.3). The results in relation to the set of combined variables and the set of subsistence variables recorded in this research to a degree aligns with the assertion and previous findings by Whitehouse (2004) and Atkinson and Whitehouse (2011). For instance, Atkinson and Whitehouse (2011) demonstrated that agricultural intensity is a significant cross-cultural predictor of dysphoric arousal i.e. mode of religiosity. Also, Whitehouse (2004) and Atkinson and Whitehouse (2011) statistically identify a connection between ritual activity (frequency and arousal) and a number of society-level variables, and argue that the two modes constitute *attractor positions* around which other socio-cultural variables cluster. It is proposed that, within the framework of the Modes theory, aspects of ritual activity, subsistence practice and social complexity should cluster predictably with respect to each mode of religiosity. However, as noted in section 8.1.1, the results generated are a reflection of the variables that were identified and recorded as part of this research.

Table 8:2: Summary of the most and least appropriate sets of variables for all statistical analyses

Sample	MDS		PCA		GLM	
	Greatest separation	**Least separation**	**Greatest separation**	**Least separation**	**Most appropriate predictor**	**Least appropriate predictor**
eHRAF	ritual	subsistence	combined variables	social complexity	combined variables	social complexity and ritual
S.W. Asia	subsistence	ritual	subsistence	ritual	subsistence	ritual
N.W. Europe	subsistence	ritual	subsistence	ritual	subsistence	ritual

Table 8:3: Summary of the sets of PCA identified variables (ranked 1-5 via PCA, where 1 = highest loading) used in each GLM and the percentage of eHRAF cultures correctly classified using each set of variables

Variable Category								
Sample	**Ritual**	**% eHRAF Class. Correct**	**Subsistence**	**% eHRAF Class. Correct**	**Social Complexity**	**% eHRAF Class. Correct**	**Combined**	**% eHRAF Class. Correct**
eHRAF	1. secondary burial practices 2. grave disturbance 3. anthropomorphic figurines 4. communal ritual structures 5. cemeteries	77	1. hunting, 2. gathering 3. crop intensity @ 2 4. food storage strategy @ 3 5. agriculture	80	1. degree of sedentism @ 2 2. private food storage 3. private cooking 4. food storage strategy @ 3 5. resource monopolization	77	1. agriculture 2. crop intensity@ 2 3. food storage strategy @ 3 4. private food storage 5. degree of sedentism @ 2	82
S.W. Asia	1. flexed burials 2. individual burials 3. special burial treatment 4. ritual buildings 5. burial goods	59	1. agriculture 2. animals domestication@ 2 3. crop intensity @ 2 4. hunting 5. gathering	78	1. burial goods 2. special burial treatment 3. individual burials 4. communal structures 5. storage of cultural knowledge	60	1. flexed burials 2. special treatment 3. individual burials, 4. degree of sedentism @ 2 5. burial goods	73
N.W. Europe	1. burial goods 2. burials associated with animals 3. inhumation 4. monuments in the landscape 5. monumental burials	74	1. hunting 2. gathering 3. agriculture 4. fishing 5. animal domestication	84	1. crop intensity @ 2 2. monuments in landscape 3. degree of sedentism at 2 4. burial goods 5. agriculture	79	1. burial goods 2. hunting 3. crop intensity @ 2 4. agriculture 5. monuments in the landscape	77

8.3 Hypothesis testing

As set out in Chapter 1, section 1.1, the focus of this DPhil research is to explore one particular hypothesis, concerning the solidarity generating effect of religious ritual activity across the agricultural transitions in south-west Asia and north-west Europe. To test this hypothesis, GLMs were employed to determine the percentage probability of each archaeological site-phase being indicative of an imagistic or doctrinal mode culture.

8.3.1 Percentage probability results for the archaeological databases

The GLM analysis based on the identified subsistence variables of the south-west Asian site-phases classified all the Epipalaeolithic site-phases as imagistic (Chapter 7, section 7.6.2). 62% of the PPNA site-phases were classified as imagistic and 38% as doctrinal cultures. The majority of PPNB site-phases (78%) were classified as doctrinal with a high percentage probability (Chapter 7, section 7.6.2). All of the PPNC and PN site-phases showed a high percentage probability of being doctrinal (Chapter 7, section 7.6.2). Overall, 27% of the Neolithic site-phases were classified as imagistic and 69% were classified as doctrinal based on the identified subsistence variables used in this research. The GLM analysis based on the identified subsistence variables from the north-west European dataset classified all of the Mesolithic site-phases as imagistic (Chapter 7, section 7.8.2). In total, 56% of the Neolithic site-phases showed a high percentage probability of being doctrinal cultures, with 33% being classified as imagistic (Chapter 7, section 7.8.2). Furthermore, 57% of Early and 50% of Middle Neolithic site-phases were classified as doctrinal. All of the Late Neolithic showed a high percentage probability of being doctrinal cultures (Chapter 7, section 7.8.2).

In relation to the hypothesis central to this thesis, the percentages generated by the GLMs suggest a general shift from an imagistic to a more doctrinal mode of religiosity associated with the agricultural transition in both regions based on the specific set of subsistence variables that were identified via PCA of each dataset (Table 8.1 and 8.3).

The results from the statistical analysis suggest that a number of Epipalaeolithic/Mesolithic subsistence practices may have been maintained in (1) the PPNA in south-west Asia and (2) the European Early and Middle Neolithic. We have examples of site site-phases from these cultural horizons that were categorised as imagistic with high percentage probabilities. It is noted that there are a number of potential factors that this result could be reflecting, including (1) the more generalised set of subsistence variables used; (2) the site-phases used in this study; (3) the gradual nature of the agricultural transition in the relation to the PPNA and; (4) that Mesolithic subsistence practices may have continued into the Neolithic in north-western Europe. The connection between the two modes and subsistence practices will be discussed further in sections 8.6 and 8.7.

8.4 A statistical framework for predicting mode of religiosity from archaeological material

An objective of this research was to design a methodology that would make it possible to identify and explore the two modes of religiosity using the archaeological material. To assess whether or not this objective was achieved, it is necessary to examine to what extent the statistical results adhere to the observations, assertions and predictions by Whitehouse (1996; 2000; 2002; 2004) and Atkinson and Whitehouse (2011) regarding the connection between the modes of religiosity and ritual, subsistence and social complexity evidence.

8.4.1 Identifying the modes of religiosity using ritual variables based on archaeological material culture

As explained in Chapter 3, section 3.7.2, Whitehouse (2000; 2002; 2004) asserts that fundamental to the modes of religiosity theory is the distinction between the imagistic and doctrinal modes based on ritual frequency and the level of dysphoric arousal. As explained in Chapter 3, section 3.7.2 and section 8.1.1, ritual frequency and dysphoric arousal level are difficult to access in archaeological contexts; thus, a set of ritual material

correlate variables which were identified during the pilot study and recorded form the three datasets were used to examine (1) whether or not the statistical techniques utilised demonstrate a connection between the ritual variables identified by PCA and the *known* imagistic and doctrinal eHRAF cultures, as predicted by Whitehouse (2000; 2002; 2004) and (2) to what extent the ritual material culture identified in the archaeological datasets can be used to correctly classify a *known* set of ethnographic cultures and, by implication, the particular archaeological site-phases. The identified ritual variables for each for each dataset were:

1. for the eHRAF: secondary burial practices, grave disturbance, anthropomorphic figurines, communal ritual structures and cemeteries

2. for the south-west Asian site-phases: flexed burials, individual burials, special burial treatment, ritual buildings and burial goods

3. for the north-west European site-phases, burial goods, burials associated with animals, inhumation, monuments in the landscape and monumental burials (Table 8.3).

The PCA analysis identified ritual variables that were common to both the eHRAF dataset and the two archaeological datasets (Table 8.1). The PCA showed that communal ritual structures reflects a shared distinguishing ritual variable common to the three datasets considered as part of this research. The presence of communal ritual structures, generally, indicated a distinction between the imagistic and doctrinal cultures in the eHRAF, and in the Mesolithic/Epipalaeolithic and Neolithic archaeological cultures, being associated with the Neolithic site-phases and doctrinal cultures (generally). In relation to the two archaeological datasets, burial goods were identified as a shared distinguishing ritual variable (Table 8.1) associated, generally, with the Mesolithic/Epipalaeolithic site-phases. These findings will be discussed in later sections (8.7, 8.9 and 8.10).

The GLM results for the eHRAF data showed that the ritual variables recorded (other than ritual frequency and dysphoric arousal level) from the *known* sample could be used to correctly distinguish between imagistic and doctrinal cultures with a success rate of 77% (Table 8.1 and 8.3). This result is promising as it demonstrates that previously classified "modes cultures" could potentially be correctly identified in the absence of ritual frequency and dysphoric arousal level information. The GLM using the ritual variables identified in the north-west European archaeology resulted in 74% of the *known* eHRAF cultures being correctly classified (Table 8.1 and 8.3 and Chapter 7). Thus, while it does not represent the best GLM, in the absence of ritual frequency and dysphoric arousal level information a set of *known* eHRAF cultures could be correctly classified with a degree of success using a set of ritual variables extracted from the European archaeological data. However, the set of PCA identified ritual variables from the south-west Asian archaeological data did not result in an appropriate GLM for correctly classifying the *known* eHRAF cultures correctly, and thus would not serve to predict the mode of religiosity for the archaeological site-phases, since only 59% of the *known* eHRAF cultures were correctly classified (Table 8.1 and 8.3 and Chapter 7). This result showed that the ritual variables identified from the south-west Asian archaeological dataset could not be used successfully to correctly classify a set of *known* samples.

Overall, the GLM results demonstrated that ritual variables identified in this research were not the best indicator of mode of religiosity in the archaeological and *known* eHRAF databases. This result could be related to three factors: (1) this research did not record ritual frequency or dysphoric level (which are central to the modes theory), since as outlined in this section and in section 8.1.1 and Chapter 2, section 2.5.2, ritual frequency and arousal level are difficult to record from archaeological contexts; (2) this research utilised a more general set of ritual variables for the purpose of conducting an integrated cross-cultural study; and (3) the result could point to a degree of ritual continuity between the pre-Neolithic and Neolithic, particularly in relation to the south-west Asian

archaeology (a point that will be discussed in section 8.8). The results from the north-west European archaeological dataset demonstrated that the set of PCA identified ritual variables may offer a way to examine the modes in the context of the north-west European transition. However, generally, we can assert that the ritual variables identified in this research do not represent the best predictor models to classify the archaeological sample in terms of the modes—with a less successful predictor model generated for the south-west Asian archaeological site-phases (Table 8.1, 8.2 and 8.3). The GLM from the eHRAF dataset is interesting as it does establish that a set of ritual variables could have the potential to examine the two modes even where ritual frequency and dysphoric arousal level information are absent.

8.4.2 Identifying the modes of religiosity via subsistence variables based on archaeological material culture

As outlined in Chapter 3, section 3.7.2, Whitehouse (2004) and Atkinson and Whitehouse (2011) assert that agricultural intensity is a significant cross-cultural predictor of dysphoric arousal i.e. mode of religiosity. The present research used sets of subsistence variables (including agricultural intensity) recorded from the eHRAF and archaeological datasets to examine (1) whether or not the statistical techniques utilised demonstrated a connection between the sets of subsistence variables and the *known* eHRAF cultures, as predicted by Whitehouse (2000; 2002; 2004) and (2) to what extent the subsistence variables identified in the archaeological datasets can be used to predict the mode of religiosity in the particular archaeological contexts. The statistical (MDS, PCA and GLM) results demonstrated a connection between the two modes of religiosity and distinct subsistence practices. For all three datasets, the PCA results consistently demonstrated a separation between site-phases/eHRAF cultures with evidence of groups engaging in hunting-gathering versus those with evidence of an intensive agriculture subsistence strategy; including a range of domesticated crops and animals (Table 8.1 and 8.3). This is not surprising in relation to the archaeology of the Neolithic transition. What

is interesting is that the hunter-gatherer versus agriculture divide was reflected in a distinction between the *known* imagistic and doctrinal cultures.

PCA identified a number of subsistence variables that were common to both the eHRAF dataset and the two archaeological datasets (Table 8.1). PCA showed that hunting, gathering and agriculture reflect a shared set of subsistence variable in the three datasets used in this research. In addition, the presence of a long-term food storage strategy was identified as a shared subsistence variable between the eHRAF dataset and the south-west Asian archaeological dataset (Table 8.1).These shared variables generally indicated distinctions between imagistic and doctrinal cultures form the eHRAF and between the Mesolithic/Epipalaeolithic and Neolithic archaeological site-phases, with hunting and gathering associated with the Mesolithic/Epipalaeolithic archaeological site-phases, as well as with many imagistic cultures. On the other hand, agriculture and long-term food storage were associated with the Neolithic site-phases and doctrinal cultures (generally). This point will be discussed in later sections (8.6, 8.7, 8.9 and 8.10).

As discussed in section 8.1.1, the positive results regarding the relationship between subsistence strategy and mode may reflect the fact that subsistence strategies are a well-researched area of archaeological inquiry and that subsistence evidence is, generally, archaeologically accessible. It is important to contextualise any results regarding subsistence variables with the available contemporary ritual and social complexity material culture, to achieve a comprehensive assessment of the different modes. Having said that, this research has shown that subsistence evidence from both an ethnographic source and the archaeological record can be used to distinguish between the imagistic and doctrinal cultures from a *known* ethnographic sample. In this regard, we can suggest that the results complement the findings of Atkinson and Whitehouse (2011) regarding the connection between the two modes of religiosity and particular subsistence practices. We can assert that subsistence evidence from the archaeological datasets can potentially be

used to predict mode of religiosity. The potential relationship between subsistence evidence and the modes of religiosity is discussed in sections 8.6 and 8.7.

8.4.3 Identifying the modes of religiosity via covariance between ritual, subsistence and social complexity variables based on archaeological material culture

As outlined in Chapter 3, section 3.7.2, Whitehouse (2004) and Atkinson and Whitehouse (2011) assert that aspects of ritual activity, subsistence practice and social complexity co-vary predictably with respect to each mode of religiosity. Following this claim, it was necessary to examine whether or not covariance was observed in the eHRAF and archaeological datasets using the ritual, subsistence and social complexity variables. To achieve this aim, this research used the variables recorded form the eHRAF and archaeological datasets to (1) examine whether or not the statistical techniques utilised demonstrated a connection between the ritual, subsistence and social complexity variables (in the *known* eHRAF cultures), as predicted by Whitehouse (2000; 2002; 2004) and (2) to explore to what extent connections between the ritual, subsistence and social complexity variables in the archaeological record could be used classify the archaeological datasets in term of the two modes of religiosity.

As outlined in section 8.4.2, PCA identified a number of subsistence variables that were common to both the eHRAF dataset and the two archaeological datasets (Table 8.1); i.e. hunting, gathering, agriculture and long-term food storage strategy. These shared variables indicated distinction between imagistic and doctrinal cultures form the eHRAF and the Mesolithic/Epipalaeolithic and Neolithic archaeological site-phases. In terms of the social complexity variables, a high degree of sedentism was identified from the eHRAF and north-west European datasets as providing a separation between the imagistic and doctrinal cultures form the eHRAF and the Mesolithic and Neolithic archaeological site-phases (Table 8.1). In addition, PCA showed that burial goods and communal ritual structures reflect distinguishing ritual variable in the two archaeological datasets used in this research, generally indicating a distinction between the

Mesolithic/Epipalaeolithic and Neolithic archaeological site-phases, with communal ritual structures associated with the Neolithic site-phases and burial good associated (largely) with the Mesolithic/Epipalaeolithic site-phases recorded in this research.

For the eHRAF cultures, the GLM analysis based on the identified sets of ritual, subsistence and social complexity variables resulted in appropriate predictor models, with varying success (Table 8.1, 8.2 and 8.3).The GLM using the ritual and social complexity variables identified in the eHRAF resulted in equally appropriate models for correctly classifying the know eHRAF samples; with 77% of the eHRAF culture being correctly classified. The GLMs using the identified subsistence variables resulted in 80% of the eHRAF culture being correctly classified. The GLM using the five variables extracted following the PCA of the entire recorded dataset was identified as the most fit-for-purpose model for correctly classifying the eHRAF data with 82% correctly classified (chapter 7, section 7.4.1) (Table 8.1 and 8.3).

For the archaeological data, the MDS and PCA based on the social complexity and combination of all variables consistently showed some distinction between the site-phases (more distinction than using the ritual variables) (Chapters 5 and 6). The MDS and PCA analysis based on the subsistence strategy variables resulted in the greatest distinction between the site-phases (Chapters 5 and 6). The GLM using the PCA identified social complexity variables resulted in the second most appropriate predictor model for the north-west European site-phases (with 79% of eHRAF cultures correctly classified). However, the PCA identified social complexity variables produced a less reliable predictor model for the south-west Asian site-phases (with 60% of eHRAF cultures correctly classified) (Table 8.2 and 8.3). The GLM based on the variables identified following PCA of the combination of all variables from each archaeological dataset were identified as a relatively fit-for-purpose models; with 77% of eHRAF cultures correctly classified (north-west European) and 73% of eHRAF cultures correctly classified (south-west Asian). The GLMs based on the subsistence variables that were identified in the

archaeological datasets and applied to the *known* eHRAF cultures resulted in the highest percentage of eHRAF cultures correctly classified—with 78% correctly using the subsistence variables identified in the south-west Asian datasets and 84% correctly using the subsistence variables identified in the north-west European site-phases. In this regard, it is suggested that the sets of subsistence variables identified in the archaeological datasets potentially represents the most appropriate models for examining the south-west Asian and the north-west European archaeology in terms of the modes of religiosity (Chapter 7, section 7.5.2.1 and 7.7.2.1).

We can suggest that, although the modes are directly related to ritual activity, the identified sets of subsistence and social complexity can, to varying degrees (1) correctly classify a sample of previously categorised eHRAF cultures and (2) could potentially be used to examine the mode of religiosity in archaeological data. Based on these results, it can be argued that there is a relationship between the two modes of religiosity and sets of socio-cultural (aside from ritual) variables. This finding based on the variables and datasets used in this research aligns with the assertion by Whitehouse (2004).

8.4.4 Identifying the modes of religiosity via population size based archaeological material culture

As outlined in Chapter 3, section 3.7.2, Whitehouse (2004) and Atkinson and Whitehouse (2011) suggest that the doctrinal mode of religiosity is associated with larger, more hierarchically organised human groups. Following these assertions, it was important to examine whether or not population size can be used (1) to statistically distinguish between the *known* eHRAF cultures and (2) to examine to what extent population size could be utilised to indicate each of the two modes of religiosity in the archaeological datasets. As outlined in section 8.2, the results indicated that, to a limited extent, population size (1) enables us to distinguish between the imagistic and doctrinal cultures and (2) could contribute to prediction of mode of religiosity from the archaeological samples used in this research—with more success for the population category of < 150

people. As noted in (sections 3.6 and 8.1.1), there are limitations to the population categories employed in this research. As population (which is an entire study in itself) was not the primary focus of this research, a population estimation method was used as that represented an accessible calculation that can be utilised for the 111 site-phase and would parallel the types of population estimations in the eHRAF sample. To examine comprehensively the connection between population size, ritual, subsistence and social complexity material culture and (ultimately) mode of religiosity, a more in-depth study is needed. The connection between modes and population size would be better studied using other, more comprehensive methods such as social network analysis and Agent Based Modelling.

8.4.5 Summary

The analysis shows that:

(1) we cannot use the PCA identified ritual or social complexity variables to predict mode reliably for the south-west Asia archaeological site-phases (with 59% and 60% of eHRAF cultures correctly classified respectively) (Table 8.1 and 8.3).

(2) the PCA identified sets of ritual variables reflect relatively fit-for-purpose models for the eHRAF and north-west European datasets (with 77% and 74% of eHRAF cultures correctly classified respectively) (Table 8.1 and 8.3).

(3) the PCA identified sets of social complexity variables produce relatively fit-for-purpose models for the eHRAF and north-west European datasets (with 77% and 79% of eHRAF cultures correctly classified respectively) (Table 8.1 and 8.3).

(3) the five identified variables following the analysis of each entire dataset resulted in the generation of fit-for purpose predictor models for the south-west Asia and north-west European archaeological datasets (with 73% and 77% of eHRAF cultures correctly classified respectively) (Table 8.1 and 8.3).

(4) the identified subsistence variables resulted in the most fit-for purpose models for the south-west Asia and north-west European archaeological datasets (with 78% and 84% of eHRAF cultures correctly classified respectively); and an appropriate predictor model for the eHRAF dataset (with 80% of cultures correctly classified) (Table 8.1 and 8.3).

(5) the five identified variables extracted following the PCA of the entire eHRAF dataset resulted in the most fit-for-purpose predictor model (with 82% of eHRAF cultures correctly classified respectively). However, it should be noted that the addition of the two social complexity variables (in this section) added in a minor way to the predictive power of the three subsistence variable (Table 8.1 and 8.3).

To an extent, the results from the eHRAF cultures adhere to the assertions by Whitehouse (2002; 2004) and Atkinson and Whitehouse (2011) as we can propose a connection between:

(1) the modes and ritual activity—realistically only in relation to ritual variables identified in the eHRAF and north-west European datasets;

(2) the modes and other socio-cultural variables—again, this is more pronounced in relation to the variables identified in the eHRAF and north-west European datasets;

(3) the modes and subsistence strategy—which has been demonstrated in relation to all three datasets.

The results indicated that subsistence evidence recorded from the archaeological datasets reflects the most appropriate model for classifying the *known* eHRAF cultures and represents the best potential to classify the site-phases from the two archaeological datasets in terms of the two modes of religiosity (Table 8.1, 8.2 and 8.3). In addition, the subsistence variables identified in the eHRAF dataset (1) result in a high (80%) classification of the know imagistic and doctrinal cultures and (2) a set of subsistence variables formed a major component of the most fit for purpose model for the *known*

eHRAF data (Table 8.1 and 8.3). Therefore, we can assert that the subsistence variables appear to be the dominant set of predictor variables for the eHRAF and the archaeological data used in this research. The connection between subsistence evidence and the two modes will be discussed in detail in sections 8.6 and 8.7.

8.5 Ritual variables as a predictor of mode in the archaeological record of the agricultural transition in both regions agricultural transition

This section discusses the extent to which the ritual variables considered in this study can be used to examine the modes in the archaeological record of the agricultural transition. As outlined in Chapter 2, section 2.4.2 and Chapter 3, section 3.7.4 and Chapter 8 section 8.1.1, the main potential limiting factors associated with the ritual variables recorded in this study are that (1) ritual frequency and dysphoric arousal data are difficult to identify and record from prehistoric archaeological contexts and (2) a set of more general ritual activity variables were used to enable a cross-cultural study.

Through the pilot study, a set of ritual material correlate variables (other than frequency and dysphoria) were identified that could be examined in the *known* eHRAF imagistic and doctrinal cultures and the *unknown* archaeological samples. The pilot study identified a number of ritual variables that could be utilised to integrate the archaeological and eHRAF data to examine the modes in the archaeology of the agricultural transition. Using MDS analysis it was possible to explore how far the recorded ritual variables patterned in relation to mode in the eHRAF cultures as well as in relation to chronological groupings of the archaeological site-phases.

PCA was used to identify the five most important ritual variables that were causing the separation between the *known* eHRAF cultures (and the *unknow*n archaeological site-phases) (Table 8.3). PCA identified communal ritual structures as a shared distinguishing ritual variable in the three datasets (Table 8.1). In context of the *known* eHRAF sample,

the presence of communal ritual structures was associated (largely) with doctrinal cultures. Similarly, in the north-west European dataset, the presence of communal ritual structures was associated with Neolithic site-phases. With only one variable, however, it is not possible to propose a trend in ritual change. From the two archaeological datasets, the use of burial goods was identified as the only shared ritual variable that separated chronological groupings of the site-phases (Table 8.1). Following the use of GLM, it was shown that ritual variables represented the weakest set of variables for the purpose of correctly classifying the eHRAF data and thus for categorising the archaeological site-phases in terms of the modes of religiosity; determined by applying the ritual variables identified in the archaeological databases in a GLM to the *known* eHRAF cultures (Table 8.1 and 8.3).

Although the ritual variables did not result in the most appropriate GLMs for each dataset, there are some important positive factors to note. First, ritual variables did produce a relatively fit for purpose GLMs for the eHRAF samples (Table 8.2 and 8.3). Similarly, it was demonstrated that a set of *known* eHRAF cultures could be correctly classified with a degree of success (74%) using a set of ritual variables extracted from the north-west European archaeological data. At the very least, it has been established that it is possible to use a set of ritual variables (other than ritual frequency and dysphoric arousal level) to potentially examine the modes of religiosity and that a set of accessible variables can be used to examine modes in the context of the north-west European transition.

In sum, the GLM results demonstrated that the sets of ritual variables identified in this research were not the best indicator of mode of religiosity in the archaeological and *known* eHRAF databases. It is suggested that this result could be related to or indicative of a number of factors, as already outlined. However, the "weaker" GLM result in relation to the south-west Asian sample may reflect a degree of ritual continuity between the pre-Neolithic and Neolithic periods, in relation to at least four variables identified in

this research (burial goods, special burial treatment, flexed burials and individual burials). The "stronger" GLM result from the north-west European data may indicate that ritual change during the Neolithic transition was more abrupt in north-western Europe and it may be reflecting aspects that are essential in the context of an imported transition. Again, this assertion is based on the variables used in this research. To explore these potential aspects of the results further it is necessary to examine the aspects of the archaeological record which may be providing us with evidence of these scenarios.

8.5.1 Ritual continuity in the south-west Asian agricultural transition

To examine the possibility of ritual continuity in terms of the gradual change in the context of the south-west Asian agricultural transition, we must consider evidence of the relationship between Epipalaeolithic and Neolithic ritual practices. The MDS and PCA based on the ritual variables demonstrated a greater degree of overlap between the site-phases, compared to the same analysis using the subsistence or social complexity variables. The results showed particularly strong overlap between a number of Epipalaeolithic and PPNA site-phases but, also, overlap between a number of Epipalaeolithic, PPNA and PPNB site-phases. This result indicates that a number of these site-phases share ritual material culture. However, ritual variables also showed a high degree of overlap in relation to the north-west European archaeological data.

The difference between the south-west Asian and the north-west European ritual results comes from the GLM analysis, as the ritual variables from the European site-phases resulted in 74% of the *known* eHRAF being correctly classified, whereas the south-west Asian ritual variables resulted in a success rate of only 59%.

The GLM result taken with the MDS and PCA statistical results generated in this research may be indicating evidence of the continuation of ritual practices form the Epipalaeolithic to Neolithic in south-west Asia. The question must be asked; what evidence do we have for continuation in the south-west Asian archaeological data? For MDS and PCA of the south-west Asian site-phases, the greatest separation appears to be between those with

communal ritual structures and those with no evidence of communal ritual structures, examples being the contrast between Middle PPNB site-phase at Kfar Hahoresh and late PPNB site-phase at Basta (with communal ritual structures) and Epipalaeolithic Beidha I, PPNA Ain Rahub and PPNB Tell Ramad I (with no communal ritual structures). Apart from communal ritual structures, there appears to be a degree of shared ritual material culture between a number of site phases. For example, overlap is observed between site-phases of different cultural-phases, such as Epipalaeolithic Ein Gev I, PPNA Iraq Ed-Dubb, PPNB Cafer Höyük and PPNC Ain Ghazal III. For these site-phases, aspects of ritual practice such as flexed burials, special burial treatment, individual burials and grave goods result in overlap. The implication is that in south-west Asia both Epipalaeolithic and Neolithic groups (used in this study) were to some extent engaging in similar ritual practices, despite clear contrasts in subsistence practice. In fact, others have suggested that the gradual nature of the indigenous agricultural transition in south-west Asia entailed significant continuity in Epipalaeolithic ritual practices (Cauvin 1994; Kuijt 1995; 1996; 2001; 2002; 2008; Banning 1998; Goring-Morris 2000, 2005; Rollefson 2000; Kuijt and Goring Morris 2002). For example, Kuijt stresses that practices such as skull manipulation and special burial treatment are examples of Epipalaeolithic ritual practices that were (re)used in the pre-pottery Neolithic.

Based on the south-west Asian site-phases used in this study, it appears that PPN ritual practices centred on the maintenance of ritual practices that emerged in earlier, Epipalaeolithic groups. It is quite possible that these ritual practices became more frequent and standardised in the Neolithic, eventually being performed by specialist ritual practitioners (Kuijt 2002).

8.5.2 Ritual change in the north-west European agricultural transition

To examine whether or not the north-west European data reflect an abrupt ritual change associated with agricultural transition, we must consider evidence of a distinction

between Mesolithic and Neolithic ritual practices present in the datasets used in this research. As with the south-west Asian archaeological data, the MDS and PCA based on the ritual variables revealed a greater degree of overlap between the site-phases, compared to using the identified subsistence or social complexity variables. The results showed particularly strong overlap between some Mesolithic and Neolithic site-phases. For example, overlap was observed between Late Neolithic Lough Gur and a number of Mesolithic sites. This result is due to the fact that Lough Gur provides archaeological evidence of inhumations, grave goods and burials associated with animals, but no evidence of monumental architecture. However, the degree of overlap (in the MDS and PCA) based on the identified ritual variables in the European dataset is less than the level of overlap in the south-west Asian archaeological dataset.

PCA of the north-west European dataset presents a separation of chronological groupings based on two sets of ritual activity variables: site-phases with monuments and monumental burial and site-phases with burial goods, burials associated with animals and inhumation. For the most part, this ritual distinction highlights that between the Mesolithic and Neolithic site-phases. For example, following PCA, a number of Mesolithic site-phases were recorded as clustering together: this group included Middle Mesolithic Tågerup, Middle Mesolithic Vedbaek and Late Mesolithic Skateholm I and Late Mesolithic Stranvägen. These site-phases provide ritual material culture which includes inhumations, grave goods, burials associated with animals and no evidence of megalithic monuments. Form the MDS and PCA, the greatest separation was between the Middle Neolithic Brú Na Bóinne Complex (Newgrange) and Late Mesolithic Tågerup. The distance is based upon specific aspects of ritual material culture identified. Middle Neolithic Brú Na Bóinne provides evidence of ritual activity including monumental architecture and monumental burials, whereas Tågerup is a late Mesolithic site-phase with evidence of inhumation burials associated with animals but has no evidence of megalithic monuments.

Finally, the GLM analysis based on the north-west European ritual variables resulted in 74% of the *known* eHRAF being correctly classified. This statistical result shows that they are relatively useful for establishing a distinction between the *known* eHRAF imagistic and doctrinal cultures. Compared to the result based on the south-west Asian ritual variables, the results from the north-west European dataset thus suggest that ritual change during the Neolithic transition may have been more abrupt (in terms of a change in ritual material culture) in north-western Europe (based on the recorded ritual variables).

8.6 Subsistence variables as an indicator of mode in the archaeological record

As discussed in section 8.1.1, the fact that the subsistence variable were identified as the most appropriate models may reflect a number of limitations associated with this research, as well as the fact that subsistence strategies are a well-researched, accessible area in archaeology.

The PCA identified several subsistence variables that were common to both the modes distinction in the eHRAF dataset and the Mesolithic/Neolithic divide in the two archaeological datasets: hunting, gathering and agriculture (Table 8.1). Also, evidence of a long-term food storage strategy was identified as a shared subsistence variable between the eHRAF dataset and the south west Asian archaeological dataset (Table 8.1).

The results demonstrated that subsistence evidence from both ethnographic sources and the archaeological record can be used to distinguish between the imagistic and doctrinal cultures in a *known* ethnographic sample. In the three GLMs based on the eHRAF and archeologically identified subsistence variables, a number of eHRAF cultures were repeatedly correctly classified with high percentages. For example, the Central Thai (doctrinal) and the Andaman (imagistic) culture were correctly classified using each of the three sets of subsistence variables. In addition, both of these cultures were correctly

classified with high percentages based on the identified sets of ritual variables. This is interesting as it reflects a relationship between two cultures that were classed as imagistic and doctrinal based on sets both ritual activity and subsistence variables. The Central Thai (doctrinal) were identified as reflecting a hierarchical organised, fully sedentary society that engages in intensive agriculture and has a set of "doctrinal" ritual practices. On the other hand, the Andaman (imagistic) culture is a mobile, seasonal hunting and foraging group that maintains indigenous ritual practices. In relation to the archaeology we can see examples of site-phases that were separated based on both the subsistence variables *and* the ritual variables. For example, based on the identified ritual variables a separation was observed in the MDS and PCA between Middle Neolithic Brú Na Bóinne Complex (Newgrange) and Late Mesolithic Tågerup. Based on the subsistence variables, Middle Neolithic Brú Na Bóinne Complex being classified as doctrinal with an 82% probability, whereas Late Mesolithic Tågerup was classified as imagistic with a 90% probability. Following the results we can suggest that sets of subsistence variables represent those with the best potential to classify the site-phases used in this research, but that there is scope to develop a multi-stranded approach to the identification of modes that incorporates ritual- as well as subsistence-based classifications.

8.7 Social cohesion, modes and the agricultural transition

The statistical results demonstrate that subsistence practices (hunting-gathering versus intensive agriculture) plausibly relate to, and help to distinguish between, religious modes (MDS and PCA), and represent an appropriate predictor models (GLM) that can be used to classify a sample of *known* eHRAF cultures correctly as well as the *unknown* archaeological cases. Using the subsistence evidence identified in the archaeological data, the statistical methods utilised in this research have suggested a connection between (1) the Epipalaeolithic/ Mesolithic site-phases and the imagistic mode and (2) Neolithic site-phases and the doctrinal mode. In light of these results, it is necessary to examine further the relationship between subsistence practices and the modes of religiosity. One potential

way to examine the relationship between the two modes and different subsistence strategies is through the framework of group cohesion theory. Using this theoretical framework, this section outlines and discusses the connection between the imagistic and doctrinal modes and levels of fusion and group identification required to generate social cohesion in relation to the different subsistence strategies. In doing so, this section will consider whether religious mode is connected to changes in the configuration of social cohesion across the Neolithic transition associated with subsistence change.

8.7.5. Social cohesion and hunter-gatherer communities

As the statistical results indicated a relationship between subsistence strategy and mode, we must consider why groups engaging in a hunting-gathering subsistence strategy may have used imagistic rituals to generate and maintain group cohesion. It is suggested that mobile hunter-gatherer groups need to form cohesive units to (1) engage in activities such as hunting; (2) defend against other groups; (3) act as an insurance against periods of food scarcity (Gurven 2004; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al*. 2015). In contrast to more extended social networks, it is suggested that mobile hunter-gatherers are bound together by relational ties between individuals who have face-to-face contact (*ibid*). In the context of hunter-gatherer groups, it is proposed that identity fusion may represent a socio-psychological mechanism that produces strong social bonds between group members (*ibid*). Moreover, it is asserted that identity fusion produced via highly arousing imagistic rituals may reflect an essential method by which hunter-gatherer groups achieve high levels of group cohesion necessary to ensure group survival.

Hunter-gatherer groups are often considered as engaging in a group-solidarity hunting strategy in which the members pool the yields of each hunting expedition (Gurven 2004). In this strategy some individuals regularly fare better than others from the decision to pool the proceeds of a hunt. We can consider that these types of group-solidarity hunts have (1) a high potential for free-riding and (2) the potential for questions such as of

"why bother hunting if the spoils go to other people?" to be demotivating concerns (Gurven (2004). In addition, small-scale groups that practice collective sharing of resources (particularly when experiencing periods of food scarcity) are particularly vulnerable to free-riders (Lewis *et al.* 2014; Salali *et al*. 2015). Collective actions such as engaging in defensive conflict with other mobile hunter-gatherer groups presents potential for individuals to defect to enemy bands, particularly, if the enemy group is perceived as being larger or more successful in securing resources (Gurven 2004). From an evolutionary perspective, activities entailing dangerous collective actions are vulnerable to defectors and thus difficult to initiate or convince others to take part in. To avoid defection and free-riding and to secure resources via participation in hunting and conflict, a high degree of cooperation and trust must be created in hunter-gather groups. Thus, for mobile hunter-gather groups to be successful, they require some method by which to produce and reinforce intense cohesion among group members.

How is intense cohesion achieved in hunter-gather groups? Although mutualistic payoffs might increase participation in group hunts, it has been argued that hunter-gatherer groups require some form of psycho-social mechanism to produce the high levels of cohesion required to limit defection, particularly when it comes to collectively engaging in dangerous activities to secure and/or defend the groups' resources. Research into the mechanisms of social cohesion in small-scale groups suggests that identity fusion may be responsible for the high level of cohesion associated with hunter-gatherer groups (Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). Furthermore, it is proposed that imagistic (highly dysphoric, episodic) practices produce the bonds of psychological kinship that result in identity fusion among members of hunter-gatherer groups (*ibid*). Painful rituals or taking part in dangerous collective actions, act upon an individuals' self-concept (Whitehouse 1996; 2000; 2002; 2004). The storing and reflection upon such events via episodic memory results in the event becoming an important aspect of the individuals' autobiographical memory, with the

details and context of the event being remembered over longer periods of time, compared to less arousing events (Whitehouse 1996; 2000; 2002; 2004; Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014). An important effect of experiencing and reflecting on highly dysphoric events is that it produces psychological kinship among those who shared the experience—described as an exclusive community (Whitehouse (1996; 2000; 2002; 2004; Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). The projection of psychological kinship onto the group intensifies the perceptions of oneness that is characteristic of identity fusion, as individuals experience a visceral sense of oneness with the other members of the (perceived) kin group (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014; Jong *et al.* 2015). The result is that, for fused individuals, self and group interests are inherently connected and threats to the group are experienced as threats to the self (Whitehouse and Lanman 2014). In this model of cohesion, identity fusion provides a greater motivation to share resources and take risks for the group than the motivation provided by punishment alone (Gurven 2004). In this regard, we can consider how imagistic practices may produce identity fusion among members of hunter-gatherer groups, binding them together as psychological kin and (1) ensuring in-group altruism among fused individuals while also (2) preparing them to take-part in high-risk, pro-group activities such as hunting and engaging in conflict (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al.* 2011a; Swann *et al.* 2012; Swann *et al.* 2014a; b; Whitehouse and Lanman 2014). With regard to participation in high-risk activities, Swann (2014) suggests that kin-detection systems associated with identity fusion explain the tendency for individuals to show a readiness to sacrifice themselves for members of their perceived kin, particular when the group is threatened.

In relation to hunting and conflict, an additional mechanism of identity fusion must be considered. It is often proposed that there is a relationship between autonomic arousal and engaging in extremely dangerous pro-group actions among fused individuals (Swann *et*

al. 2010b; Swann 2014). It is stated that physiological arousal through exercise (increased autonomic arousal) increases personal agency, which in turn encourages the endorsement of extreme pro-group actions among highly fused individuals (Swann 2014). For instance, Swann *et al.* (2010b) found that raising the autonomic arousal level (i.e. pulse rate) of fused group members through group exercise increased their endorsement of extreme pro-group actions. However, they found that for non-fused individuals, group exercise did not result in a significant increase in the endorsement of extreme pro-group actions. Thus, it is proposed that when the agency of fused persons is augmented by autonomic arousal, endorsement of pro-group actions, also, increases (Swann *et al.* 2010b). Focusing on terrorist violence, Atran (2010; 2016) asserts that engaging in physically stimulating group actions such as sport, martial arts or hiking increases the sense of an exclusive gang among members of a prospective terrorist cells and augments the feeling of brotherhood among fused individuals. The effect of such high levels of fusion enables individuals to participate in extreme actions including self-sacrifice for the sake of the group mission. In this regard, we can consider how taking part in physically demanding group bonding rituals or activities (e.g. hunting expeditions) further acts to reinforce the cohesion among fused individuals.

An important example of the relationship between dangerous actions and identity fusion is offered by Whitehouse and McQuinn (2013). They examine how frontline conflict represents a shared highly dysphoric experience that produces psychological kinship and intense levels of identity fusion among group members. In a survey of fighters during the 2011 revolution in Libya, they observed that (1) rebel groups employed low-frequency, dysphoric rituals as part of the process of induction into the group and (2) the degree of shared dysphoria in battle predicted the strength of identity fusion within rebel units. They documented that frontline fighters were more likely than non-fighters to protect members of their battalion over their families, indicating that individuals who had shared traumatic experiences had higher levels of identity fusion with those they had fought

alongside than actual kin members. In relation to the tendency for fighters to express stronger fusion with the members of the group they shared combat experience with, Whitehouse *et al.* (2014) offers us two possibilities: (1) that fusion compels group members to risk their lives in the frontline combat or (2) engaging in frontline fighting produces high levels of identity fusion between group members. The latter possibility aligns with a number of findings from cross-cultural ethnographic research on the effects of dysphoric experiences and/or rituals and group cohesion (Whitehouse 2000; 2004; Salali *et al.* 2015). The general observation is thus that sharing dysphoric experiences with other group members may reflect the best conduit for high levels of identity fusion to emerge. We can propose that identify fusion is linked to the endorsement and participation in extremely dangerous actions by individual members for the group (Swann *et al.* 2009; Swann *et al*. 2010a; b; Gómez *et al*. 2011a; Swann *et al.* 2012; Whitehouse and Lanman 2014; Whitehouse *et al.* 2014). What is interesting is that the frontline fighters in Libya do not represent hunter-gatherers but do inform us of how collective action problems (in this case conflict) and shared dysphoric experience give rise to or require more imagistic based social cohesion. This shows that apart for the hunter-gatherer versus settled agriculturalist distinction, there are other collective action factors that enable us to examine the use of imagistic rituals in groups—warfare being one.

In the context of the agricultural transition, we can propose that pre-Neolithic mobile hunter-gatherer groups faced a number of key problems—namely, food scarcity, free-riding and defection. High risk collective actions such as hunting and conflict had the potential to encourage defection. Faced with such problems, mobile hunter-gatherers needed to form highly cohesive bonds (1) to ensure a food supply—especially in relation to large game food source; (2) to prevent defection; and (3) to defend acquired or available resources.

It is a contention to this research that Identity fusion through imagistic practices represented an ideal mechanism to generate the required high levels of group cohesion

among bands of mobile hunter-gatherers. We can assert that taking part in imagistic (dysphoric) rituals and engaging in dangerous activities such as hunting large game and conflict represented the necessary infrequent but arousing episodic actions that would have produced and reinforce psychological kinship among the participants—resulting in identity fusion among the group members (Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). Taking part in hunting expeditions or warfare would have heightened autonomic arousal and encouraged highly fused individuals to continue to or repeatedly engage in highly dangerous pro-group actions.

In the context of pre-Neolithic hunter-gatherer groups, therefore, identity fusion through highly arousing imagistic rituals and experiences could have ensured the extraction, sharing and protection of group resources (*ibid*). Whether Identity fusion encourages people to engage in dangerous pro-group actions or vice-versa, we can propose a relationship between the type of resource strategies (i.e. hunting) used by mobile hunter-gatherers and the production of the identity fusion via imagistic rituals, for the purpose of providing the necessary cohesion to limit defection and engender pro-group altruism. In this sense we can consider why, in the absence of ritual frequency and dysphoric arousal information, archaeological evidence of subsistence (in this case hunter-gathering) practices may be related to the imagistic mode of religiosity. One possibility is a proposed connection between the collective action problems faced by small-scale hunter-gatherer groups and the use of imagistic mode rituals to generate the required level of identity fusion, to ensure group survival. This may explain the results in relation to the application of the sets of subsistence variables to the *known* eHRAF cultures.

8.7.6. Social cohesion and agricultural communities

The statistical results highlighted a relationship between subsistence strategy and mode, raising the question of why groups engaging in an agricultural subsistence strategy would use doctrinal mode rituals to generate and maintain group cohesion?

Whitehouse and Lanman (2014) propose that the development of the doctrinal mode represents an on-going ritual change paralleling and responding to gradual changes in resource strategies—as human groups transitioned form mobile hunter-gatherers to sedentary agriculturalists. Moreover, they suggest that the first emergence of the doctrinal mode reflects a necessity to produce the required levels of group cohesion to ensure cooperation in emerging and expanding agriculturalist communities. It is proposed that complex societies emerged as a direct consequence of the agricultural transition as adopting agriculture (1) enabled the maintenance of high population densities and (2) required (hierarchically) organised cooperation among members of an extended community (Carneiro 1971; Richerson and Boyd 2001; Salali *et al*. 2015). As previously mentioned, Atkinson and Whitehouse (2011) demonstrate a correlation between doctrinal rituals and high levels of agricultural intensity.

At the most fundamental level, there are a number of challenges associated with a sedentary agriculturalist subsistence strategy. These include: (1) an investment in a long-term food security strategy based on maintaining crops and animals in a particular area; (2) an investment in a long-term subsistence strategy in which the benefits may not be yielded for a number of months; (3) an increase in population numbers and density (an expanding social network); (4) an increased need for cooperation with non-kin members—particularly for large projects; (5) an increased need for levels of organisation to manage cooperation; and (6) potential attacks from other groups—e.g. mobile hunter-gatherers or expansionist neighbouring agriculturalists (Banning 1998; Bar-Yosef and Rollefson 1998; Kuijt and Goring-Morris 2002; Colledge and Conolly 2004; Bellwood 2005; Armelagos and Harper 2005; Bellwood 2005; Coward 2010; Rowley-Conwy 2011).

In the context of the challenges associated with the emergence and establishment of agriculture, dysphoric rituals used to create small group cohesion would be unable to produce the level of cohesion and cooperation in the context of extended social (non-kin)

networks. It is asserted that, during the transition to agriculture, the successful groups were the ones that produced a sense of shared identity among members of a large group (possibly by eliminating or supressing more local imagistic practices) (Whitehouse and Lanman 2014). The fundamental difference in this perspective is that mobile hunter-gather groups require shared intense social bonding practices to engender a sense of kin for the purpose of reducing defection, whereas sedentary farming communities require a socio-culturally reinforced sense of commitment to an imagined community (Anderson 1983; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al.* 2015). In the latter situation, shared beliefs, values, and other identity markers are required to ensure the necessary level of cooperation between (relative) strangers. Furthermore, the information central to the sense of group identity must be easily transmitted, replicated and recognised among members of a particular extended social network. It is suggested that, in the context of early agriculturalist communities, doctrinal practices emerged and were utilised to generate the sense of group identity essential to pro-group cooperation (Henrich and Henrich 2007; Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al.* 2015). In this regard, it is asserted that doctrinal mode practices are particularly suitable in communities where group survival depends on long-term group cooperation (e.g. for the purpose of agriculture) across large social networks. In that, extended agriculturalist communities require forms of cohesion that are diffused throughout the entire network but are less intensely felt (compared to imagistic practices) (Whitehouse 1996; 2002; 2004; Whitehouse and McQuinn 2013; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014). Doctrinal practices provide an effective schema for regulating the beliefs and practices that produce group identification among a large population (Whitehouse and Lanman 2014). In this context, it is proposed that doctrinal rituals directly enable the standardisation, codification and spread of a set of identity markers that encouraged and reinforced group identification and, thus, ensured cooperation in extended agriculturalist communities (Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al*. 2015).

What are the aspects of doctrinal practices that may have been responsible for the production of group identification in the context of early agriculturalist communities during the Neolithic transition? In terms of cognition, it is suggested that doctrinal rituals are central to the production of group identification as the routine nature of doctrinal rituals engages the semantic memory and enables individuals to store and recall the information essential to a groups' belief and practices (Whitehouse 2002; 2004; Whitehouse and Lanman 2014). The repetition of rituals makes them easier to remember and recreate accurately as their associated beliefs become a stable part of the each participant's semantic memory (Whitehouse 2002; 2004; Whitehouse and Lanman 2014). In relation to the connection between the doctrinal mode and group identification is it asserted that doctrinal practices and rituals produce the levels of group identification associated with the alignment and cooperation among members of an extended group with shared beliefs or values through ethnic and coalition psychology. This happens as these psychology mechanisms enable us to learn, follow, and enforces shared social norms which leads to a sense of a group with shared beliefs—particularly, in an extended network (Henrich and Henrich 2007; Richerson and Boyd 2005; Kurzban and Neuberg 2005). Taking this into account, we can suggest that doctrinal practices produced the base-line level of group identification to ensure cooperation among members in early agriculturalist communities where the management, extraction and distribution of resources required a greater investment by a large network of individuals (Whitehouse 2002; 2004; Atkinson and Whitehouse 2011; Whitehouse *et al* 2014; Whitehouse and Lanman 2014).

Archaeological evidence is emerging that links the Neolithic transition with material culture associated with regular, organised rituals and group identity markers. As discussed in section 2.4.2, Mithen (2004) and Whitehouse and Hodder (2010) suggested that the first appearance of routinized collective rituals occurs in agriculturalist communities in the Neolithic Middle East around 8,000 years ago. For example, it is

proposed that Çatalhöyük provides evidence of a transition from low-frequency, high-arousal rituals connected with the production of highly fused, cohesive groups necessary for engaging in large-game hunting to material culture connected with the regular reinforcement of group values/beliefs associated with enhancing group identification (Whitehouse and Hodder 2010; Whitehouse and McQuinn 2013). Evidence of repeated architectural and artistic forms associated with the later Neolithic layers at Çatalhöyük are indicative of more routinized, prescribed ritual and societal practices associate with a more doctrinal mode of religiosity (Whitehouse and Hodder 2010). We can also consider the possibility of group identification emerging in the context of:

(1) spatially extensive material culture links during the pre-pottery Neolithic of south-west Asia—e.g. the PPNB examples given by Coward (2010);

(2) a possible connection between regional groups in the context of the Neolithic cultures of north-western European—e.g. the emergence of Megalithic monuments may indicate a shared, more doctrinal religious/ritual framework; and

(3) the *mega-site* population centres such as PPNB Ain Ghazal which represent densely populated areas where a shared world view may be important to generate and maintain social cohesion.

These examples provide potential evidence of an organised, standardised belief system shared by an extended network associated with the emergence of a group identity. In these examples, group or religious leaders may have emphasized connections not only with the more immediate, local group but also with an extended network.

In sum, a connection is plausible between doctrinal practices and the levels of group identification required in agriculturalist communities to ensure cooperation. It is suggested that the Neolithic transition reflects a process through which people came to be bonded and identified with much larger (more impersonal) social groups. Doctrinal mode rituals and practices served to produce and reinforce the level of group identification

necessary to the achieve group cooperation. Routinized, highly-organised rituals were fundamental to the establishment of large-scale agriculturalist communities as they produced the essential level of group identification that was needed to ensure pro-group cooperation in the context of an expanding social network—extending trust, resources and assistance to (often unknown) group members that share the same beliefs and practices. As the agricultural transition unfolded, it is increasingly connected with the emergence of a sense of group identification among members of extended (non-kin) networks which was generated and reinforced by doctrinal practices. The connection between sedentary agriculturalist communities, group identification and the doctrinal mode may (1) explain why the recorded subsistence variables were shown to be the best set of predictor variables for religious mode, and (2) indicate that, in the absence of ritual frequency and arousal information, subsistence strategy evidence is an aspect of material culture that can potentially be employed to assess the modes of religiosity in the archaeological record, ideally in combination with other lines of evidence.

8.8 The emergence of the doctrinal mode during the agricultural transition

The results generated in this research are largely consistent with the hypothesis that the agricultural transition was associated with a shift to a more doctrinal ritual mode. It is proposed that doctrinal mode practices acted as a mechanism to facilitate an increase in cohesion via group identification in early agricultural communities. In addition, the relationship between the development of agriculture and the emergence of the doctrinal mode is proposed by a number of authors (Atkinson and Whitehouse 2011; Curry *et al*. 2014; Whitehouse and Lanman 2014; Whitehouse *et al*. 2014; Salali *et al*. 2015). In this thesis I propose that doctrinal practices may have operated to produce group cohesion in these communities. However, this only explains the eventual role of doctrinal rituals in

these communities. What were the initial aspects of the transition to agriculture that eventually led to the emergence of a recognisably doctrinal mode? To do this, it is necessary to examine the aspects of agricultural activity that plausibly enabled the emergence of the doctrinal mode. It has been suggested that characteristics of the adoption of agriculture (sedentism, increase in group size and the need for organised cooperation) presented an ideal socio-cultural platform for the emergence of the doctrinal mode (Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011; Whitehouse *et al.* 2013; Currie *et al*. 2015). For instance, it has been argued that the routine nature of agricultural activity facilitates regular ritual activity through its association with regular, time/season focused activities; this includes fixed daily activities and regular cycles of sowing, tending and harvesting (Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011; Whitehouse *et al.* 2013; Currie *et al*. 2015). New ritual forms developed that were structured around daily or longer-term cyclical events, with the trade-off being that these rituals were less intense emotional experiences (Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011; Whitehouse *et al.* 2013; Currie *et al*. 2015). The routine nature of rituals increased group identity and, therefore, resulted in greater cooperation (Whitehouse and Hodder 2010; Atkinson and Whitehouse 2011; Whitehouse *et al.* 2014; Currie *et al.* 2015). It thus appears plausible that actual agricultural activity, as well as the associated increase in sedentism and production of a food surplus, promoted a general increase in the frequency of communal rituals and (indirectly) created a situation where features of a more doctrinal mode could have emerged, including regular, orchestrated rituals, the emergence of a class of ritual practitioners and the transmission of ideas over a large regional network.

The archaeological evidence of ritual activity reflects a more regular, routinized, homogeneous form of ritual experience associated with the agricultural transition in south-west Asia (Goring-Morris 2000; Rollefson 2000; Kuijt 2000 a, b; 2001 2008; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b 2004) and north-western Europe (Larsson

1986; Andersen 1988a; b; 1997; 2004; Thomas 1987; 1990; 1991; 1993; Cooney, G. 1990; 2000; Hodder 1990; Kirk 1993; Richards 1996; Whittle 1996; Bradley 1998; Cooney and Grogan 1999; Raetzel-Fabian 1999; Berg 2002). For example, many PPNB communities standardised a number of mortuary rituals including (1) the use of skull caching in extramural locations; (2) burial practices including skull plastering; (3) burial without grave goods; and (4) the caching of cultic objects such as zoomorphic figurines (Banning 1998; Goring-Morris 2000; Rollefson 2000; Kuijt 2000 a; b; 2001; 2008). Kuijt (2008) points out that the MPPNB site-phases of Jericho, Ain Ghazal, Kfar Hahoresh, Yiftahel, Beidha, Tell Aswad and Wadi Shu'eib present evidence of sedentary communities involved in intensive agriculture with standardised domestic architecture, standardised lithic technology and a number of similar mortuary practices. Furthermore, this thesis has shown that material culture such as ritual buildings, communal buildings, zoomorphic and anthropomorphic figurines reflect distinctive aspects of PPNB material culture and: (1) the MPPNB sites clustered together in the MDS and PCA analysis and; (2) following GLM based on a PCA identified set of subsistence variables, 83% of the MPPNB site-phases were categorised as doctrinal. From this evidence, we can suggest that an agriculture-based lifestyle facilitated an increase in standardisation indicative of the types of shared identity markers connected with group identification in a more doctrinal mode of religiosity.

As this research is proposing a relationship between changes in subsistence strategy and religious transition (in this case, the emergence of the doctrinal mode), it is necessary to examine examples of empirical research that have connected socio-economic and religions changes respectively, since these may provide further insight into the emergence of the doctrinal mode during the agricultural transition. Outside the framework of the Modes of Religiosity theory, a number of authors have examined the ritual consequences associated with socio-economic transitions. In relation to the transition to agriculture, Peoples and Marlowe (2012) examine religious developments associated with

agriculturalists using cross-cultural data. They identify that shifting to an agriculture-based economy generally results in the emergence of a number of problems that require collective action, examples being an increased need for public works such as construction of communal storage facilities and defensive perimeters. They propose that the need to solve these problems in an efficient manner leads to (1) increased social stratification and (2) the emergence of leaders to organise and guarantee cooperation. It is in the context of these two propositions that Peoples and Marlowe (2012) suggest that *moral High Gods* emerge. It is asserted that these are normally associated with new codes of conduct that ensure group cohesion in groups engaging in agriculture. Essentially, Peoples and Marlowe (2012) suggest that belief in moral High Gods is directly related to the challenges faced by agriculturalist groups (depending on high levels of the cooperation for food security). People and Marlowe highlight a connection between a religious change (the emergence of moral High Gods) and the development of agriculture. In this thesis it is proposed that the concept of moral High Gods would serve as an ideal identity marker in an extended network as it would (1) reinforce group identity in an obvious way as concepts such as *we are the people who belief in this particular God* (*the true God)* and (2) generate the idea of an external, objective punisher in the context of an extended network. In doing so, we can suggest that the idea of a *moral High God* would have facilitated and reinforced the required level of group identification among non-kin to ensure cooperation in agriculturalist communities.

Baumard *et al*. (2015) examine the relationship between socio-economic change and the emergence of major religious movements between 500 BC and 300 BC. Using historical data, they argue that the major world religions such as Buddhism, Brahmanism and Judaism emerged in the context of exceptional economic growth and prosperity, connected directly with increases in food availability and consumption, survival rates, and population size. They suggest that these socio-economic transformations enabled a number of social changes that aided the emergence of these religions. For example, it is

asserted that this period of socio-economic change facilitated the growth of a class of specialist religious practitioner. Employing *life history theory* (which proposes that increases in absolute affluence have predictable effects on human motivation and reward systems), they suggest that an increase in affluence led to an increase and spread of new ideas of self-control and cooperation; and this motivational shift created a situation where new religious doctrines consistent with these goals could emerge. Although the model proposed by Baumard *et al.* (2015) is based on evidence from periods later than the agricultural transition, it can be suggested that similar processes occurred in the Neolithic, in that a socio-economic change (the transition to agriculture) prompted religious change (in our case, the transition to a more doctrinal mode). The model they propose for the emergence of new religions has a number of parallels with the agricultural transition, as central to their model is (1) the development of a food surplus; (2) an increase in resource monopolization; and (3) the rise of a specialist class. Therefore, we can suggest that the model of religious change associated with an economic transformation presented by Baumard *et al.* (2015) provides a framework to consider what aspects of the adoption of agriculture facilitated the emergence of the doctrinal mode during the agricultural transition.

In terms of a socio-cognitive mechanism that facilitated the emergence of the doctrinal mode, a crucial aspect of the competitive feasting model (Hayden 1990; 2001 a; b; 2003; 2004; 2009) is the connection drawn between feasting and *Food-Risk-Reduction* strategies in hunter-gatherer groups. Different to many of the other *ritual before agriculture* models, Hayden's important innovation is that he provides an actual socio-cognitive mechanism that explains how his model works. He outlines a number of new strategies adopted by transegalitarian groups to reduce food-risks, which resulted in domestication (Hayden 2009). Using Wiessner's (1982) research on risk avoidance, Hayden (2009, 598) outlines four major types of food-risk-reduction strategies employed by transegalitarian hunter-gather groups:

1. prevention of resource loss via manipulation and/or exclusive territoriality.
2. risk pooling based on (a) sharing of food and obligatory reciprocal (b) centralized redistribution via central administrators.
3. the establishment of regional reciprocal alliances used to access food in times of need based on (a) regional kinship networks; (b) rituals, including common totemic ancestors; (c) frequent visiting and reciprocal hospitality and (f) exchange of exotic or prestige items.
4. the creation of enemies who could be displaced if the need arose (expropriation)

I would argue that the same food-risk-reduction mechanisms described by Hayden (2009) were fundamental to the development of a more doctrinal religion during the agricultural transition. Of all the challenges faced by agriculturalist groups, the most fundamental is likely securing a food supply against (1) uncontrollable factors; i.e. environmental problems leading to crop failure and (2) controllable factors i.e. lack of group cooperation. It is plausible that food-risk-reduction became far more immediate in the context of the first sedentary agricultural groups that depended on the yield from a particular plot(s) of land, compared to mobile hunter-gatherer groups. It is in the context of the early agricultural communities in south-west Asia that the four major food-risk-reduction strategies (outlined by Hayden 2009) become critical social motivational mechanisms which, ultimately, aided the emergence of a more doctrinal mode religion. P*revention of resource loss via manipulation and/or exclusive territoriality* (Hayden (2009; 598) can be considered as a fundamental issue in sedentary agriculturalist groups. A central strategy for protecting territory (where food is grown) is to promote the idea of the "group territory". The effect of the establishment of the concept of the group territory could be the binding of group members into a network that promotes the need to protect each other's plots within a territory. It is proposed that one of the ways to achieve this type of cohesion or group identification is to find a common identifier which defines you

as a group. A common worldview or religion (regularly reinforced by rituals) would be a way of achieving a high level of group identification.

The second strategy identified by Hayden (2009; 598) is *Risk pooling based on (a) sharing of food and obligatory reciprocal (b) centralized redistribution via central administrators*. The pooling of resources through various methods would have been an ideal way to ensure food security in early agricultural groups as it would have guaranteed the immediate food-security of the group by creating reciprocation-based alliances in the group—including non-kin members (Mauss 1990). The third strategy identified by (Hayden (2009; 598) is *the establishment of regional reciprocal alliances used to access food in times of need, based on (a) regional kinship networks; (b) rituals, including common totemic ancestors; (c) frequent visiting and reciprocal hospitality and (f) exchange of exotic or prestige items*. Similar to the last point, these strategies would have been important mechanisms for ensuring food security in the context of early agricultural groups through the creation of an extended reciprocation network and the development of hierarchies to coordinate and control the extraction and distribution of resources. These two factors would have facilitated the emergence of the doctrinal mode by providing the necessary hierarchical structures and extended networks associated with the doctrinal mode (as suggested by Whitehouse 2000; 2002; 2004). Perhaps the most important social-binding mechanism identified by Hayden (2009) is, what he terms, "rituals, including common totemic ancestors" (Hayden 2009; 598). As discussed in section 8.5.2, it is a contention of this research that, in the context of an increased reliance on group cooperation to achieve food security in the agricultural transition, doctrinal rituals would have played a fundamental role in producing and reinforcing group identification, and this common group identity would have promoted group cooperation centred on the protection of the area where crops are being grown. Furthermore, we can suggest that doctrinal rituals focusing on common totemic symbols and the ancestors would have (a) created a distinctive group identity and (b) legitimised the groups' claim to particular

areas in the landscape (where food was being produced). In this framework, we can suggest that doctrinal rituals could have emerged and been utilised to transmit and reinforce particular worldviews and values, especially in larger social networks (as described by Atkinson and Whitehouse 2011; Whitehouse *et al.* 2014), producing the required levels of group identification and resulting in increased cooperation for the purpose of securing a food supply in the event of a disruption to your own source of food.

The fourth strategy in the food-risk-reduction model proposed by Hayden (2009; 598) centres on the *creation of enemies who could be displaced if the need arose (expropriation)*. It is argued in this thesis that a more doctrinal ritual/religious framework (regular routinized reinforcement of beliefs and values) would have been fundamental to forging group identity and maintaining cooperation in the agricultural transition. Thus a more doctrinal set of rituals aided the establishment of a distinctive group identity, which would have facilitated the identification of the "other", the "outsider" or the "non-believer" who may pose an immediate threat to "our way of life" by impacting on food security. In this context, we can propose that a doctrinal religion would have been an ideal mechanism for shaping/establishing and maintaining group identity in the context of the new social and economic situation produced by the transition to agriculture. It can be argued that food-risk-reduction strategies during the agricultural transition account for the evidence of interpersonal violence associated with the agricultural transition in Europe: in the British Isles (Schulting and Wysocki 2005; Schulting 2006), southern Scandinavia (Fibiger *et al.* 2013) and the mass grave at Talheim in southwest Germany (Wahl and König 1987). Interpersonal violence may reflect a type of extended fusion (discussed in section 2.7.1.2.) that can occur in large social networks. In this regard, we can suggest that risk-reduction relating to food security (acquiring and maintaining arable land) could be associated with the legitimization of the use of violence for protecting territory and expanding into new areas. It can be suggested further that food-risk-reduction strategies employed by agricultural communities during the transition to agriculture facilitated the

emergence of a more of doctrinal religious/ritual framework connected with increased commitment to a longer-term food strategy and a defined locality (arable lands). In sum, food risk reduction is the central concern in sedentary agriculturalist communities. It is proposed that food risk reduction strategies provide a fundamental need to create the idea of a group identity to ensure cooperation. Furthermore, it is asserted that doctrinal mode rituals emerged in this context to produce the required level of group identification

In this thesis it is suggested that a number of factors facilitated the emergence of a more doctrinal mode of religiosity in the context of the agricultural transition in south-west Asia, namely: (1) the seasonal/cyclical nature of agricultural activity facilitated the emergence of more frequent ritual activities; (2) the production of a surplus and the increase need to organise collective labour created a more hierarchical social network which resulted in the emergence of specialists, including ritual practitioners; (3) increased sedentism and an expanding social network facilitated and necessitated the transmission of beliefs and practices through a more doctrinal framework (high frequency/low dysphoric arousal); and (4) socio-cognitive mechanisms such as food-risk-reduction strategies were fundamental motivators in the emergence of a more doctrinal mode to generate the required levels of group identification, which centred on a shared world view (legitimised and reinforced by regular ritual activity).

8.9 Building a cognitive picture of a Neolithic doctrinal religion

This section utilises research focusing on cognitive models of the emergence and transmission of religion as well as the archaeological material culture from both regions to present a hypothetical model of an emerging doctrinal "Neolithic religion".

8.9.1 Cognitive devices and an emerging doctrinal religion in the Neolithic

As outlined in Chapter 2, the framework of religious belief including religious doctrine, ritual practices and the transmission/establishment of religious concepts are directly associated with aspects of human cognition. The complex cognitive devices that would

have played a role in the emergence, transmission and establishment of *new* religious ideas and ritual practices in the context of the agricultural transition include: semantic memory, episodic memory, relevance mechanisms, somatic markers, cross-domain-analogical thinking system, theory of mind (TOM) and hyper-sensitive agency detection devices (HADD). The semantic memory system enables us to store and recall large amounts of knowledge (Whitehouse 2004; 2007; Hassabis and Maguire 2007; Schacter *et al*. 2011). It is proposed that semantic memory was central to the transmission of any new religious teachings in the context of a more doctrinal religion during the agricultural transition (Whitehouse 2000; 2002; 2004). Semantic memory would have been a particularly important cognitive device in the context of a more doctrinal religion which is characterised by standardised rituals, beliefs and doctrine spread through a large, geographically extensive social network. Aspects of ritual practices such as regular meetings in communal ritual buildings would have continually reinforced religious knowledge stored in semantic memory, and that semantic memory enabled religious concepts to be transmitted through large(r) social networks while maintaining the integrity of the information. In terms of European material culture, we can suggest that, for example, the proliferation of megalithic monuments in north-western Europe may provide evidence of religious concepts shared over a large geographical area (Tilley 1984; 1990; 1991; 1993; Eogan 1986;b; Larsson 1986; Andersen 1988a; b; 1997; 2004; Cooney 1990; Hodder 1990; Sherratt 1990; Kirk 1993; McMann 1994; Bergh 1995; Richards 1996; Whittle 1996; Cooney and Grogan 1999; Raetzel-Fabian 1999; Cooney 2000; O'Kelly 2004).

In relation to shared ideology in south-west Asia, Coward and Gamble (2008) and Coward (2010; 2013) use social network analysis to examine the distribution of artefacts throughout south-west Asia from the Epipalaeolithic through the Pre-Pottery Neolithic. Coward (2010) states that based on different type of material culture the network connections between contemporary site-phases increased (became denser) from the

Epipalaeolithic through the Pre-Pottery Neolithic, demonstrating a high level of contact and exchange between samples of geographically distributed Neolithic sites.

In the context of an emerging, more doctrinal religion, we can suggest that episodic memory would have facilitated the maintenance of memories of infrequent ritual events or episodes (Whitehouse 2004; 2007; Hassabis and Maguire 2007; Schacter *et al*. 2011). Examples of infrequent ritual events in the Neolithic could have been rites of passage at or in megalithic monuments and/or taking part in or witnessing particular burial practices such as the re-excavation of a grave to remove a skull (Kuijt 1996; 2001; 2002a; 2002b; 2008; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b). We have evidence of secondary burial practices including skull removal and skull plastering from a number of sites in south-west Asia from the Pre-Pottery Neolithic cultural horizons (Kuijt 1996; 2001; 2002a; b; c; 2002b; 2008; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; c). We can propose that sites such as Gobekli Tepe are suggestive of some form of irregularly occurring, arousing communal gathering, be it for feasting or other activities (Mithen 2004; Perters and Schmidt 2004; Schmidt 2006; Watkins 2010; Banning 2011; Dietrich *et al* 2012).

The perspective developed here also has implications for the role of Theory of Mind (TOM) and Hyper sensitive agency detection devices (HADD) in creating non-reflective beliefs directly associated with an emerging doctrinal religion in the Neolithic. TOM is responsible for generating inferences about mental states without biological considerations, enabling us to project or conceive of a mental state associated with a deceased person. HADD is central to producing non-reflective beliefs regrading agency (or the presence of agency), the result being the perception of intentional agents (supernatural forces) (Barrett 2000; 2003; 2004; 2007). We can propose that the combination of both of these cognitive devices enabled Neolithic people to maintain concepts such as life after death, ancestors or supernatural agents such as God(s). We can suggest that the idea of agency was reinforced by the attendance of regular rituals at

communal buildings, visiting or knowledge of burial sites and the circulation of anthropomorphic and zoomorphic figurines (Kuijt 1996; 2001; 2002a; 2002b; 2003; 2008; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b).

The concept of agency is probably most pronounced in the emergence of megalithic tombs in north-western Europe. For example, Cooney (2000) asserts that central to the societal change in the north-west European Neolithic is a gradual change of emphasis from burial rites to ancestral rites from the Mesolithic to the Neolithic. In relation to passage tombs, it is suggested that direct association with the ancestors was essential to the symbolic and cultural importance of these tombs (Cooney and Grogan 1999; Cooney 2000). Hodder (1990) suggests that the act of constructing monuments for the ancestors can be seen as a process which reinforced lineage relationships between somewhat dispersed subgroups. We can thus suggest that cognitive devices such as TOM and HADD played an active role in the attribution of agency to the ancestors and the presence of supernatural agents.

8.9.2 General socio-cognitive features of an emerging doctrinal religion in the Neolithic

Combining the cognitive and anthropological research into religious form and transmission with the material culture identified in this thesis, this section will briefly outline the probable cognitively salient features of an emerging Neolithic, more doctrinal religion. In contextualising the inherent connection between the transmission and establishment of religious ideas and human cognitive devices, a number of possible inferences concerning religious belief during the agricultural transition can be made. The central feature of an emerging doctrinal religion in the Neolithic is that it develops in the context of (1) a greater reliance on a long-term investment in a particular subsistence strategy (agriculture), in which the benefit may not appear for a number of months (Bar-Yosef 2004; Armelagos and Harper 2005; Bellwood 2005; Dolukhanov *et al.* 2005; Zeder 2011); and (2) a larger (possibly more geographically extensive) social network (Kuijt

1996; 2001; 2002a; 2002b; 2003; 2008; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; Coward 2010; Finlayson *et al.* 2011). In this context we can suggest that, fundamentally, cultural transmission of religious beliefs and ritual practices made cooperation more effective in the context of an expanding social network and an increased reliance on a long-term, labour intensive, subsistence strategy. In the context of the hypothesis central to this research, it can be asserted that the emerging Neolithic doctrinal religion may have centred on high frequency rituals with low dysphoric arousal levels. It is suggested that the communal architecture (ritual buildings and monuments) and the proliferation of a number of artefacts such as anthropomorphic and zoomorphic figurines (particularly in the PPNB) may be demonstrating the emergence of a more organised, routinized set of beliefs associated with the agricultural transition (Kuijt 1996; 2001; 2002a; 2002b; 2003; 2008; Cooney 200; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; Kuijt *et al.* 2011).

Any new religious concepts/ideas must have been both intuitive and minimally counterintuitive, enabling the concepts/ideas to spread effectively through a larger social network (Barrett 2007). For an idea to reach the level of a religious belief or doctrine it must be shared. However, some ideas spread more easily than others, based on their level of complexity: the more complex an idea is, the less likely it is to be spread (*Ibid*). Ideas that are both intuitive and minimally counterintuitive spread well as the general concept is familiar with the exception of one or two extraordinary attributions (Barrett 2000; 2003; 2004; 2007). Furthermore, an emerging more doctrinal religion in the Neolithic must have had good concept control (*Ibid*). Good concept control is central to the transmission and endurance of religious ideas. Good concept control ensures that the concepts are structured so that they appear plausible or believable, even if contradicted by others (Barrett 2000; 2003; 2004; 2007). Importantly, rituals which bring people together such as meetings at ritual locations (e.g. megalithic tombs) almost always have good concept control (*Ibid*). We can suggest that the important representations in an emerging doctrinal

religion would have been easily remembered ones, as hard-to-remember representations are forgotten or transformed into more easily remembered ones, before reaching a cultural level of distribution—particularly, in large groups (Barrett 2000; 2003; 2004; 2007). Again, the archaeological evidence of a number of shared religious artefacts and practice over widespread geographic regions (Cooney 1990; Hodder 1990; Sherratt 1990; Kirk 1993; McMann 1994; Kuijt 1996; 2001; 2002a; 2002b; 2003; 2008; ; Richards 1996; Whittle 1996; Cooney and Grogan 1999; Raetzel-Fabian 1999; Cooney 2000; Kuijt and Goring-Morris 2002; Verhoeven 2002a; b; Coward 2010; Finlayson *et al.* 2011) may be indicative of the spread of ideas or concepts that could be easily remembered and transmitted without losing their meaning. We can suggest that portable artefacts such as zoomorphic and anthropomorphic figurines, as well as larger, more permanent expressions of religious ideas such as the megalithic tombs would have served to reinforce a number of religious concepts. We can propose that ritual actions were (1) external expressions of religious belief and commitment; (2) acts of reinforcement; and (3) acts of transmission (Barrett 2000; 2003; 2004; 2007; Whitehouse 2000; 2002).

In sum, it is justifiable to argue that aspects of human cognition facilitated the formation/emergence of new religious concepts and practices in the context of the gradual agricultural transition in south-west Asia, and the transmission and establishment of new religious ideas and practices in the context of the more abrupt agricultural transition in north-western Europe.

8.10 Material culture expressions of an emerging doctrinal Neolithic mode of religiosity

In relation to the question, ‘what aspects of material culture from each region may be indicative of the emergence of a more doctrinal mode?’ the ritual material culture from the site-phases categorised as doctrinal by the GLMs is informative. For the south-west Asian archaeological dataset, it is communal structures and ritual buildings that can, to an

extent, be considered as indicative of the emergence of the doctrinal mode in the site-phases used in this research (Table 8.3). For the north-west European archaeological dataset, monumental architecture represents the clearest materialisation of a more doctrinal religion in that region (Table 8.3). Apart from ritual material culture, this thesis has shown that non-ritual material culture may represent a complementary way to examine the emergence of an increasingly doctrinal religion during the Neolithic transition in both regions. For the south-west Asian archaeological dataset, it is asserted that subsistence evidence of intensive agriculture and animal domestication may be associated with a more doctrinal mode (Table 8.1 and 8.2). Although not as successful as the subsistence evidence in relation the GLM results, social complexity material culture such as evidence of fully of sedentary groups/communities, communal structures and storage of cultural knowledge could potentially reflect additional, non-ritual archaeological evidence of an emerging more doctrinal religion (Table 8.3). For the north-west European archaeological dataset, it is proposed that subsistence evidence of agriculture and animal domestication are connected with a more doctrinal mode (Table 8.3). The identified social complexity variables were not as successful as the subsistence evidence in relation the GLM results, but we can suggest that material culture such as evidence of fully of sedentary groups/communities and intensive agriculture represent additional non-ritual archaeological evidence of an emerging more doctrinal religion (Table 8.2 and 8.3). It is proposed that the MPPNB in south-west Asia and the Late Neolithic in north-west Europe represent periods that display material culture that provides evidence of the emergence of a more doctrinal mode of religiosity relative to earlier periods.

Of course these suggestions relate to the site-phases and variables used in this research, and to the GLMs of varying success applied to the *known* eHRAF cultures. There may be additional variables that prove as good or better at examining the modes in archaeological data, and future work should be framed around this problem.

8.11 The dynamic modes of religiosity model in the agricultural transition: gradual versus abrupt processes

This section considers the emergence of the doctrinal mode in the agricultural transition in both regions. It is proposed that the emergence of the doctrinal mode during the agricultural transition should be considered in the context of a dynamic (rather than a dichotomous) relationship between the imagistic and doctrinal modes. For example, as outlined in section 8.7.1, frontline fighters in Libya reflect people from, until recently, an organised state that in a conflict situation utilise a more imagistic based social cohesion framework. This shows that a (so called) doctrinal group can and will employ imagistic practices in certain scenarios. In this regard, I would argue that the emergence of a more doctrinal mode included the incorporation of imagistic practise and concepts.

Although ritual activity is central to the modes of religiosity theory, the results demonstrated that the sets of ritual variables coded and identified (via PCA) in this research are not the most appropriate set of variables to distinguish between the *known* eHRAF cultures and thus not the most appropriate variables that could be used to classify the archaeological site-phases in terms of the two modes. Although the ritual variables did result in a more successful GLM based on the European ritual variables, the MDS and PCA analysis based on the ritual variables demonstrated substantial overlap in pre-Neolithic and Neolithic site-phases from both archaeological datasets. In light of the statistical analysis carried out in relation to both archaeological datasets, it can be suggested that (1) the ritual variables used in this research demonstrated a degree of shared ritual practices across the agricultural transition; particularly in relation to southwest Asia; (2) communal ritual structures (including monuments) appears to one of the main variables in the datasets that may be related to the development of a more doctrinal mode in the archaeological datasets (as outlines in section 8.4). As we are proposing that the doctrinal mode emerged in the context of the agricultural transition, we need to examine and discuss its emergence in the context of two different transitions: (1)

a gradual, prolonged agricultural transition in south-west Asia (in the context of a wider, gradual socio-economic change from Late Epipalaeolithic to Pottery Neolithic); and (2) a comparatively more abrupt agricultural transition in north-western Europe, associated with a radical socioeconomic change.

First, to understand the gradual emergence of the doctrinal mode in the context of the south-west Asian agricultural transition, we must consider its relationship to the previous (imagistic) mode practices in this region. The statistical results generated in this research provide evidence of the continuation of ritual practices form the Epipalaeolithic to Neolithic in south-west Asia, as discussed above (section 8.2 and 8.5). From the analysis presented in this thesis we can observe that practices such individual burial, special treatment and burial goods reflect shared practices between the Epipalaeolithic to Pottery Neolithic (particularly the PPNA and PPNB) (Chapter 7 Table 7.5 and 7.6). The evidence of overlap in MDS and PCA may indicate that in south-west Asia both Epipalaeolithic and Neolithic groups (used in this study) were engaging in these practices. This proposal aligns with the assertion by a number of authors that gradual nature of the agricultural transition entailed some continuation of Epipalaeolithic ritual practices (Cauvin 1994; Kuijt 1995; 1996; 2001; 2002; 2008; Banning 1998; Goring-Morris 2000, 2005; Rollefson 2000; Kuijt and Goring Morris 2002). This point can be considered in the context of the assertion concerning the emergence of the doctrinal mode by Whitehouse (2000; 2002; 2004) and Mithen (2004). Whitehouse (2004) suggest that the imagistic mode is older than the doctrinal (with plausible evidence present in the European Upper Palaeolithic). It is asserted that the two modes are not mutually exclusive as "in some cases, a religious tradition that incorporates all the elements of the doctrinal mode also exhibits some of the features of the imagistic mode" (Whitehouse 2004, 75). Examining the archaeological evidence for the imagistic and doctrinal modes, Mithen (2004) suggests that the emergence of the doctrinal mode is a diversification of the imagistic mode in the early stage of the agricultural transition. It is proposed that doctrinal mode

emerges gradually out of the Imagistic mode (during the agricultural transition in south-west Asia) probably through an augmentation, regularization and increase in frequency of some imagistic practices, as well as the addition of new, doctrinal religious features. In relation to this claim, it is necessary to examine the evidence for ritual continuity during the transition. As mentioned in section 8.5, other researchers suggest that MPPNB mortuary practices provide examples of ritual continuity from the late Epipalaeolithic (Bar-Yosef 1981; Bar-Yosef and Belfer-Cohen 1989a; Cauvin 1994; Kuijt 1995; 1996; 2008; Banning 1998; Goring-Morris 2000, 2005; Rollefson 2000; Kuijt and Goring Morris 2002). It is asserted that mortuary rituals from the late Epipalaeolithic through the PPN display a range of continued practices including individual burial, the single burial of adults, an absence of grave goods and secondary burial practices including skull removal (Kuijt 1995; 2001). Kuijt (2001) points out that at the Lower Jordan valley site of Netiv Hagdud there is an example of PPNA and Late Epipalaeolithic skulls being cached together. It is suggested that the continuation of ritual/mortuary practices is evidence of a shared ritual practices from the Late Epipalaeolithic through to the Pre-Pottery Neolithic (PPN). Pertinent to the emergence of the doctrinal mode, Kujit (2008) asserts that PPN versions of Epipalaeolithic ritual practices are *more complex and uniform*. This assertion by Kujit (2008) may provide an indication that the practices were becoming more widespread and more standardised, characteristics associated with an emerging (more) doctrinal mode of religiosity.

Moreover, the archaeology of the PPNB presents examples of site-phases where architecture was intentionally constructed over previous burial areas. This evidence suggests that the location of previous burial were recorded or remembered (Kuijt 2002). Also, abandoned structures from previous periods were used as burial grounds in the PPNB; examples include Yiftahel and Beidha (*Ibid*). The Epipalaeolithic, PPNA and PPNB cultural horizons provide examples of burials associated with the inclusion of animal bone (usually wild animals), an example being Kfar HaHoresh (Kuijt 2002). Kuijt

(2002) suggest that the inclusion of animal bones with human burials may reflect beliefs associated with the status of hunters in the community or an attempt to make direct connections with the past in the context of the dramatic socio-economic changes during the PPNA and PPNB. In the context of the Modes of Religiosity theory, we can propose that the gradual emergence of the doctrinal mode during the agricultural transition was predicated on the maintenance of a number of practices that were used by earlier, Epipalaeolithic groups. As outlined in section 8.5, we can suggest that through the Pre-Pottery Neolithic in south-west Asia, the Epipalaeolithic rituals (1) may have become more frequent; (2) were augmented with a set of doctrinal practices; and (3) became more standardised/organised and were performed by specific ritual practitioners. This may account for the overlap when the south-west Asia was analysed using MDS and PCA.

In an ethnographic study using the Modes of Religiosity theory as an explanatory framework, Naumescu (2008) examines the changing role of the Catholic Church in Western Ukraine, focusing on the socialist and post-socialist eras, respectively. Naumescu (2008) examines the transmission of religious information in both urban and rural regions. In this study it is demonstrated the re-emergence of the Catholic faith in the post-socialist era relied on both imagistic and doctrinal aspects of ritual performance; it is suggested that unorthodox or more imagistic ritual practices were incorporated into this "new" re-emerging religion. Perhaps it was this inter-related relationship between the imagistic and doctrinal modes that enabled the gradual emergence of the doctrinal mode in the context of the agricultural transition in south-west Asia, characterised by an incorporation or augmentation of imagistic practices.

Secondly, we must consider the transition from an imagistic to a more doctrinal mode of religiosity in the context of a more abrupt transition to agriculture in north-western Europe (Colledge and Conolly 2004; Armelagos and Harper 2005; Bellwood 2005; Rowley-Conwy 2011; Sørensen and Karg 2014). The ritual variables identified in the European dataset produced a more successful GLM than the south-west Asian ritual

variables when applied to the *known* eHRAF cultures (with 84% correctly classified). This result may be reflecting the more abrupt nature of the transition in Europe. The GLM based on the identified subsistence variables was deemed to be the most fit for purpose GLM when applied to the know eHRAF cultures (with 84% correctly classified). This result highlighted a distinction between hunter-gatherers and sedentary agriculturalists. The GLM showed that, based on the subsistence variables, a number of Early and Middle Neolithic site-phases used in this research were classified as imagistic (chapter 7 Table 7.8 and 7.9), with a range of predicted percentages (Chapter 7 Table 7.9). Although the agricultural transition is considered as an abrupt shift from hunting and gathering to agriculture in north-west Europe (compared to south-west Asia), the results generated in this study suggest that there is some continuity between the Mesolithic and the Early and Middle Neolithic site-phases recorded in relation to subsistence practices. Therefore, the question must be asked to what extent the development of the doctrinal mode in agricultural transitions in north-western Europe involved a dynamic relationship between previous more imagistic ritual practices and new more doctrinal practise (particularly in the Early and Middle Neolithic). In the context of a rapid transition how were doctrinal practices adopted?

Current human archaeogenetic research demonstrates that the Neolithic transition is not consistent with a (total) population replacement in north-western Europe (Rosser *et al.* 2000; Semino *et al.* 2000; Di Giacomo *et al.* 2004; Dupanloup *et al.* 2004; Semino *et al.* 2004; Cruciani *et al.* 2007; Busby *et al.* 2011; Pinhasi *et al.* 2012 Haak *et al.* 2015; Smith *et al.* 2015). In this regard, we must consider the emergence of the doctrinal mode in terms of a transmission of (probably imported) new ideas and ritual/religious practices among (a largely) indigenous Mesolithic populations. Thomas (2007) suggests that the relatively rapid agricultural transition in Ireland and Britain indicates that indigenous Mesolithic populations must have had a dynamic role in the formation of the Neolithic in these areas. In this regard, we must consider that (a potential) shift to a more doctrinal

mode in north-western Europe involved the incorporation of aspects of Mesolithic (more imagistic) beliefs, concepts and practices. PCA highlighted grave goods as evidence of shared ritual material culture in the Mesolithic and Neolithic—based on the ritual variables recorded in this research. However, we cannot reliably use one type of material culture (in this case grave goods) to infer ritual continuity. The statistical methods used in this research showed that monumental architecture and burials reflected the greatest separation in terms of ritual evidence between the Mesolithic and Neolithic site-phases. This result is expected to a degree as megalithic monuments are generally presented as a defining ritual feature of the Neolithic (Cooney 1990; Sherratt 1990; Kirk 1993; Cooney and Grogan 1999; Cooney 2000). However, in the context of a rapid transition without the replacement of the indigenous population, we must consider to what extent the emergence of megalithic monuments during the agricultural transition is connected to previous Mesolithic practices and concepts.

For the most part, megalithic monuments are considered in the context of Neolithic ideas of permanency and legitimisation by association with the ancestors (Cooney 1990; Sherratt 1990; Kirk 1993; Cooney and Grogan 1999; Cooney 2000). However, Whitley (2002) and Scarre (2008) suggest that the concept of ancestors as a characteristic feature of farming (Neolithic) communities run contrary to the ethnographic evidence. Scarre (2008) suggests that the emergence of a Neolithic religion is a product of a process of reworking and augmentation of previous notions, rather than the replacement of the previous Mesolithic beliefs and concepts. In Scarre's model, older beliefs and places associated with them became incorporated into a newer world view or religion during the Mesolithic to Neolithic transition. A number of authors suggest that Mesolithic communities had a concept of attachment to specific landscapes that was similar to that of the Neolithic monument builders. For example, it is suggested that shell middens are an example of permanent Mesolithic "monuments" directly associated with particular landscapes (Pollard 1990; 1996; 2000; Cummings 2003; 2013; Warren 2007). It is

suggested that, similar to megalithic monuments, shell middens served as locales where people returned to regularly; which engendered a connection to particular landscapes (Cummings 2003; Warren 2007). Hellewell and Milner (2011) assert that Neolithic mortuary practices such as disarticulation and burial of bones in shell middens (recorded in Britain) indicate continuity with Mesolithic practices. It is proposed that Mesolithic shell middens demonstrate that Mesolithic hunter-gatherer communities in north-western Europe were building large and permanent features in the landscape, indicating that Mesolithic groups had an understanding of the world that was consistent with notions of Neolithic monumentality (Pollard 1990; 1996; 2000; Cummings 2003; 2013; Warren 2007). It is possible that similarities in concepts and beliefs enabled the rapid "conversion" to a more doctrinal mode in the agricultural transition in north-western Europe. If we are going to attempt to examine/explain this shift to a more doctrinal mode or religiosity, the assertion that Mesolithic and Neolithic concepts of the world were not that dissimilar (Cummings 2003; Warren 2007) adheres to the assertion by Whitehouse (2000) regarding the ethnographic evidence of a conversion form an imagistic to a more doctrinal religion, in Melanesian communities. Although the Melanesian communities had been the target of a number of unsuccessful Christian missionary groups, Whitehouse (2000) outlines the success of a large-scale politico-religious movement (in his example, a cargo cult). He asserts that, apart from the explicitly doctrinal nature of the new movements (high frequency, routinized practices), the important aspect of the conversion and maintenance were: (1) the movement was rooted in cosmological assumptions that the Melanesians regarded as plausible; (2) conversion occurred through the establishment of the new movement under indigenous leaders; and (3) the movement was very centralised and hierarchical organised—aiding the transmission of the doctrine (Whitehouse 2000; 42). The point by Whitehouse that the new movement was grounded in cosmological assumptions that the Melanesians regarded as plausible can be considered as analogous to the assertion by Cummings (2003) and Warren (2007) that Mesolithic and Neolithic concepts of the world were similar. We can use this example by

Whitehouse (2000) to consider the mechanisms of a Neolithic "conversion" in north-western Europe from an imagistic to an increasingly doctrinal mode. We can suggest that the transition to a more doctrinal mode in Neolithic of north-western Europe relied on (1) a similarity in concepts between both "religion"; and (2) the incorporation/integration of previous Mesolithic ritual concepts and practices.

In proposing a dynamic model of the modes of religiosity during the agricultural transition, it is necessary to address the effect of socio-economic change in the latter phases of the Neolithic in both regions. Although this thesis has proposed a transition from an imagistic to a more doctrinal mode of religiosity across the agricultural transition in both regions, it is important to note that the archaeology of the Neolithic transition presents evidence that indicates that the transition was not a one directional progression (Kuijt 2000; Whitehouse *et al.* 2013) and this can add to our understanding of the dynamic aspect of the (initial) emergence of the doctrinal mode.

For example, the archaeological record of both regions presents examples of substantial socio-economic change towards the end of the Neolithic periods. In south-west Asia, we have evidence that a number of large-scale aggregate villages ('megasites') were abandoned in the Late PPNB to PPNC period (Kuijt 2000). The collapse of the 'megasites' must have had an effect on the doctrinal rituals/religion, as its maintenance and transmission relied on intensive agriculture, a large social network and the increased hierarchy associated with the agricultural transition. In north-western Europe the Late Neolithic is also connected with a dramatic socio-economic change. For instance, focusing on the Irish Neolithic, Whitehouse *et al.* (2013) suggest that the archaeobotanical record may indicate a decrease in arable land and agricultural activity associated with a change in climate from 3400 BC onward. Similarly, Stevens and Fuller (2012) present evidence of a late Neolithic decrease in agricultural activity in Britain. They assert that agriculture does not recover (become intensive) in Britain until the Middle Bronze Age.

If the doctrinal mode (as proposed by Whitehouse 2000; 2004) is associated with centralized political organization, large-scale routinized religions and a religious and secular hierarchy, then the dramatic changes such as the collapse of the 'megasites' in south-west Asia and the subsistence/climatic changes in Late Neolithic north-western Europe could potentially present a challenge for the modes of religiosity model problem (re the emergence of the doctrinal mode). We can frame it like this: if the doctrinal mode emerges during the agricultural transition, what happens to it when we see these dramatic changes? Exactly this problem/question displays the need to consider the agricultural transition as a period reflecting the dynamic aspects of religious modes. The agricultural transition is fundamental to creating the necessary conditions for the emergence of the doctrinal mode—i.e. increased population, increased sedentism, increased social network, increase social hierarchy/inequality and an increased need for social cohesion connected to a greater reliance on a longer-term subsistence strategy. But in light of the archaeological evidence, we must consider the possibility of a temporary decrease in doctrinal mode activities in some regions following the collapse of the 'megasites', or certain climatic events. However, this is not to suggest that the doctrinal mode or its ritual practices were abandoned. Perhaps such socio-economic changes may have resulted in a temporary resurgence of a more imagistic type ritual. As in the example of the frontline fighters in Libya who lived in an organised society but a conflict situation resulted in the emergence of more imagistic based social cohesion . In this regard, we can suggest that the "permanent" establishment of the doctrinal mode may not occur during the agricultural transition in south-west Asia and Europe but perhaps in the context of the hierarchically organised, literate, proto-urban societies (Jones 1987; Keswani 1996: 2004; Dietler 1998; Webb 1999; Chesson 2003; Chesson Philip 2003; Pernicka *et al* 2003) of the subsequent Bronze and Iron Ages.

8.12 Summary

The results present here suggest that the agricultural transition was to a large extent connected with a shift from an imagistic to an increasingly doctrinal mode of religiosity in both south-west Asian and north-western Europe. Archaeologically recorded subsistence variables proved to be the most successful set of variables for distinguishing modes of religiosity (when applied to the *known* eHRAF cases), and potentially the most useful for classifying the archaeological site-phase in terms of the two modes. Ritual variables were the least successful predictor variables of mode, and proved especially weak for distinguishing chronological groupings in the south-west Asian site-phases. The emergence of a more doctrinal mode is plausibly linked to socio-economic changes that characterise the agricultural transition. It is suggested that a combination of socio-economic factors such as a reliance on a long-term subsistence strategy, increased sedentism, increased population and a greater reliance on a larger social network presented a situation where doctrinal mode rituals and practices were used to increase group cooperation and ensure food security via a common religious outlook. In this sense, it is proposed that a more doctrinal mode of religiosity would have been essential to generating social cohesion by establishing and reinforcing a sense of group identification in early agricultural communities. Furthermore, an important aspect of the emergence and transmission of the doctrinal mode was the incorporation of earlier imagistic concepts and practices.

However, while suggesting that the transition to agriculture facilitated a ritual/religious change, I would advocated a more "multi-causal model" (Zeder 2011; 54) of the agricultural transition which integrates the subsistence, ritual and socio-cultural material culture rather than making causal claims, e.g. that subsistence change 'caused' ritual change, or *vice versa*. Adopting a multi-causal model approach enables us to consider and examine the emergence of the doctrinal mode in the context of the multi-level socio-cultural and socio-economic transformations associated with the agricultural transition.

Like the socio-economics of the Neolithic, religion was a multifaceted and dynamic aspect of the agricultural transition and cannot be framed as a direct, linear development from imagistic to doctrinal. In the agricultural transition in both regions there is evidence for periods of relative stability and periods of drastic socio-economic change. In focusing on the agricultural transition, this research has provided fresh insight into the emergence of the doctrinal mode and the dynamic relationship between the two modes during the agricultural transition in south-west Asia and north-western Europe.

Chapter 9: Conclusion and future work

9.1 Summary and conclusions

This research set out is to address the problem of how hunter-gatherer communities adjusted socially to farming during the agricultural transition in south-west Asia and north-western Europe, by incorporating research developed in the cognitive anthropology of ritual activity. This research utilised the Modes of Religiosity theory as a theoretical framework to examine socio-religious change in the context of the agricultural transition. Central to this research was the examination of one particular hypothesis: that the solidarity-generating effect of ritual activity connected with a more doctrinal mode of religiosity was a fundamental strategy for maintaining group cohesion in the context of the agricultural transition in both regions. To test this hypothesis, data were gathered and analysed from 34 cultures in the eHRAF database, previously categorised as imagistic or doctrinal by Atkinson and Whitehouse (2011), and 111 well documented archaeological site-phases from south-west Asia and north-western Europe. This research employed a suite of exploratory and problem-oriented multivariate statistical techniques to examine whether or not the archaeological material provides evidence of a shift from an imagistic to an increasingly doctrinal mode of religiosity across the agricultural transition in one or both regions.

The statistical results from the datasets used in this research indicate that sets of variables relating to subsistence practice offer the best potential to examine the modes of religiosity during the agricultural transition. The ritual and social complexity variables considered produced predictive models of varying success. Ritual and social complexity variables derived from the north-west European archaeological data resulted in relatively fit for purpose models when applied to the *known* eHRAF cultures. On the other hand, the ritual

and social complexity variables derived from the south-west Asian archaeological data resulted in weak predictive models when applied to the *known* eHRAF cultures.

These findings are consistent with the central hypothesis, that the agricultural transition included a shift from an imagistic to a more doctrinal of religiosity in both regions. Based on the subsistence evidence examined in this research, a connection between different subsistence strategies and the two modes was identified. It is a contention of this thesis that the two modes may be considered as adaptations to distinct resource extraction problems faced by groups engaged in these diverse subsistence strategies. It is proposed that the imagistic mode is essential in small-scale hunter-gatherer groups to generate the level of identity fusion required to limit defection and ensure participation in dangerous pro-group actions such as hunting and conflict. In sedentary agriculturalist communities, doctrinal mode rituals and practices are essential to create a sense of group identity in extended, hierarchically organised social networks to ensure the level of cooperation associated with agriculture. Therefore, we can assert that the solidarity-generating effect of ritual activity associated the doctrinal mode of religiosity was a key strategy for maintaining group cohesion across the agricultural transition in both regions.

The statistical results demonstrated that, in the absence of ritual frequency and dysphoric arousal level data, a set of ritual material correlate variables did not represent the most appropriate predictor model to distinguishing between the *known* imagistic and doctrinal cultures from the eHRAF and archaeological databases. It is worth noting that for the south-west Asian dataset, the greatest distinction in ritual practices was observed between the Epipalaeolithic and the PPNB site phases; this included ritual material culture such as ritual buildings and figurines. Similarly, a distinction was observed between the Mesolithic and the Middle and Late Neolithic site-phases in the north-west European dataset, particularly relating to the emergence of megalithic monuments. It is proposed that these distinctions in ritual material culture present an opportunity to consider the nature of the “new” ritual practices that relate to the emergence of a more doctrinal mode

of religiosity in the context of the data collected for this research. However, the results for the archaeological datasets also suggest that aspects of Epipalaeolithic/Mesolithic ritual practices were continued and maintained in the Neolithic, and hence that continuity featured in the emergence of the doctrinal mode during the Neolithic transition in both regions.

This thesis has related the material culture evidence to features of human cognition by outlining the socio-cognitive aspects of the agricultural transition such as Food-Risk-Reduction, as well as the actual cognitive devices that facilitated the emergence, transmission and establishment of doctrinal mode practices and beliefs. Furthermore this research has demonstrated how a methodology combining target data gathering, database management and statistical analysis can be used to examine the two modes of religiosity from a sample of material culture data, particularly in the absence of ritual frequency and dysphoric arousal data. It has outlined how the modes of religiosity can be studied in a sample of archaeological site-phases by employing specific, complementary statistical methods (MDS and PCA and GLM). In so doing, this research represents a unique methodological approach to examining the relevance of the Modes of Religiosity theory via integration of cross-cultural ethnographic material and archaeological data. Moreover, this thesis has demonstrated that examining ethnographic data and integrating it with archaeological data using a specific set of material correlates and statistical techniques reflects a new potential way to examine ritual and other aspects of human behaviour that can be used to aid our interpretation of the archaeological record. In this sense, this research represents an innovative methodological approach to hypothesis generation and testing using integrated ethnographic and archaeological material.

In relation to wider debates regarding the agricultural transition in both regions, this thesis has established that a change in ritual activity relating to the emergence of a "new" religious framework played a central role in maintaining social cohesion in early agricultural communities. In addition, this research has demonstrated the centrality of

aspects of human cognition (related to social cohesion via ritual) to the emergence and establishment of the first agricultural communities in south-west Asia and north-western Europe. This thesis has demonstrated that ritual, subsistence practices and social complexity should not be examined as stand-alone features in the context of the agricultural transition; but should be approached as interconnected elements of the agricultural transition.

9.2 Future work

The future direction of my research is to integrate three interrelated elements (1) further exploring the eHRAF database to identify sets of material correlates that could be applied in a variety of regions with different archaeology—making the research carried out in this thesis more applicable in other regions; (2) increasing the sample size in relation to incorporating more archaeological samples from different regions reflecting different agricultural transitions; (3) employing an integrated social network analysis and spatial statistics (i.e. GIS mapping) approach; and (4) using agent-based modelling for hypotheses generation and testing. The long-term objective of this research is to increase the sample size to facilitate a big data study which would incorporate archaeological and ethnographic material from a number of geographic regions and archaeological cultural horizons. The purpose of this expanded study would be (1) to examine socio-religious aspects of the agricultural transition in central, southern and Eastern Europe—for the purpose of comparing the results with the research presented in this thesis; and (2) to examine the socio-cognitive elements of the agricultural transition in other areas—particularly, the independent transition to agriculture in Southeast Asia. The application of social network analysis and GIS would build on the initial work carried out in south-west Asia by Coward (2010; 2013) by producing a geospatial social network analysis focusing on shared ritual, subsistence and social complexity material culture. This approach would make it possible to chart both the trajectory of the agricultural transition and to examine the level of connectedness between sites in south-west Asian as well as In

Europe. This would represent the first integrated application of social network analysis to examine the commonalities and difference in the agricultural transition in both regions. Furthermore, a future objective of this research is to utilise agent-based modelling (ABM) as a method to generate and test a number of hypotheses relating to social configurations across the agricultural transition, since ABM enables us to simulate multiple virtual (demographic) scenarios which could account for the archaeological material culture recorded. It is proposed to apply agent based modelling initially to the south-west Asian agricultural transition to complement the application of social network analysis by modelling and examining the spread of people and ideas (via material culture such as artefacts, architecture and burial practices). Expansion of this research through the incorporation of these complementary techniques would provide a detailed picture of the relationship between exchange networks, shared religious practices and social cohesion in the context of the agricultural transition in south-west Asia, north-western Europe and beyond.

Thesis Bibliography

Abdi, H. and Williams, L.J., 2010. Principal component analysis. *WIREs Computational Statistics,* 2, pp. 433–459.

Abramiuk, M.A., 2012. *The Foundations of Cognitive Archaeology*. MIT Press: MIT.

Agresti, A., 2007. *Categorical Data Analysis*. New York: Wiley.

Allaby, R.G, et al., 2008. The genetic expectations of a protracted model for the origins of domesticated crops. *Proceedings of the National Academy of Sciences,* 105, pp. 13982-13986.

Allan,W., 1945. *Studies in African land usage in Northern Rhodesia*. *Rhodes-Livingstone Institute Papers*, 15. Cape Town: Rhodes-Livingstone Institute.

Allan, W., 1969. *The African Husbandman.* Edinburgh: Oliver and Boyd.

Ammerman, A.J. and Cavalli-Sforza, L.L., 1984. *The Neolithic Transition and the Genetics of Populations in Europe*. New Jersey: Princeton University Press.

Ammerman, A. J. et al., 1976. Toward the estimation of population growth in Old World prehistory. In E.B.W. Zubrow, ed. 1976. *Demographic anthropology*. *Quantitative Approaches.* Albuquerque: University of New Mexico Press. pp. 27-61.

Andersen, N. H., 1997. *The Sarup Enclosures. The Funnel Beaker Culture of the Sarup site including two causewayed camps compared to the contemporary settlements in the area and other European enclosures*. Jutland Archaeological Society Publications XXXIII: I. Arhus.

Andersen, N. H., 2004. Sarup Causewayed enclosures placed in a Neolithic ritual landscape on Funen. *Denmark Journal of Nordic Archaeological Science,* 14, pp. 11–17.

Andersen, S. H., 1988. A survey of the late Palaeolithic of Denmark and Southern Sweden. In: M.Otto, ed., 1976. *De la Loire g~ Oder. Les civilisation du Paleolithique final dans le nord-ouest europaen*. Oxford: BAR International Series 444. pp. 523-566.

Andersen, S.T., 1992. Early and Middle Neolithic Agriculture in Denmark: Pollen Spectra from soils in Burial Mounds of the Funnel Beaker Culture. *Journal of European of Archaeology*, 1, pp. 153-180.

Andersson ,M., P Karsten, P. et al., 2004. *Stone Age Scania*. Sweden: Riksantikvarieambetets forlag.

Armelagos, G.J. and Harper, K .N., 2005. Genomics at the origins of agriculture, part one. *Evolutionary Anthropology*, 14(2), pp.68–77.

Asch, D.L., 1975. *Human Evolution*. New York: Rand-Nally. New Haven HRAF press.

Ascher, R., 1959. A Prehistoric Population Estimate Using Midden Analysis and Two Population Models. *South- western Journal of Anthropology*, 15, pp.168-78.

Ashton, N. and S. Lewis., 2002. Deserted Britain: Declining populations in the British Late Middle Pleistocene. *Antiquity*, 76, pp. 388-96.

Asouti, E., 2006. Beyond the Pre-Pottery Neolithic B Interaction Sphere. *Journal of World Prehistory*, 20, pp. 87–126.

Asouti, E. and Fuller, D., 2012. From Foraging to Farming in the Southern Levant: The Development of the Epipalaeolithic and the Pre-pottery Neolithic Plant management Strategies. *Veg. Hist. Archaeobot*, 21, pp. 149-162.

Atkinson, Q.D. and Whitehouse, H., 2011. The Cultural Morphospace of Ritual form: Examining Modes of Religiosity Cross-Culturally. *Evolution and Human Behavior* 32(1), pp. 50-62.

Atran, S. 2001. The Trouble with Memes: Inference Versus Imitation in Cultural Creation. *Human Nature*, 12, 351–381.

Atran, S. 2002. *The religious landscape*. Cambridge: Cambridge University Press.

Atran, S. 2010. *Talking to the enemy: Faith, brotherhood, and the (un)making of terrorists*. New York: Harper-Collins.

Atran, S. and Henrich, J. 2010. The Evolution of Religion: How Cognitive By-Products, Adaptive Learning Heuristics, Ritual Displays, and Group Competition Generate Deep Commitments to Prosocial Religions. *Biological Theory*, 5(1), pp. 18-30.

Atran, S., Ginges, J. 2012. Religious and sacred imperatives inhuman conflict. Science 336(6083), 855–857.

Atran, S. 2016. The Devoted Actor: Unconditional Commitment and Intractable Conflict across Cultures. *Current Anthropology* (Supplement 13). 57(2). https://www.researchgate.net/publication/296472495_The_Devoted_Actor_Unconditional_Commitment_and_Intractable_Conflict_across_Cultures accessed on 07-03-16

Accessed December 2015

Bagwell, E. A., 2006. Specialization, social complexity and vernacular architecture: A cross-cultural study of space construction. In E.C. Robertson et al, eds. 2006. *Space and Spatial Analysis in Archaeology*. University of Calgary Press, pp. 29-35.

Bailey, K. G., and G. Nava. 1989. Psychological kinship, love, and liking: preliminary validity data. *Journal of Clinical Psychology* 45(4), 587–594.

Baines, J., 1983. Literacy and ancient Egyptian society. *Man*, 18(3), pp. 572– 599.

Balter M. 2010. Archaeology. The tangled roots of agriculture. *Science* 22; 327(5964), 404-6.

Banning, E. B., 1998. The Neolithic Period: Triumphs of Architecture, Agriculture, and Art. Near *Eastern Archaeology*, 61(4), pp.188-237.

Banning, E. B., 2011. So Fair a House: Göbekli Tepe and the Identification of Temples in the Pre-Pottery Neolithic of the Near East. *Current Anthropology*, 52(5), pp. 619-660.

Banning, E.B., Rahimi, D., and Siggers,J., 1994. The Late Neolithic of the Southern Levant: Hiatus, Settlement Shift or Observer Bias?. The Perspective from Wadi Iqlab. *Paléorient*, 20, pp. 151-64.

Bar Yosef, O. and Goren, G., 1973. Natufian remains in Hayonim Cave. *Paleorient*, 1, pp. 49-68.

Barclay, H.B., 1971. The Nile Valley. In L.E. Sweet, ed. *The Central Middle East; a handbook of anthropology and published research on the Nile Valley, the Arab Levant, Southern Mesopotamia, the Arabian Peninsula, and Israel.* New Haven: HRAF Press.

Barker, G., 2006. *The Agricultural Revolution in Prehistory*. Oxford: OUP Oxford.

Barrett, J.L., 1998. Cognitive Constraints on Hindu concepts of the Divine. *Journal for the scientific study of religion*, 37, pp. 608-619.

Barrett, J.L., 1999. Theological correctness: Cognitive Constraints and the study of religion. *Method and Theory in the study of Religion*, 11, pp. 325-339.

Barrett, J.L., 2000. Exploring the natural foundations of religion. *Trends in Cognitive Sciences*, 4, pp. 29-34.

Barrett, J.L., 2001. How ordinary cognition informs petitionary prayer. *Journal of Cognition and Culture*, 1, pp. 259-269.

Barrett, J.L., 2004a. Finding agents everywhere. In: J.L. Barret, ed. 2004. *Why would anyone believe in God?*. Walnut Creek, California: AltaMira Press.

Barrett, J.L., 2004b. *Why would anyone believe in God?*. Walnut Creek, CA: AltaMira Press.

Barrett, J.L., 2007. Gods. In: H. Whitehouse and J. Laidlaw, eds. 2007. *Religion, Anthropology and Cognitive Science*. Durham NC: Caroline Academic Press, pp. 179-210.

Barrett, J.L. and Johnson, A.H., 2003. The role of control in attributing intentional agency to inanimate objects. *Journal of Cognition and Culture*, 3(3), pp. 208-217.

Baron, J., and Spranca, M. 1997. Protected values. *Organizational Behavior and Decision Processes* 70, 1–16.

Bar-Yosef, O., 1998. The Natufian Culture in the Levant, Threshold to the Origins of Agriculture. *Evolutionary Anthropology*, 6(5), pp. 159-177.

Bar-Yosef, O., 2002. The Natufian and the Early Neolithic: Social and Economic Trends in Southwestern Asia. In: P. Bellwood and O. Renfrew, eds. 2002. *Examining the Farming/Language Dispersal Hypothesis*. Oxford: Oxbow Books. pp. 113–126.

Bar-Yosef, O., 2004. East to West-Agricultural Origins and Dispersal into Europe. *Current Anthropology*, 45, pp. 1-3.

Bar-Yosef, O. and Belfer-Cohen, A., 1989. The origins of sedentism and farming communities in the Levant. *Journal of World Prehistory*, 3, pp. 447–498.

Bar-Yosef, O. and Belfer-Cohen, A,. 1992. From foraging to farming in the Mediterranean Levant. In: A.B. Gebauer and D.T. Price, eds. 1992. *Transitions to Agriculture in Prehistory*. Madison: Prehistory Press. pp. 21–48.

Bar-Yosef, O. and Belfer-Cohen, A., 1999. Encoding Information: Unique Natufian Objects from Hayonim Cave, Western Galilee, Israel. *Antiquity*, 73, pp. 402–410.

Bar-Yosef, O. and Belfer-Cohen, A., 2002. Facing Environmental Crisis: Societal and Cultural Changes at the Transition from the Younger Dryas to the Holocene in the Levant. In: R.T.J. Cappers and S. Bottema, eds. 2002. *The Dawn of Farming in the Near East.* Berlin: ex oriente, Studies in Early Near Eastern Production, Subsistence, and Environment, 6, pp. 55–66.

Bar-Yosef, O. and Mayer, D. E., 2005. The Exploitation of Shells as Beads in the Palaeolithic and Neolithic of the Levant. *Paleorient*, 31, pp. 176–185.

Bar-Yosef, O. and Villa, F., 1990. The Natufian Culture and the Origin of the Neolithic in the Levant. *Current Anthropology*, pp. 433-436.

Baumard, N., Hyafil, A. et al., 2015. Increased Affluence Explains the Emergence of Ascetic Wisdoms and Moralizing Religions. *Current Biology*, 25, pp. 10–15.

Baumhoff, M. A., 1962. Ecological determinants of aboriginal California populations. *American Archaeology and Ethnology*, 49(2), pp. 155-236.

Baxter, M.J., 1994. *Exploratory multivariate analysis in archaeology*. Edinburgh: University Press.

Beals, K. L, et al., 1984. Brain size, cranial morphology, climate, and time machines [and comments and reply*]*. *Current Anthropology*, 25(3), pp. 301–330.

Beck, C. and Jones, G. T., 1989. Bias and Archaeological Classification. *American Antiquity*, 54(2), pp. 244-262.

Beerenwinkel, N. et al., 2005. Computational methods for the design of effective therapies against drug resistant HIV strains. *Bioinformatics*, 21(21), pp. 3943-50.

Belfer-Cohen, A., 1991. The Natufian in the Levant. *Annual Review of Anthropology*, 20, pp. 167-186.

Belfer-Cohen, A., 1995. Rethinking Social Stratification in the Natufian Culture: the Evidence from Burials in the Southern Levant. In: S. Campbell and A. Green, eds. 1995. *The Archaeology of Death in the Ancient Near Oxford.* Oxford: Oxbow Books. pp. 9-16.

Belfer-Cohen, A. and Goring-Morris, A.N., 2011. Becoming Farmers: The Inside Story. *Current Anthropology*, 52(S4), pp. 209-220.

Bell, C., 1997. *Ritual: Perspectives and dimensions*. New York/Oxford: Oxford University Press.

Bell, C., 1993. *Ritual Theory, Ritual Practice.* New York/Oxford: Oxford University Press.

Bell, C., 2007. Response: Defining the need for a definition. In E. Kyriakidis, ed. 2007. *The Archaeology of Ritual.* Los Angeles: Cotsen Institute of Archaeology at UCLA. pp. 277–88.

Bellwood, P., 2005. *First Farmers: The Origins of Agricultural Societies*. Oxford: Blackwell Publishing.

Bender, B., 1978. Gatherer-hunter to farmer: a social perspective. *World Archaeology,* 10, pp. 204-22.

Bentley, R.A., Chikhi, L. and Price, T.D., 2003. The Neolithic Transition in Europe: Comparing Broad Scale Genetic and Local Scale Isotopic Evidence. *Antiquity,* 77, pp. 63-66.

Berg, S., 1995. *Landscapes of the Monuments: A Study of the Passage Tombs in the Cuíl Irra Region*. Stockholm: University of Stockholm.

Berg, S., 2002. Knocknarea- The Ultimate Monument. Megaliths and mountains in Neolithic Cúil Irra, north west Ireland. In: C. Scarre, ed. 2002. *Monuments and Landscape in Atlantic Europe*. London: Routledge. pp. 139-151.

Bergh, S. and Hensey, Robert. 2013. Unpicking the Chronology of Carrowmore. Oxford *Journal of Archaeology* 32 (4), 343–366

Bermúdez, J.L., 2010. *Cognitive Science: An Introduction to the Science of the Mind*. Cambridge: Cambridge University Press.

Bernard, H.R. and Killworth, P.D., 1973. On the social structure of an ocean-going research vessel and other important things. *Social Science Research,* 2, pp. 145-184.

Berndt, R.M., 1959. The Concept of the 'Tribe' in the Western Desert of Australia. *Oceania,* 30, pp. 82-107.

Bernstein, R. J., 1983. *Beyond Objectivism and Relativism: Science, Hermeneutics, and Praxis.* Philadelphia: University of Pennsylvania Press.

Bettinger, R., Richerson, P., Boyd R. 2009. Constraints on the development of agriculture. *Current Anthropology* 50(5), 627-31.

Bewick, V. et al., 2004. Statistics review 13: Receiver operating characteristic curves. *Critical Care,* 8, pp. 508-512.

Bienert, H.D., 1991. Skull cult in the prehistoric Near East. *Journal of Prehistoric Religion,* 5, pp. 9-23.

Binford, L.R., 1968. *New Perspectives in Archaeology*. Aldine: Chicago. pp. 313–341.

Binford, L.R., 2001. *Constructing Frames of Reference: An Analytical Method for Archaelogical Theory Building Using Hunter-Gatherer and Environmental Data Sets*. Berkeley: University of California Press.

Binford, L.R. et al., 1970. Archaeology at Hatchery West. *Society for American Archaeology*, Memoirs 24.

Birdsell, J.B., 1953. Some environmental and cultural factors influencing the structuring of Australian Aboriginal populations. *The American Naturalist*, 87(834), pp. 171-207.

Bloch, M., 1989. *Ritual, History and Power: Selected papers in anthropology*. London: Athlone Press.

Bocquet-Appel, J-P., 2002. Paleoanthropological Traces of a Neolithic Demographic Transition. *Current Anthropology*, 43, pp. 637–650.

Bocquet-Appel, J-P. and Masset, C., 1982. Farewell to paleodemography. *Journal of Human Evolution*, 11, pp. 321–333.

Bocquet-Appel, J-P. and Naji, S., 2006. Testing the hypothesis of a worldwide Neolithic demographic transition: Corroboration from American cemeteries. *Current Anthropology*, 47, pp. 341–365.

Bogaard, A., 2004. *Neolithic Farming in Central Europe*. London: Routledge.

Bogaard, A., 2005. 'Garden agriculture' and the nature of early farming in Europe and the Near East. *World Archaeology*, 37(2), pp. 177-196.

Bogaard, A. and Isaakidou, V., 2010. From Mega-Sites to Farmsteads: Community Size, Ideology and the Nature of Early Farming Landscapes in Western Asia and Europe. In: B. Finlayson and G. Warren, eds. 2010. *Landscapes in Transition*. Oxford: Oxbow Books.

Bogaard, A. and Jones, G., 2007. Neolithic Farming in Britain and Central Europe: Contrast or Continuity?. *Proceedings of the British Academy*, 144, pp.357-375.

Boone, J.L., 1992. Competition, Cooperation and the Development of Social Hierarchies. In: E.A. Smith and B. Winterhalder, eds. 1992. *Ecology, Evolution and Social Behavior*. New York: Aldine de Gruyter. pp. 301-337.

Boskey, A. L. 2013. Bone composition: relationship to bone fragility and antiosteoporotic drug effects. *BoneKEy Reports*, 2, 447.

Bottema, S. 2002. The use of Palynology in Tracing Early Agriculture. In R.T.J. Cappers and S.Bottema, eds. 2002. *The Dawn of Farming in the Near East*. *Studies in Early Near Eastern Production, Subsistence, and Environment*, 6. Berlin:Ex Oriente. pp. 27–38.

Bowie, F., 2000. *The Anthropology of Religion.* Oxford: Blackwell.

Boyd, B., 1995. Houses and Hearths, Pit and Burials: Natufian Mortuary Practices at Mallaha (Eynana), Upper Jordan Valley. In: S. Campbell and A. Green, eds. 1995. *The Archaeology of Death in the Ancient Near East*. Oxford: Oxbow Books. pp. 17-28.

Boyd, R. and Richerson, P. J. 1985. *Culture and the Evolutionary Process*. Chicago: University of Chicago Press.

Boyd, R. and Richerson, P. J. 1988. The evolution of reciprocity in sizable groups. *Journal of theoretical Biology* 132, 337-356.

Boyd, R. and Richerson, P. J. 1992. Punishment allows the evolution of cooperation (or anything else) in sizeable groups. *Ethology and socio-biology* 113, 171- 195.

Boyd, R. and Richerson, P.J. 2005.*The Origin and Evolution of Cultures*. Oxford: University Press

Boyer, P., 2001. *Religion Explained: The human instincts that fashion gods, spirits and ancestors.* London: William Heinemann.

Bradley, A.P., 1997. The use of the area under the ROC curve in the evaluation of machine learning algorithms. *Pattern Recognition*, 30 (7), pp. 1145–1159.

Bradley, R., 1990. *The Passage of Arms: An archaeological analysis of prehistoric hoards and votive deposits.* Cambridge: Cambridge University Press.

Bradley, R., 1998. *The significance of monuments: On the shaping of human experience in Neolithic and Bronze Age Europe*. London: Routledge.

Bradley, R. 1984. *The social foundations of prehistoric Britain*. Harlow: Longman.

Bradley, R., 2003. Neolithic Expectations. In: I. Armit, E. Murphy, E. Nelis and E. Simpson, eds. 2003. *Neolithic Settlement in Ireland and Western Britain*. Oxbow, Oxford. pp. 218-222.

Braidwood, R. J., 1960. The Agricultural Revolution. *Scientific American*, 203, pp.130-141.

Bramanti, B. *et al.* 2009. Genetic discontinuity between local hunter-gatherers and Central Europe's first farmers. *Science* 326, 137–140

Branscombe, N.R *et al*. 1999.The context and content of social identity threat. In N. Ellemers, R. Spears, and B. Doosje (eds.), *Social identity: Context, commitment, content. Oxford: Blackwell, 35–58*

Brody, B.A. and Grandy, R.E., 1989. *Readings in the Philosophy of Science*, 2nd ed. Englewood Cliffs, New Jersey: Prentice Hall.

Brinch Petersen, E. 1973. Dobbeltgraven fra Dragsholm. Nationalmuseets Arbejdsmark 187-188.

Brooks, M. L., *et al.* 2011. Reasserting the self: Blocking self-verifying behavior triggers compensatory self-verification. *Self and Identity*, 10, 77– 84.

Brotherton, P. *et al*. 2013. Neolithic mitochondrial haplogroup H genomes and the genetic origins of Europeans. *Nature Communications* 4, 1764

Brown, B. M., 1987. Population Estimation From Floor Area: a Restudy of "Naroll's Constant". *Cross-Cultural Research,* 21, pp. 1–49.

Buikstra, J. E., 1981. Mortuary Practices, Paleodemography and Paleopathology: a Case Study from the Koster Site (Illinois). In J.E. Buikstra et al., eds. 1981. *Archaeology of Death*. Cambride: Cambridge University Press. pp. 123-132.

Buikstra, J.E. and Konigsberg, L.W., 1985. Paleodemography: critiques and controversies. *American Anthropologist,* 87 (2), pp. 316-333.

Burbank, V.K., 1987. Female aggression in cross-cultural perspective. *Cross-Cultural Research,* 21(1-4), pp. 70–100.

Buhrmester, M. D., *et al*. 2012. My group's fate is my fate: Identity fused Americans and Spaniards link personal life quality to outcome of 2008 elections. *Basic and Applied Social Psychology*, 34, 527–533.

Burch, E.S., 1972. The caribou/wild reindeer as a human resource. *American Antiquity,* 37(3), pp. 339-368.

Busby, G.B.J. et al., 2011. The peopling of Europe and the cautionary tale of Y chromosome lineage R-M269. *Proceedings of the Royal Society B: Biological Sciences,* 279 (1730), pp. 884–92.

Byrd, B.F., 1994. Public and Private, Domestic and Corporate: the Emergence of the Southwest Asian village. *American Antiquity,* 59, pp. 639–666.

Byrd, B.F., 2005. Reassessing the Emergence of Village life in the Near East. *Journal of Archaeological Research*, 13(3), pp. 231-290.

Byrd, B.F., and Banning, E.B., 1989. Alternative Approaches for Exploring Levantine Neolithic Architecture. *Paléorient,* 15(1), pp. 154-160.

Calhoun, J.B., 1970. Population. In: A. Alison, ed. *Population Control*. Harmondsworth: Penguin. pp. 100-130.

Cappers, R.T.J., Bottema, S., Woldring, H., van der Plicht, H., and Streurman, H.J., 2002. Modelling the emergence of farming: Implications of the vegetation development in the Near East during the Pleistocene–Holocene transition. In: R.T.J. Cappers and S. Bottema, eds. *The Dawn of Farming in the Near East. Studies in Early Near Eastern Production, Subsistence, and Environment* 6. Berlin: Ex Oriente. pp. 3-14.

Carmichael, D.L. et al., eds. 1991.*Sacred Sites, Sacred Places*. London: Routledge.

Carneiro R.L., 1962. Scale Analysis as an Instrument for the Study of Cultural Evolution. *Southwestern Journal of Anthropology,* 18, pp. 149-169.

Carneiro R.L. 1970. A Theory of the Origin of the State. *Science* 80 (169), 733–738.

Carneiro R.L., 1986. On the Relationship between Size of Population and Complexity of Social Organization. *Journal of Anthropological Research*, 42, pp. 355-364.

Carneiro R.L., 2000. The Transition from Quantity to Quality: A Ne-glected Causal Mechanism in Accounting for Social Evolution. *Proceedings of the National Academy of Sciences of the United States of America*, 97, pp. 12926-12931.

Carneiro R.L. and HilseI D.F., 1966. On Determining the Probable Rate of Population Growth during the Neolithic. *American Anthropologist,* 68, pp. 177–181.

Carpenter, S., 2000. Effects of cultural tightness and collectivism on selfconcept and causal attributions. *Cross-Cultural Research,* 34(1), pp. 38–56.

Casselberry, S.E., 1974. Further refinement of formulae for determining population from floor area. *World Archaeology,* 6(1), pp. 118-122.

Casteel, R.W., 1972. Two static maximum population-density models for hunter-gatherers: A first approximation. *World Archaeology,* 4, pp. 19-40.

Casteel, R.W., 1973. The relationship between population size and carrying capacity in a sample of North American hunter-gatherers. *Paper circulated at the meeting of the Ninth International Congress of Anthropological and Ethnological Sciences*. Chicago.

Casteel, R.W., 1976. Human population estimates for hunting and gathering groups based upon net primary production data: examples from the Central Desert of Baja California. *Journal of anthropological research,* 35(1), pp.85-92.

Casteel, R.W., 1979. Relationship between surface area and population size: a cautionary note. *American Antiquity,* 44, pp. 803-807.

Caulfield, S., R. G. ODonnell, and P. I. Mitchell. 1998. 14C dating of a Neolithic field system at Ceide Fields, County Mayo, Ireland. *Radiocarbon* 40, 62940.

Cauvin, J., 1972. *Religions neolithiques de Syro-Palestine, Libraire d'Amerique et d'Orient*. Paris: Jean Maisonneuve.

Cauvin, J., 1994. *Naissance des divinites, naissance de l'agriculture: La revolution des symboles au Neolithique*. Paris: CNRS.

Cauvin, J., 2000. *The Birth of the Gods and the Origins of Agriculture.* Cambridge: Cambridge University Press.

Cavalli-Sforza, L. P. Menozzi, P., Piazza, A. 1994. *The History and Geography of Human Genes*. Princeton: Princeton University Press

Cavalli-Sforza, L.L, Minch, E. 1997. Paleolithic and Neolithic lineages in the European mitochondrial gene pool. *American Journal of Human Genetics* 61, 247–254.

Chamberlain, A T., 2006. *Demography in Archaeology*. Cambridge: Cambridge University Press.

Chamberlain, A.T., 2009. Archaeological Demography. *Human Biology,* 81(3), pp. 275-286.

Chapman, R., 2003. *Archaeologies of Complexity*. London: Routledge.

Chesson, M.S., 2003. Households, Houses, Neighbourhoods and Corporate Villages: Modelling the Early Bronze Age as a House Society. *Journal of Mediterranean Archaeology,* 16(1), pp. 79-102.

Chesson, M.S. and Graham, P., 2003. Tales of the City? 'Urbanism' in the Early Bronze Age Levant from Mediterranean and Levantine Perspectives, *Journal of Mediterranean Archaeology,* 16(1), pp. 3-16.

Chikhi, L. et al., 2002. Y Genetic Data Support the Neolithic Demic Diffusion Model. *Proceedings of the Nationall Academy of Science,* 99, pp. 11008-11013.

Childe, V.G., 1928. *The Most Ancient East*. London: Routledge and Kegan Paul.

Childe, V.G., 1936. *Man Makes Himself*. London: Watts.

Clark, C. and Haswell, M.R., 1964. *The Economics of Subsistence Agriculture*. London: Macmillan.

Clark, G., 1954. *Excavations at Star Carr*. London and New York: Cambridge University Press.

Clark, G., 1969. *Archaeology and society*. New York: Barnes & Noble.

Clark, G., 1972. *Star Carr: A case study in bioarchaeology*. London: Addison-Wesley Modular Publications 10.

Colledge, S. and Conolly, J., 2004. Archaeobotanical Evidence for the Spread of Farming in the Eastern Mediterranean. *Current Anthropology,* 45, pp. 35-58.

Collett, D. 2014. *Modelling Binary Data*. London : Chapman & Hall

Conklin, H., 1959. Population-land balance under systems of tropical forest agriculture. *Proceedings of the Ninth Pacific Science Congress of the Pacific Science Association*, 1957, pp. 7-63.

Conneller, C., 2009. Transforming bodies: mortuary practises in Mesolithic Britain. In: S. McCarten et al, eds. 2009. *Mesolithic Horizons*. Oxford: Oxbow. pp. 690-697.

Conneller, C. and Warren, G., 2011. *Mesolithic Britain and Ireland: New Approaches*. Stroud: Tempus.

Cook, S.F., 1946. A reconsideration of shellmounds with respect to population and nutrition. *American Antiquity,* 12, pp. 51-53.

Cook, S.F., 1972a. Can pottery residues be used as an index to population?. *Contribution of the University of California Archaeological Research Facility,* 14, pp. 17-40.

Cook, S.F., 1972b. *Prehistoric demography. Mc Caleb Module in Anthropology*. Reading, Mass.: Addison-Wesley.

Cook, S.F. and Heizer, R.F., 1965. The quantitative approach to the relation between population and settlement size. *Contribution of the University of California Archaeological Research Facility,* 64.

Cook, S.F., and Heizer,R.F., 1968. Relationships among houses, settlement areas, and population in aboriginal California. In: K.C. Chang, ed. 1968. *Settlement archaeology*. Palo Alto, California: National Press. pp. 79-116.

Cooney, G., 1990. The Place of Megalithic Tomb Cemeteries in Ireland. *Antiquity*, 64, pp. 741-753.

Cooney, G., 2000. *Landscapes of Neolithic Ireland*. London: Routledge.

Cooney, G., 2003. Rooted or routed? Landscapes of Neolithic settlement in Ireland. In: I. Armit et al, eds. 2003. *Neolithic settlement in Ireland and Western Britain*. Oxford: Oxbow. pp. 47–55.

Cooney, G., 2007. Parallel worlds or multi-stranded identities? Considering the process of 'going over' in Ireland and the Irish Sea zone. In A. Whittle and V. Cummings, eds. 2007. *Going Over: the Mesolithic-Neolithic Transition in North-West Europe.* Oxford: Oxford University Press. pp. 543-566.

Cooney, G. and Grogan, E., 1999. *Irish Prehistory A Social Perspective*. Dublin: Wordwell.

Corsten, L.C.A. and Gabriel, K.R., 1976. Graphical exploration in comparing variance matrices. *Biometrics,* 32, pp. 851-863.

Cosmides, L. & Tooby, J. 1992. Cognitive adaptations for social exchange. In Barkow, L. Cosmides and J. Tooby (eds) *The adapted mind: Evolutionary psychology and the generation of culture*. Oxford: Oxford University Press.

Coward, F. *et al.* 2008. The spread of Neolithic plant economies from the Near East to northwest Europe: a phylogenetic analysis. *Journal of Archaeological Science* 35(1), 42-53.

Coward, F., 2010b. Casting the net wide: small worlds, material culture and social networks during the Epipalaeolithic and early Neolithic of the Near East. *Bulletin of the Council for British Research in the Levant*, 5, pp. 52–56.

Coward, F., 2013. Grounding the Net: Social Networks, Material Culture and Geography in the Epipalaeolithic and Early Neolithic of the Near East (21,000–6,000 cal BCE). In: C. Knappett, ed. 2013. *Network Analysis in Archaeology: New Approaches to Regional Interaction*. Oxford: University Press

Coward, F. and Gamble, C., 2008. Big brains, small worlds: material culture and the evolution of the mind. *Philosophical Transactions of the Royal Society*, 363, pp. 1969–1979.

Cowgill, U.M., 1962. An agricultural study of the southern Maya Lowlands. *American Anthropologist,* 64, pp. 273-286.

Cruciani, F. et al., 2007. Tracing past human male movements in northern/eastern Africa and western Eurasia: new clues from Y-chromosomal haplogroups E-M78 and J-M12. *Molecular Biology Evolution,* 24 (6), pp. 1300–1311.

Cummings, V., 2003. Mesolithic world-views of the landscape in western Britain. In: L. Larsson et al., eds. *Mesolithic on the move: papers presented at the Sixth International Conference on the Mesolithic in Europe.* Stockholm, 2003. Oxford: Oxbow. pp. 74-81.

Cummings, V., 2010. Formalising the sacred? The late Mesolithic and early Neolithic monumental landscapes of Britain and Ireland. In: G. Warren and B. Finlayson, eds. *Landscapes in transition: understanding hunter-gatherer and farming landscapes in the*

early Holocene of Europe and the Levant. Amman: Council for British Research in the Levant. pp. 115- 124

Cunniff, J. et al., 2010. Was Low Atmospheric CO2 a Limiting Factor in the Origin of Agriculture?. *Environmental Archaeology*, 15(2), pp. 113-123.

Cunningham, G., 1999. *Religion and Magic: Approaches & theories.* Edinburgh: Edinburgh University Press.

Currie, T.E., 2013. Cultural Evolution Branches Out The Phylogenetic Approach in Cross-Cultural Research. *Cross-Cultural Research*. Sage Publications, 47(2), pp. 102-130.

Currie, T.E, Bogaard, A. et al., 2015. Agricultural productivity in past societies: Toward an empirically informed model for testing cultural evolutionary hypotheses. *Cliodynamics*, 6(1), pp. 24-56.

Dupanloup, I., et al. 2004. Estimating the impact of prehistoric admixture on the genome of Europeans. *Molecular Biology and Evolution* 21, 1361-1372.

Davis. F.W and Goetz, S., 1990. Modelling vegetation pattern using digital terrain data. *Landscape Ecology*, 4, pp. 69-80.

Dawkins, R., 1976. *The Selfish Gene*. Oxford: Oxford University Press.

De Marrais, E., Goseen, C. and Renfrwew, C., 2004. *Rethinking Materiality: The Engagement of Mind with the Material World*. Cambridge: Cambridge University Press.

De Ruiter, J. et al., 2011. Dunbar's number: Group size and brain physiology in humans re-examined. *American anthropologist*, 113 (4), pp. 557–568.

Dennett, D., 1987. *The intentional stance*. Massachusetts Institute of Technology: MIT Press.

Dennett, D., 1991a., Memes and the Exploitation of Imagination. *The Journal of Aesthetics and Art Criticism*, 48(2), pp. 127-135.

Dennett, D., 1991b. *Consciousness Explained*. Boston: Little, Brown and Co.

Dennett, D., 1995., *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. London: Penguin Science.

Denton, T., 2007. Yet another solution to Galton's problem. *Cross-cultural research*. Sage Publications, 41(1), pp. 32-45.

Derks, T., 1998. *Gods, Temples, and Ritual Practices: The Transformation of Religious Ideas and Values in Roman Gaul*. Amsterdam: Amsterdam University Press.

Di Giacomo, F.; Luca, F.; Popa, L.O., et al., 2004. Y chromosomal haplogroup J as a signature of the post-neolithic colonization of Europe. *Human Genetics*, 115 (5), pp. 357-71.

Diamond, J., 2002. Evolution, Consequences and Future of Plant and Animal Domestication. *Nature*, 418, pp. 700-707.

Dickson, D.B. et al., 2005. Where do you go when you die? A cross-cultural test of the hypothesis that infrastructure predicts individual eschatology. *Journal of Anthropological Research*, 61(1), pp. 53–79.

Dietler, M., 1998. A Tale of Three Sites: The monumentalisation of Celtic oppida and the politics of Collective Memory and Identity. *World Archaeology*, 30(1), pp. 72-89.

Dietler, M. Hayden, B. 2001. *Feasts: Archaeological and Ethnographic Pespectives on Food, Politics, and Power.* Washington, D.C. : Smithsonian Institution Press

Dietrich, O. et al., 2012. The role of cult and feasting in the emergence of Neolithic communities. New evidence from Göbekli Tepe, south-eastern Turkey. *Antiquity*, 86(333), pp. 674-695.

Dineley, M. 2004. *Barley, Malt and Ale in the Neolithic* (British Archaeological Reports International series 1213). Oxford: Archaeopress.

Dobson, A.J., 2002. *An Introduction to Generalized Linear Models*. London: Chapman and Hall.

Dobson, P. and Gelade, G.A., 2012. Exploring the roots of culture using spatial autocorrelation. *Cross -Cultural Research. Sage Publications*, 46(2), pp. 160-187.

Dolukhanov, P.,Shukurov, A., Gronenborn, D., Sokoloff, D., Timofeev, V., Zaitseva, G., 2005. The Chronology of Neolithic Dispersal in Central and Eastern Europe. *Journal of Archaeological Science*, 32, pp. 1441-1458.

Donald, M., 1991. *Origins of the Modern Mind: Three Stages in the Evolution of Cognition and Culture*. London: Harvard University Press.

Donald, M., 1993. Précis of Origins of the Modern Mind: Three Stages in the Evolution of Cognition and Culture. *Behavioural and Brain Sciences*, 16(4), pp. 737-791.

Donald, M., 1998. Material Culture and Cognition: Concluding Thoughts. In: C.Renfrew, and C. Scarre, eds. 1998. *Cognition and Material Culture: The Archaeology of Symbolic Storage*. Cambridge: Mc Donald Institute for Archaeological Research. pp. 67-75.

Duday, H., 2006. L'archéologie ou l'archeologie de la mort (Archaeothanatology or the Archaeology of Death). In: R. Gowland and C. Knüsel, eds. *The Social Archaeology of Funerary Remains.* Oxford: Oxbow. pp. 30-56.

Duday, H, Courtaud P, Crubezy, E, Sellier, P, Tillier, A., 1990. L'anthropologie de terrain : reconnaissance et interpretation des gestes funéraires. *Bulletin et Memoires de la Societe d'Anthropologie de Paris*, 2(3-4), pp. 29-50.

Dunbar, R.I.M., 1992. Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22 (6), pp. 469–493.

Dunbar, R.I.M., 1993. Coevolution of neocortical size, group size and language in humans. *Behavioural and Brain Sciences*, 16 (4), pp. 681–735.

Dupanloup, I., Bertorelle, G., Chikhi, L. and Barbujani, G., 2004. Estimating the Impact of Prehistoric Admixture on the Genome of Europeans. *Molecular Biology and Evolution*, 21 (7), pp.1361–72.

Durkheim, E., 1912. *The Elementary Forms of the Religious Life*. Translated from French by J.Swain, 1965. New York: Oxford University Press.

Dyson-Hudson, R., and Dyson-Hudson, N. 1980. Nomadic Pastoralism. *Annual Review of Anthropology* 9:15-61.

Earle, T.K., Preucel, R.W., 1987. Processual Archaeology and the Radical Critique. *Current Anthropology*, 28(4), pp. 501–538.

Eff, E. A., 2002. Does Mr. Galton still have a problem? Autocorrelation in the standard cross-cultural sample. *World Cultures*, 15(2), pp. 153–170.

Ember, C.R and Ember, M., 1994. War, Socialization, and Interpersonal Violence. A Cross-Cultural Study. *Journal of Conflict Resolution*, 38(4), pp. 620-646.

Ember, C.R. and Ember, M., 2009. *Cross-cultural research methods*. Plymouth: Rowman Altamira.

Ember, M., 1963. The Relationship between Economic and Political Development in Non-industrialized Societies. *Ethnology*, 2, pp. 228–248.

Ember, M. and Otterbein, K.F., 1991. Sampling in cross-cultural research. *Cross-Cultural Research. Sage Publications*, 25(1-4), pp. 217-233.

Eogan, G . 1968. Excavations at Knowth, Co Meath, 1962-1965.Proceedings of the Royal Irish Academy C, p.299-400.

Eogan, G .1974. Report on the excavations of some passage graves, unprotected inhumation burials and a settlement site at Knowth, Co Meath. *Proceedings of the Royal Irish Academy* 74C, p.11-112.

Eogan, G. 1967. The Knowth (Co Meath) excavations. *Antiquity* 41, 302-304.

Eogan, G. 1973. A decade of excavations at Knowth, Co Meath. *Irish University Review* 3, 66-79.

Eogan, G. 1980. Objects with Iberian affinities from Knowth, Ireland. *Rev Guimareãs*, 89, 275-279.

Eogan, G.1986. *Knowth and the passage-tombs of Ireland*. Thames & Hudson.

Eogan, G., 1986a. *Knowth and the Passage Graves of Ireland*. London: Thames and Hudson.

Eogan, G., 1986b. *Excavations at Knowth*. Dublin: Royal Irish Academy.

Eogan, G. 1993. Neolithic ritual at Knowth? Co Meath. *Archaeology Ireland* 7(4). p.16-18.

Eogan, G. 1994. A Grooved Ware wooden structure at Knowth, Boyne Valley, Ireland. *Antiquity* 68(259). p.322-330.

Eogan, G. 1997. Pre-tomb Neolithic house discovered at Knowth, Co Meath. *Archaeology Ireland* 11(2), 36-42.

Eogan, G. 1998. Knowth before Knowth. *Antiquity* 72(275). p.162-172

Eogan, G. and Roche, H. 1997. Excavations at Knowth Dublin:Royal *Irish Academy* Vol 1-4.

Eogan, G. and Roche, H. 1997. *Excavations at Knowth 2: Settlement and Ritual Site of the Fourth and third Mellennia BC*. Dublin:Royal Irish Academy.

Esbensen, K. and Geladi, P., 1987. Principal Component Analysis. *Chemometrics and Intelligent Laboratory Systems* 2(1-3), pp. 37-52.

Evans, J.D., and Renfrew, C., 1968. *Excavations at Saliagos near Antiparos*. London: Thames & Hudson.

Evans-Pritchard, E. E., 1937. *Witchcraft, Oracles and Magic among the Azande.* Oxford: Oxford University.

Fawcett, T., 2005. An introduction to ROC analysis. *Pattern Recognition Letters*, 27, pp. 861–874.

Feinman, G.M., 1995. The Emergence of Inequality. A Focus on Strategies and Processes. In: T.D. Price and G.M. Feinman, eds. 1995. *Foundations of Social Inequality*. New York: Plenum. pp. 255-279.

Feinman, G.M. et al., 2012. Cooperation and Collective Action in the Cultural Evolution of Complex Societies. *Journal of Archaeological Method and Theory,* 21(1), pp. 98-133.

Fenwick, J. 1995. The manufacture of the decorated macehead from Knowth, county Meath. *Journal of the Royal Society of Antiquaries of Ireland* 125, 51-60.

Fibiger, L., Ahlström, T., Bennike, P., and Schulting, R.J., 2013, Patterns of violence-related head trauma in Neolithic southern Scandinavia. *American Journal of Physical Anthropology*, 150, pp. 190-202.

Field, A., 2005. *Discovering Statistics Using SPSS*. Thousand Oaks, CA: Sage Publications.

Finkelstein, I., 1990. A Few Notes on Demographic Data from Recent Generations and Ethnoarchaeology. *Palestine Exploration Quarterly*, 122(1), pp. 47-52.

Finlayson, B., Mithen, S., Najjar, M. et al., 2011. Architecture, sedentism, and social complexity at Pre-Pottery Neolithic A WF16, southern Jordan. *Proceedings of the National Academy of Sciences,* 108(20), pp. 8183-8188.

Fischer, A., 1982. Trade in Danubian shaft-hole axes and the introduction of Neolithic economy in Denmark. *Journal of Danish Archaeology,* I. pp. 7-12.

Fischer, A. et al., 2007. Coast-inland mobility and diet in the Danish Mesolithic and Neolithic: evidence from stable isotope values of humans and dogs. *Journal of Archaeological Science,* 34(2007), pp. 2125–2150.

Flanagan, J.C., 1989. Hierarchy in Simple" Egalitarian Societies. *Annual Review of Anthropology,* 18, pp. 245-266.

Flanagan, J.C. and Rayner, S., 1988. *Rules, Decisions and Identity in Egalitarian Societies*. London: Gower.

Flannery, K.V., 1969. Origins and Ecological Effects of Early Domestication in Iran and the Near East: A Comparative Study. In: P. Ucko and G. Dimbleby, eds. 1969. *The Domestication and Exploitation of Plants and Animals*. Duckworth: London. pp. 73–100.

Flannery, K.V. 1972a. The Origins of the Village as a Settlement Type in Mesoamerica and the Near East: A Comparative Study. In P. Ucko et al., eds. 1972. *Man, Settlement and Urbanism*. Duckworth: London. pp. 23–53.

Flannery, K.V., 1972b. The cultural evolution of civilizations. *Annual review of ecology and systematics. Annual Reviews*, 3(1), pp. 399-426.

Flannery, K.V., 1973. The Origins of Agriculture. *Review of Anthropological Research,* 2, pp. 271–330.

Flannery, K.V., 1998. The ground plans of archaic states. In: G.M. Feinman and J.Marcus, eds. 1998. *Archaic States.* Santa Fe, New Mexico: School of American Research Press. pp. 15–57.

Flannery, K.V., 1999. Process and agency in early state formation. *Cambridge Archaeological Journal*, 9, pp. 3-21.

Flannery, K.V. and Marcus, J., 2012. *The Creation of Inequality: How Our Prehistoric Ancestors Set the Stage for Monarchy, Slavery, and Empire*. Cambridge, Massachusetts: Harvard University Press.

Forge, A., 1972. Normative factors in the settlement size of Neolithic cultivators (New Guinea). In: P.J. Ucko et al., eds. 1972. *Man, settlement and urbanism.* London: Duckworth. pp. 363-376.

Frachetti, M., 2009. *Pastoralist landscapes and social interaction in Bronze Age Eurasia*. University of California Press: California

Friedman, J. and Rowlands, M., 1978. *The Evolution of Social Systems*. London: Duckworth.

Fu, Q., *et al.* 2012. Complete mitochondrial genomes reveal Neolithic expansion into Europe. *PLoS ONE* 7, e32473.

Fuller, D. et al., 2011. Cultivation and Domestication had Multiple Origins: Arguments against the Core Area Hypothesis for the Origin of Agriculture in the Near East. *World Archaeology,* 43(4), pp. 628-652.

Gamba, C. *et al*. 2012. Ancient DNA from an Early Neolithic Iberian population supports a pioneer colonization by first farmers. *Mol. Ecol*. 21, 45–56

Gallivan, M.D., 2002. Measuring sedentariness and settlement population: Accumulations research in the Middle Atlantic region, American Antiquity, 67(3), pp. 535-557.

Garfinkel, Y., 1994. Ritual Burial of Cultic Objects: The Earliest Evidence. *Cambridge Archaeological Journal,* 4(2), pp. 159-188.

Garwood et al, eds., 1991. *Sacred and profane*. Oxford: Oxbow.

Gebel, H.G.K., Hermansen, B.D. and Jensen, C.H., 2001. *Magic Practices and Ritual in the Eastern Neolithic*. Berlin: Ex Oriente

Gibson, A.M. and Simpson, D.D.A., 1998. *Prehistoric Ritual and Religion: Essays in Honour of Aubrey Burl*. Stroud, UK: Sutton Publishing.

Gilman, A., 1981. The Development of Stratification in Bronze Age Europe. *Current Anthropology,* 22, pp. 1-23.

Ginges, J., *et al*. 2007. Sacred bounds on rational resolution of violent political conflict. *Proceedings of the National Academy of Science* (USA) 104(18), 7357–7360.

Gkiasta, M., Russell, T., Shennan, S., Steels, J., 2003. Neolithic Transition in Europe: the Radiocarbon record revisited. *Antiquity*, 77, pp. 45-62.

Godelier, M., 1977. *Perspectives in Marxist Anthropology*. Cambridge: Cambridge University Press.

Gómez, A., *et al.* 2011a. On the nature of identity fusion: insights into the construct and a new measure. *Journal of Personality and Social Psychology*. 100, 918–33.

Gómez, Á., *et al.* 2011b. Rejected and Excluded Forevermore but Even More Devoted: Irrevocable Ostracism Intensifies Loyalty to the Group Among Identity-Fused Persons. *Personality and Social Psychology Bulletin* 37(12) 1574–1586

Gopher, A. and Gophna, R., 1993. Cultures of the Eighth and Seventh Millennia BP in the Southern Levant: A Review for the 1990s. *Journal of World Prehistory,* 7(3), pp. 297-353.

Goring-Morris, A.N., 1993. From foraging to herding in the Negev and Sinai: the Early to Late Neolithic transition. *Paléorient,* 19(1), pp. 65-83.

Goring-Morris, A.N., 2005. Life Death and the Emergence of Differential Status in the Near Eastern Neolithic: Evidence from Kfar Hahoresh, Lower Galilee, Israel. In: J. Clarke, ed. 2005. *Archaeological Perspectives on the Transition and Transformation of Culture in the Eastern Mediterranean*. Oxford: Oxbow Books. pp. 89-105.

Goring-Morris, N., Belfer-Cohen, A., 2011. Neolithisation Processes in the Levant: The Outer Envelope. *Current Anthropology: The Origins of Agriculture: New Data, New Ideas*, 52(S4), pp. 195-208.

Gourou, P., 1966. *The tropical world*. New York: Ronald Press.

Gower, J., 1971a. Statistical methods of comparing different multivariate analyses of the same data. In: F. Hodson et al, eds. 1971. *Mathematics in the Archæological and Historical Sciences*. Edinburgh: Edingburh University Press. pp. 138–149.

Gower, J., 1971b. A General Coefficient of Similarity and Some of Its Properties. *Biometrics*, 27(4), pp. 857-871.

Gray, P.B. and Young, S.M., 2011. Human-Pet Dynamics in Cross-Cultural Perspective. *Anthrozoos*, 24 (1), pp. 17–30.

Gremliza, F.G.L., 1962. *Ecology of Endemic Diseases in the Dez Irrigation Pilot Area*. New York: Development and Resource Corporation.

Grosman, L. and Belfer-Cohen, A., 2002. Zooming onto the 'Younger Dryas'. In: R.T.J. Cappers and S. Bottema, eds. 2002. *The Dawn of Farming in the Near East, Studies in Early Near Eastern Production, Subsistence, and Environment*. Berlin: Ex Oriente. pp. 49–54.

Gruber, G., ed. 2005. Identities in Transition. Mesolithic Strategies in the Swedish Province of Östergötland. *Riksantikvarieämbetet, Arkeologiska Undersökningar*. *Skrifter* No. 64. Stockholm: Linköping Riksantikvarieämbetet.

Guisan, A. and Harrell, F.E., 2000. Ordinal response regression models in ecology. *Journal of Vegetation Science*, 11, pp. 617-626.

Guisan, A. et al., 2002. Generalized linear and generalized additive models in studies of species distributions: setting the scene. *Ecological Modelling*, 157, pp. 89-100

Guo, X. et al., 2006. Assessing semantic similarity measures for the characterization of human regulatory pathways. *Bioinformatic*, 22, pp. 967–973.

Gurven, M. 2004. To give and to give not: The behavioral ecology of human food transfers. *Behavioral and Brain Sciences* 27, 543–583

Haak W, *et al.* 2005. Ancient DNA from the first European farmers in 7500-year-old Neolithic sites. *Science* 310, 1016–1018.

Haak W, *et al.* 2010. Ancient DNA from European early Neolithic farmers reveals their near eastern affinities. *PLoS Biol* 8: e1000536.

Haak, W. *et al.*, 2015. Massive migration from the steppe was a source for IndoEuropean languages in Europe. *Nature*, 522 (7555), pp. 207-211.

Hack, J.T., 1942. The changing physical environment of the Hopi Indians of Arizona. *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University*, 35(1).

Haldorsen S, et al., 2011. The climate of the Younger Dryas as a boundary for Einkorn domestication. *Vegetation History and Archaeobotany*, 20(4), pp. 305-318.

Hall, R.H., 1972. *Organizations: Structure and Process*. New Jersey: Prentice-Hall.

Hand, D.J., et al. 1998. Discriminant analysis when the cases arise from a continuum. *Pattern Recognition*, 31, pp. 641-650.

Hanks, B.K. and Linduff, K.M., eds. 2009. *Social Complexity in Prehistoric Eurasia: Monuments, Metals and Mobility.* Cambridge: Cambridge University Press.

Hanley, J.A. and McNeil, B.J., 1982. The meaning and use of the area under the receiver operating characteristic (ROC) curve. *Radiology*, 143, pp. 29-36.

Harbison, P., 1988. Pre-Christian Ireland: From the First Settlers to the Early Celts. Dublin: Wordwell.

Harlan, J.R., 1995. *The Living Fields: Our Cultural Heritage*. Cambridge: Cambridge University Press.

Harrell, F.E., 2001. *Regression Modelling Strategies with Applications to Linear Models, Logistic Regression, and Survival Analysis*. New York: Springer.

Harris, D.R., 1996. *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. Washington: Smithsonian Institution Press.

Harris, D.R., 2002. Development of the agropastoral economy in the Fertile Crescent during the Pre-Pottery Neolithic period. In R.T.J. Cappers and S. Bottema, eds. 2002. *The Dawn of Farming in the Near East.* Studies in Early Near Eastern Production, Subsistence, and Environment, 6. Berlin: Ex Oriente. pp. 67–83.

Harrison, G.A. et al., 1964. *Human Biology. An introduction to human evolution, variation, and growth*. New York: Oxford University Press.

Hartley, S. et al., 2006. Quantifying uncertainty in the potential distribution of an invasive species: climate and the Argentine ant. *Ecology Letters* 9, pp. 1068–1079.

Hassabis, D. and Maguire, E.A., 2007. Deconstructing episodic memory with construction. *Trends in Cognitive Sciences*, 11(7), pp. 299-306.

Hassan, F.A., 1978. Demographic Archaeology. In: M.B. Schiffer, eds. 1978. *Advances in Archaeological Method and Theory*, 1. New York: Academic. pp. 49-103.

Hassan, F.A., 1981. *Demographic Archaeology*. London: Academic Press.

Hastie, T. and Tibshirani, R., 1990. *Generalized Additive Models*. London: Chapman and Hall.

Hauptmann, H. and Özdoğan, M., 2007. Die neolithische Revolution in Anatolien. In Badisches Landesmus, ed. 2007. *Die ältesten Monumente der Menschheit. Landesausstellung Baden-Württemberg im Badischen Landesmuseum Schloß Karlsruhe 20.1.–17.6.2007*. Karlsruhe, 26–36. Stuttgart.

Hayden, B., 1990. Nimrods, Piscators, Pluckers, and Planters: The Emergence of Food Production. *Journal of Anthropological Archaeology*, 9, pp. 31-69.

Hayden, B., 1992. Models of Domestication. In: A.B Gebauer and D.T. Price, eds. 1992. *Transitions to Agriculture in Prehistory*. Madison: Prehistory Press. pp. 11–19.

Hayden, B., 1995. A New Overview of Domestication. In T.D Price and A.B. Gebauer, eds. 1995. *Last Hunters, First Farmers: New Perspectives on the Prehistoric Transition to Agriculture*. Santa Fe: School of American Research Press. pp. 273–299.

Hayden, B., 2001a. Fabulous feasts: a prolegomenon to the importance of feasting. In: M. Dietler and B.Hayden, eds.2001. *Feasts: archaeological and ethnographic perspectives on food, politics, and power*. Washington, DC: Smithsonian Institution. pp. 23–64.

Hayden, B., 2001b. Richman, Poorman, Beggarman and Chief: The dynamics of social inequality. In: G.M. Feinman and T.D. Price, eds. 2001. *Archaeology at the Millennium: A sourcebook*. London: Kluwer Academic. pp. 231-272.

Hayden, B., 2004. Sociopolitical organization in the Natufian: a view from the Northwest. In: C. Delage, ed. 2004. *The last hunter-gatherer societies in the Near East. British Archaeological Reports International Series*. Oxford: John and Erica Hedges. pp. 263–308.

Hayden, B., 2009. The Proof Is in the Pudding: Feasting and the Origins of Domestication. *Current Anthropology*, 50(5), pp. 597-601.

Hayden, B. and Gargett, R., 1990. Big Man, Big Heart?: A Mesoamerican View of the Emergence of Complex Society. *Ancient Mesoamerica*, 1, pp. 3-20.

Hellewell, E., Milner N., 2011. Burial practices at the Mesolithic-Neolithic transition in Britain: Change or continuity?. *Documenta Praehistorica*, 38(1), pp. 61-68

Henesy, R., 2015. *First Light: The Origins of Newgrange*. Oxford: Oxbow books.

Henry, D.O., 1986. The Prehistory and Paleo-environments of Jordan : An overview. *Paléorient*, 12(2), pp. 5-26.

Henry, D.O., 1989. *From Foraging to Agriculture: The Levant at the End of the Ice Age*. Philadelphia: University of Pennsylvania Press.

Henry, D.O., 1995. *Prehistoric Cultural Ecology and Evolution*. New York: Plenum Press.

Henrich, J., and Boyd, R. 1998. The evolution of conformist transmission and the emergence of between group differences. *Evolution and Human Behavior*, 19, 215–242.

Henrich, J., and Boyd, R. 2001. Why people punish defectors: weak conformist transmission can stabilize costly enforcement of norms in cooperative dilemmas. *Journal of Theoretical Biology*, 208, 79–89.

Henrich, J., and Boyd, R. 2002. On modeling cultural evolution: why replicators are not necessary for cultural evolution. *Journal of Cognition and Culture*, 2(2), 87–112.

Henrich, J., and Gil-White, F. 2001. The evolution of prestige: freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior*, 22, 165–196.

Henrich, J., and Henrich, N. 2007. *Why humans cooperate: a cultural and evolutionary explanation*. Oxford: Oxford University Press.

Henrich, J., and McElreath, R. 2006. Dual inheritance theory: The evolution of human cultural capacities and cultural evolution. In R. Dunbar, and L. Barrett (eds.) *Oxford Handbook of evolutionary psychology*. Oxford: Oxford University Press, 555–570

Henrich, J., *et al.* 2005. Five Misunderstandings About Cultural Evolution. Human Nature, 19, 119-137.

Henry, D.O. 2002. Models of agricultural origins and proxy measures of prehistoric demographics. In: R.T.J. Cappers and S. Bottema, eds. 2002. *The Dawn of Farming in the Near East, Studies in Early Near Eastern Production, Subsistence, and Environment* (6). Berlin: Ex Oriente. pp. 15–25.

Herity, M., 1974. *Irish Passage Graves*. Dublin: Irish University Press.

Herkenrath, M., 2002. Quantitative cross-national analysis as a research tool in the sociology of developing countries: a critical examination. *Current Sociology*, 50(4), pp. 517–530.

Hernando et al., 2009. Unravelling the size distribution of social groups with information theory on complex networks. *Physics and Society* [e-journal]. Available through: Cornell University Library website < http://arxiv.org/abs/0905.3704>

accessed 20 November 2013

Hervella, M., *et al*. 2012. Ancient DNA from Hunter-Gatherer and Farmer Groups from Northern Spain Supports a Random Dispersion Model for the Neolithic Expansion into Europe. *PLoS ONE* 7(4): e34417.

Hewstone, M., *et al*., H. 2002. Intergroup bias. *Annual Review of Psychology* 53, 575–604.

Hill, J.D., 1995. *Ritual and Rubbish in the Iron Age of Wessex: A study on the formation of a specific archaeological record*. Oxford: BAR British Series, 242.

Hill, K.C. et al., 2001. Mortality rates among wild chimpanzees. *Journal of Human Evolution* 40, pp. 437–450.

Hill, K. 2002. Cooperative food acquisition by Ache foragers. *Human Nature* 13(1), 105–28.

Hillman, G.C., 1996. Late Pleistocene changes in wild plant-foods available to hunter-gatherers of the northern Fertile Crescent: Possible preludes to cereal cultivation. In: D.R. Harris, ed. 1996. *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. Washington: Smithsonian Institution Press. pp. 159–203.

Hillman, G.C. and Davies, M.S., 1992. Domestication rate in wild wheats and barley under primitive cultivation: Preliminary results and the archaeological implications of field measurements of selection coefficient. In: P.C.Anderson, ed. 1992. *Prehistoire de l'Agriculture*. Paris: CNRS. pp. 119-58.

Hodder, I., 1987. Contextual archaeology: An interpretation of Catal Huyuk and a discussion of the origins of agriculture. *Bulletin of the Institute of Archaeology,* 24, pp. 43–56.

Hodder, I. 1990. *The Domestication of Europe: Structure and Contingency in Neolithic Societies*. Oxford: Basil Blackwell Ltd.

Hodder, I., 2001. Symbolism and the origins of agriculture in the Near East. *Cambridge Archaeological Journal*, 11, pp. 107–112.

Hodder, I., 2003. The lady and the seed: Some thoughts on the role of agriculture in the 'Neolithic Revolution'. In: H. Hauptmann and N. Bas, eds. 2003. *From Village to Cities: Studies Presented to Ufuk Esin, Arkeolojive*. Istanbul: Sanat Publications. pp. 129-139.

Hodder, I., ed. 1982. *Symbolic and Structural Archaeology*. Cambridge: Cambridge University Press.

Hodder, I. and Cessford, C., 2004. Daily Practice and Social Memory at Çatalhöyük. *Antiquity*, 69(1), pp. 17-40.

Hodder, I. and Hutson, S., 2003. *Reading the Past: Current Approaches to Interpretation in Archaeology*. 3rd ed. Cambridge: Cambridge University Press.

Hoffman, D. 2014. What have genetics ever done for us? The implciations of aDNA for interpreting identiy in Early Neolithic Central Europe. *European Journal of Archaeology* 18 (3), 454-476

Hoffman, E., McCabe, K. & Smith, V. 1998. Behavioral foundations of reciprocity: Experimental economics and evolutionary psychology. *Economic Inquiry* 36, 335–52. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145611

Accessed 12-01-16

Hole, F., 2000. Is size important? Function and hierarchy in Neolithic settlements. In: I. Kuijt, ed. 2000. *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*. New York: Kluwer Academic/Plenum Publishers. pp. 191–209.

Hole, F. et al., 1969. Prehistory and human ecology of the Deh Luran Plain. An early village sequence from Khuzistan, Iran. *Memoirs of the Museum of Anthropology, University of Michigan 1*.

Hope K., et al., 2013. Using the Scientific Method to Guide Learning: An Integrated Approach to Early Childhood Curriculum. *Early Childhood Education Journal,* 41, pp. 315–323.

Hoppa, R. D., and Vaupel, J.W., 2002. *Paleodemography: Age Distributions from Skeletal Samples*. Cambridge, U.K.: Cambridge University Press.

Horton, R., 1973. Lévy-Bruhl, Durkheim and the scientific revolution. In: M. Horton and R. Finnegan, eds. 1973. *Modes of Thought.* London: Faber and Faber. pp. 249–305.

Horwitz, L.K., Goring-Morris, N., 2004. Animals and ritual during the Levantine PPNB: a case study from the site of Kfar Hahoresh. *Israel Anthropozoologica,* 39(1), pp. 165-178.

Hosfield, R., 1999. The Paleolithic of the Hampshire Basin: A Regional Model of Hominid Behavior during the Middle Pleistocene. Oxford: BAR, British Series, 286.

Hosfield, R., 2005. Individuals among palimpsest data: Fluvial landscapes in southern England. In: C. Gamble and M. Porr, eds. 2005. *The Hominid Individual in Context*. London: Routledge. pp. 220-243.

Hotelling, H., 1933 Analysis of a complex of statistical variables into principal components. *Journal of Educational Psychology*, 24(6), pp. 417-441.

Howell. D., 2009. *Statistical Methods for Psychology*. California: Wadsworth Publishing

Howells, W.W., 1960. Estimating population numbers through archaeological and skeletal remains. In R.F. Heizer and S.F. Cook, eds. 1960. *The application of quantitative methods in archaeology, Viking Fund Publication in Anthropology*, 28, pp. 158-180.

Hupka, R.B. et al., 1999. Universal development of emotion categories in natural language. *Journal of personality and social psychology,* 77 (2), p. 247.

Hvass, S and Storgaard, B., eds., 1993. *Digging Into the Past: 25 Years of Archaeology in Denmark*. Copenhaguen: Royal Society of Northern Antiquaries.

Ingold, T., 1996a. Human worlds are culturally constructed. Against the motion (1). *Anthropology*. London/New York: Routledge. pp. 112–118.

Ingold, T., 1996b. Hunting and gathering as ways of perceiving the environment. In R. Ellen and K. Fukui, eds. 1996. *Redefining Nature: Ecology, Culture and Domestication.* Oxford/Washington: Berg. , pp. 117–155.

Ingold, T., 1996c. Growing plants and raising animals: An anthropological perspective on domestication. In D.R. Harris, ed. 1996. *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. Washington, DC: Smithsonian Institution Press. pp. 12–24.

Ingold, T., 2000. *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*. London: Routledge.

Isaakidou, V. and Tomkins, P., 2008. *Escaping the Labyrinth. The Cretan Neolithic in Context*. Oxford: Oxbow Press.

Jackson, J.E., 1991. *A User's Guide to Principal Components*. New York: John Wiley and Sons.

Jamieson, P.L., 1971. Demographic and Comparative Analysis of the Albany Mounds (Illinois) Hopewell Skeletons. In E.B. Herold, ed. 1971. *The Indian Mounds at Albany*. Iowa: Davenport Museum Anthropological Papers.

Jans, M.M.E., 2002: In Situ Preservation of Archaeological Bone: A Histological Study Within A Multidisciplinary Approach. *Archaeometry*, 44(3), pp. 343–352.

Jennbert, K., 1986. Neolithization--a Scanian perspective. *Journal of Danish Archeology*, 4, pp. 196-197.

Jennbert, K., 1987. Neolithization processes in the Nordic area. *Swedish Archaeology*, 1981- 1985, StockhoIm, pp. 21-35.

Johnson, A.W. and Earle, T., 2000. *The Evolution of Human Societies: From Foraging Group to Agrarian State*. Stanford: Stanford University Press.

Johnson, J.G.A., 1982. Organizational Structure and Scalar Stress. In: C. Renfrew et al., eds.1982. *Theory and Explanation in Archaeology*. New York: Academic Press. pp. 389–421.

Johnson, M., 1999. *Archaeological Theory*. London: Blackwell.

Johnson, N.P., 2004. Advantages to transforming the receiver operating characteristic (ROC) curve into likelihood ratio co-ordinates. *Statistics in Medicine*, 23, pp. 2257–2266.

Jolliffe, I.T., 2002. *Principal Component Analysis*. New York: Springer

Jong, J., *et al*. 2015. Shared Negative Experiences Lead to Identity Fusion via Personal Reflection. PLoS ONE 10(12): e0145611. doi:10.1371/journal.pone.0145611

Acessed 19-12-15

Jones, R., 1987. A False Start? The Roman Urbanisation of Western Europe. *World Archaeology*, 19(1), pp. 47-57.

Karsten, P. and Nilsson, B., 2006. *In the wake of a woman: stone age pioneering of North-Eastern Scania, Sweden, 10,000-5000 B.C.: the Årup settlements*. Stockholm: National Heritage Board, Sweden.

Keswani S.P., 1996. Hierarchies, Heterarchies, and Urbanization Processes: The View from Bronze Age Cyprus. *Journal of Mediterranean Archaeology*, 9(2), pp. 211-250.

Keswani S.P., 2004. *Mortuary Ritual and Society in Bronze Age Cyprus*. *Monographs in Mediterranean Archaeology*. Leiden/Oakville: Equinox Publishing Ltd.

Khazanov, A. M. 1994. *Nomads and the outside world*. Madison: University of Wisconsin Press

Kijuit, I., 1996. Negotiating equality through ritual: A consideration of Late Natufian and Pre-Pottery Neolithic A period mortuary practices. *Journal of Anthropological Archaeology*, 15, pp. 313–336.

Kirk, T., 1993. Space, Subjectivity, Power and Hegemony: Megaliths and Long Mounds in Earlier Neolithic Brittany. In: Tilley, eds. 1993. *Interpretative Archaeology*. Oxford: Berg Press.

Klandermans, B., *et al*. 2002. Identity processes in collective action participation:Farmers' identity and farmers' protest in the Netherlands and Spain. *Political Psychology*, 23, 235–251.

Klein, R.G., 1969. *Man and Culture in the Late Pleistocene: A Case Study*. San Francisco :Chandler.

Kline, M.A. and Boyd, R., 2010. Population size predicts technological complexity in Oceania. *Proceedings of the Royal Society B: Biological Sciences*, 277 (1693), pp. 2559–2564.

Knappett, C., 2005. *Thinking through Material Culture: and Interdisciplinary Perspective*. Philadelphia: Philadelphia University Press.

Knutsson K., Falkenström P. & Lindberg K-F., 2005. *Appropriation of the past. Neolithisation in the Northern Scandinavian Perspective. I: Mesolithic on the move*. In: L. Larson, ed. 2005. Oxford: Oxbow Books.

Kohler, T.A., 1978. Ceramic breakage-rate simulation: population size and the southeastern chiefdom. *Newsletter of Computational Archaeology*, 14, pp. 1-18.

Köhler-Rollefson, I., 1989. Changes in Goat Exploitation at 'Ain Ghazal between the Earlyand Late Neolithic : A Metrical Analysis. *Paléorient*, 15(1), pp. 141-146.

Kohler-Rollefson, I. and Rollefson, G.O., 1993. PPNA Adaptations in the first Half of the 6th Millennium B.C. *Paléorient*, 19(1), pp. 33-42.

Kohler-Rollefson, I., and Rollefson, G.O., 2002. Brooding about breeding: Social implications for the process of animal domestication. In R.T.J. Cappers and S. Bottema, eds. 2002. *The Dawn of Farming in the Near East, Studies in Early Near Eastern Production, Subsistence, and Environment 6*. Berlin: Ex Oriente. pp. 177–181.

Kolb, C.C., 1985. Demographic Estimates in Archaeology: Contributions From Ethnoarchaeology on Mesoamerican Peasants. *Current Anthropology*, 26, pp. 581–599.

Konigsberg, L.W. and Frankenberg, S.R., 1992. Estimation of age structure in anthropological demography. *American Journal of Physical Anthropology,* 89, pp. 235–256.

Kosse, K., 1989. Group Size and Societal Complexity: Thresholds in the Long-Term Memory. *Journal of Anthropological Archaeology,* 9, pp. 275-303.

Kosse, K., 1994. The Evolution of Large, Complex Groups: A Hypothesis. *Journal of Anthropological Archaeology,* 13, pp. 35–50.

Kramer, C., 1980. Estimating prehistoric populations: An ethnoarchaeological approach. In: M.T. Barrelet, ed. *L'Archeologie de 'Iraq.* Paris: Centre National de la Recherche Scientifique. pp. 315–334.

Kramer, C., 1982. Ethnographic Households and Archaeo-logical Interpretation: A Case from Iranian Kurdistan. *American Behavioural Scientist,* 25, pp. 663–675.

Kroebe, A.L., 1953. *Cultural and Natural Areas of Native North America*. Berkeley: University of California Press.

Kuijt, I., 1996. Negotiating Equality through Ritual: A Consideration of Late Natufian and Prepottery Neolithic A Period Mortuary Practices. *Journal of Anthropological Anthropology,* 15, pp. 313–336.

Kuijt, I., 2000a. Life in Neolithic farming communities: An introduction. In I. Kuijt, ed. 2000. *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation.* New York: Kluwer Academic/Plenum Publishers. pp. 3–13.

Kuijt, I., 2000b. Keeping the peace: Ritual, skull caching and community integration in the Levantine Neolithic. In: I. Kuijt, ed. 2000. *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation.* New York: Kluwer Academic/Plenum Publishers. pp. 137–163.

Kuijt, I., 2000c. People and Space in Early Agricultural Villages: Exploring Daily Lives, Community Size, and Architecture in the Late Pre-Pottery Neolithic. *Journal of Anthropological Archaeology,* 19. pp. 75–102.

Kuijt, I., 2001a. Place, Death, and the Transmission of Social Memory in Early Agricultural Communities of the Near Eastern Pre-Pottery Neolithic. *Archeological Papers of the American Anthropological Association; Special Issue: Social Memory, Identity, and Death: Anthropological Perspectives on Mortuary Rituals*, 10, pp. 80-99.

Kuijt, I., 2002. Reflections on ritual and the Transmission of Authority in the Pre-pottery Neolithic of the Southern Levant. In H.G.K. Gebel, B.D. Hermansen and C. Hoffmann Jensen, eds. 2002. *Magic practices and ritual in the Near Eastern Neolithic: Studies in Early Near Eastern Production, Subsistence, and Environment, Vol. 8, proceedings of a workshop held at the 2nd International Congress on the Archaeology of the Ancient Near East (ICAANE), Copenhagen University*. Berlin: Ex Oriente, pp. 81-90.

Kuijt, I., 2008. The Regeneration of Life: Neolithic Structures of Symbolic Remembering and Forgetting. *Current Anthropology,* 49(2). pp. 171-197.

Kuijt, I. and Chesson, M., 2005. Lumps of clay and pieces of stone: ambiguity, bodies, and identity as portrayed in Neolithic figurines. In S. Pollock and R. Bernbeck, eds. 2005. *Archaeologies of the Middle East: Critical Perspectives*. Malden: Blackwell. pp. 152–183.

Kuijt, I. and Finlayson, B., 2002. The 2002 excavations at Dhra' Jordan: Preliminary results from the Jericho IX and Pre-Pottery Neolithic A period components. *NeoLithic* 2(02), pp. 17–21.

Kuijt, I. and Goring-Morris, N., 2002. Foraging, farming, and social complexity in the Pre-Pottery Neolithic of the southern Levant: A review and synthesis. *Journal of World Prehistory*, 16(4), pp. 361-440.

Kuijt, I., Guerrero Vila, E., Molist, M. and Anfruns, J., 2011. The Changing Neolithic Household: Household Autonomy, Integration and Mortuary Practices, Tell Halula, Syria. *Journal of Anthropological Archaeology*, 30(4), pp. 502-522.

Kurzban, R., and S. Neuberg. 2005. Managing ingroup and outgroup relationships. In. D. Buss, (eds) *The handbook of evolutionary psychology*. Hoboken: Wiley, 653–675.

Kyriakidis, E, ed., 2007. *The Archaeology of Ritual. Cotsen advanced seminars, 3.* Los Angeles: Cotsen Institute of Archaeology at UCLA, University of California.

Lacan M, *et al.* 2011. Ancient DNA reveals male diffusion through the Neolithic Mediterranean route. *Proceedings of the National Academy of Science* USA 108: 9788–9791.

Lagacé, R.O., 1979. The HRAF probability sample: Retrospect and prospect. *Cross-Cultural Research. Sage Publications*, 14(3), pp. 21-229.

Larsson, L., 1985. Of house and hearth. The excavation, interpretation and reconstruction of a Late Mesolithic house. *Archaeology and Environment*, 4, pp. 197-209.

Larsson, L., 1987. Some aspects of cultural relationship and ecological conditions during late Mesolithic and early Neolithic. In: G. Burenhult, A. Carlsson, A. Hyenstrand, and T. Sjovold, eds. *Theoretical Approaches to Artefacts, Settlement and Society*. Oxford: BAR International Series, 366, pp. 165-176.

Larsson, L., 1990. The Mesolithic of Southern Scandinavia. *Journal of World Prehistory*, 4(3), pp. 257-309.

Larsson, L. and Zagorska, I., eds. n.d. *Back to the Origin. New research in the Mesolithic-Neolithic Zvejnieki cemetery and environment, northern Latvia*. Stockholm: Almqvist& Wiksell Intl. pp. 217–233.

Larsson, M., 1986. Neolithization in Scania-- a Funnel Beaker perspective. *Journal of Danish Archaeology*, 5, pp. 244-247.

Lazaridis, I. *et al.* 2014. Ancient human genomes suggest three ancestral populations for present-day Europeans. *Nature* 513, 409-413.

Le Blanc, S., 1971. An Addition to Naroll's Suggested Floor Area and Settlement Population Relationship. *American Antiquity,* 36, pp. 210–211.

Leach, H.M., 2003. Human domestication reconsidered. *Current Anthropology,* 44(3), pp. 349–368.

Lee, R.B., 1969. Kung Bushman Subsistence: An Input-Output Analysis. In: A.P. Vayda, ed. 1969. *Environment and Cultural Behaviour: Ecological Studies in Cultural Anthropology*. New York: Natural History Press. pp. 47-79.

Lee, R.B. and DeVore, I., 1968. What hunters do for a living, or how to make out on scarce resources. In: P.J. Ucko et al, eds. 1968. *Man, settlement and urbanism*, London: Duckworth. pp. 30-48.

Lee-Thorp, J.A., *et al.* 1989. Stable carbon isotope ratio differences between bone collagen and bone apatite, and their relationship to diet. Journal of Archaeological *Science*,16:585-599

Lemon, C.H and Smith, D.V., 2006. Influence of response variability on the coding performance of central gustatory neurons. *The Journal of Neuroscience,* 26(28), pp. 7433–7443.

Leroi-Gourhan, A., 1964. *Les Religions de la Préhistoire*. Paris: Presses Universitaires de France.

Levinson, D., 1981. Physical punishment of children and wife-beating in cross-cultural perspective. *Child Abuse & Neglect*, 5(2), pp. 193–195.

Levinson, D. and Malone, M.J., 2000. Cross-Cultural Research. In: S. Sanderson, ed. *Sociological Worlds: Comparative and Historical Readings in Society*. London: Routledge. pp. 371–377.

Lévi-Strauss, C., 1968. *Structural Anthropology.* London, Allen Lane: The Penguin Press.

Lévi-Strauss, C.,1973. *Tristes Tropiques*: Translated from French by J. and D. Weightman. London: Penguin.

Lewis, H.M, *et al*. 2014. High mobility explains demand sharing and enforced cooperation in egalitarian hunter-gatherers Nature Communication. 5 (5789)

Lewis-Williams, J. D., 2008. Religion and archaeology: An analytical materialist account. In: D.S. Whitley and K. Hays-Gilpin, eds. *Belief in the Past: Theoretical approaches to the archaeology of religion.* Walnut Creek: Left CoastPress. pp. 23–42.

Mace, R., Pagel, M., Bowen, J.R. et al., 1994. The comparative method in anthropology [and comments and reply]. *Current Anthropology. University of Chicago Press,* 35(5), pp. 549-564.

MacAlister, R. 1944. Preliminary report on the excavation at Knowth. *Proceedings of the Royal Irish Academy*, 49. p.131-166.

Madsen, T., 1982. Settlement systems of early agricultural societies in east Jutland: a regional study of change. *Journal of anthropological archaeology,* 1, pp. 197-236.

Madsen, T. and Jensen, H.J., 1982. Settlement and land use in early Neolithic Denmark. *Analecta Praehistorica Leidensia,* 15, pp. 63-86.

Malafouris, L., 2004. The cognitive basis of material engagement: where brain, body and culture conflate. In: E. De Marrais, C. Goseen and C. Renfrwew, eds. 2004. *Rethinking Materiality: The Engagement of Mind with the Material World*. Cambridge: Cambridge University Press. pp. 53-62.

Malinowski, B., 1944. *A Scientific Theory of Culture*. Chapel Hill: University of North Carolina Press.

Malinowski, B., 1974. *Magic, Science and Religion and Other Essays.* London: Souvenir Press

Malley, B., 2007. The doctrinal mode and Evengelical Christianity in the United States. In: H. Whitehouse and J. Laidlaw, eds. 2007. *Religion, Anthropology, and Cognitive Science*. Durham NC: Carolina University Press. pp. 79-88.

Malone, C., Barrowclough, D.A. and Stoddart, S., 2007. Introduction. In: D. A. Barrowclough and C. Malone, eds. *Cult in Context: Reconsidering ritual in archaeology.* Oxford: Oxbow Books. pp. 1–7.

Malone, M.J.S. and Ian, A., 1998. *Culture summary.* New Haven, Connecticut: Kanuri.

Malmström, H., *et al.* 2009. Ancient DNA reveals lack of continuity between Neolithic hunter-gatherers and contemporary Scandinavians. *Current Biology* 19(20), 1758-1762.

Manly, B.F.J., 2000. *Multivariate Statistical Methods: A Primer*. London: Chapman and Hall.

Mann, C.C., 2011. The Birth of Religion. *National Geographic*, 219(6), pp. 39-59.

Marcus, J., 1973. Territorial organization of the lowland Classic Maya. *Science*. American Association for the Advancement of Science, 180 (4089), pp. 911-916.

Marcus, J., 1976a. The origins of Mesoamerican writing. *Annual Review of Anthropology*, 5(1976), pp. 35-67.

Marcus, J., 1976b. The size of the early Mesoamerican village. In: K.V. Flannery, eds. *The early Mesoamerican village*. New York: Academic Press. pp. 79-88.

Marcus, J., 2007. Rethinking Ritual. In: Kyriakidis, E., ed. 2007. *The Archaeology of Ritual*. Los Angeles: Cotsen Institute of Archaeology, UCLA. pp. 43-76.

Marcus, J. and Flannery, K., 1994. Ancient Zapotec Ritual and Religion: An Application of the Direct Historical Method. In: C. Renfrew and E. Zubrow, eds. *The Ancient Mind: Elements of Cognitive Archaeology*. Cambridge: Cambridge University Press. pp. 55-74.

Mardia, K.V., 1978. Some properties of classical multidimensional scaling. *Communications on Statistics – Theory and Methods*, pp. 1233–1241.

Martin, L. H. and Whitehouse, H. 2005 eds. History, Memory, and Cognition. *Historical Reflections/ Reflexions Historiques* 31, 2 , ISSN 0315-7997

Martinsson-Wallin, H. and Wallin, P., 2010. The story of the only (?) megalith grave on Gotland Island. *Documenta Praehistorica* 37, pp. 77-84.

Mason, S.J, Graham, N.E., 2002. Areas beneath the relative operating characteristics (ROC) and relative operating levels (ROL) curves: Statistical significance and interpretation. Quarterly *Journal of the Royal Meteorological Society*, 128, pp. 2145–2166.

May, J. 2003. Eogan of Knowth. *Current Archaeology* 188, 328-334

Mauss,M., 1990. *The Gift. The form and reason for exchange in archaic societies*. London; Routledge.

Mc Brearty, S. and Brooks, A.S., 2000. The revolution that wasn't: a new interpretation of the origin of modern human behaviour. *Journal of Human Evolution*, 39(5), pp. 453-563.

McCall, L.W., 2009. Studying Cultural Evolution at the Tips: Human Cross-cultural Ecology. *Evolution: Education and Outreach*, 2(1), pp. 55–62.

McCauley, R.N. and Lawson, E.T., 2002. *Bringing Ritual to Mind: Psychological foundations of cultural forms.* Cambridge: Cambridge University Press.

McCauley, R.N. and Lawson, E.T., 2007. Cognition, religious ritual and archaeology. In: E. Kyriakidis, ed. 2007. *The Archaeology of Ritual.* Los Angeles: Cotsen Institute of Archaeology at UCLA. pp. 209-254.

McCorriston, J. and Hole, F., 1991. The ecology of seasonal stress and the origins of agriculture in the Near East. *American Anthropologist*, 93, pp. 46–69.

McCullagh, P. and Nelder, J.A., 1989. *Generalized Linear Models.* London: Chapman and Hall.

McCulloch, C.E., 1997. Maximum likelihood algorithms for generalized linear mixed modes. *Journal of the American Statistical Association*, 92, pp. 162–170.

McElreath, R., *et al.* 2005. Applying evolutionary models to the laboratory study of social learning. *Evolution and Human Behavior*, 26, 483–508

MCGovern, P.E. 2009. *Uncorking the past: the quest for wine, beer, and other alcoholic beverages*. Berkeley (CA) & London: University of California Press

McKay, R., and Whitehouse, H. 2015. Religion and Morality. *Psychological Bulletin* 141(2), 447-473

McMann, J., 1994. Forms of Power: Dimensions of an Irish Megalithic Landscape. *Antiquity*, 68, pp. 525-44.

McMichael, E.V., 1960. Towards the estimation of prehistoric populations. *Indiana Academy of Sciences, Proceedings*, 69, pp.78-82.

Me-Bar, Y. and Valdez, F., 2004. Recovery Time After a Disaster and the Ancient Maya. Journal of Archaeological Science, 31, pp. 1311-1324.

Mellaart, J., 1970. *Excavations at Hacilar*. Edinburgh: Edinburgh University Press

Mellars, P.A. and Stringer, C., 1989. *The Human Revolution. Behavioural and biological perspectives in the origins of modern humans*. Edinburgh: Edinburgh University Press

Meskell, L., 2004. Devine Thinking. In: E. De Marrais, C. Goseen and C. Renfrwew, eds. 2004. *Rethinking Materiality: The Engagement of Mind with the Material World*. Cambridge: Cambridge University Press. pp. 249-260.

Metz, C.E., 1978. Basic principles of ROC analysis. *Seminars in Nuclear Medicine*, 8, pp. 283-298.

Miller, D. and Tilley, C., 1984. *Ideology, Power and Prehistory*. Cambridge: Cambridge University Press.

Milner, N and Woodman, P., 2005. Looking into the Canon's Mouth: Mesolithic Studies in the 21st Century. In: N. Milner and P. Woodman, eds. *Mesolithic Studies at the Beginning of the 21st century*. Oxford: Oxbow. pp. 1-13.

Mithen, S., 1996. *The Prehistory of the Mind, a Search for the Origins of Art, Religion and Science*. London: Thames and Hudson.

Mithen, S., 1997. Cognitive archaeology, evolutionary psychology and cultural transmission, with particular reference to religious ideas. *Archeological Papers of the American Anthropological Association*, 7(1), pp. 67-74.

Mithen, S., 2004. From Ohalo to Çatalhöyük: The Development of Religiosity during the Early Prehistory of Western Asia, 20,000–7000 BC. In: H. Whitehouse and L.H. Martin, eds. *Theorizing Religions Past*. California: AltaMira Press. pp. 17–43.

Moore, A.M.T. and Hillman, G.C., 1992. The Pleistocene to Holocene transition and human ecology in southwest Asia: the impact of the Younger Dryas. *American Antiquity*, 57, pp. 482-449.

Morris, B., 2006. *Religion and Anthropology: A critical* introduction. Cambridge: Cambridge University Press.

Mount, C. 1997. Early Bronze Age Burial in South-East Ireland in the Light of Recent Research. *Proceedings of the Royal Irish Academy Section C Archaeology, Celtic Studies, History, Linguistics, Literature*. 97(3), 101-193.

Munro, N.D., 2004. Zooarchaeological measures of hunting pressure and occupation intensity in the Natufian. *Current Anthropology*, 45, pp. 5–33.

Munro, N, D. and Grosman, L. 2010. Early evidence (ca. 12,000 B.P.) for feasting at a burial cave in Israel. *Proceedings of the National Academy of Sciences of the United States of America* 107(35), 15362-6

Murdock, G.P., 1949. *Social structure*. London: Collier -Macmillan Limited.

Naroll, R., 1956. A preliminary index of social development. *American Anthropologist*, 58, pp. 687-771.

Naroll, R., 1962. Floor Area and Settlement Population. *American Antiquity*, 27, pp. 587–589.

Naroll, R., 1965. Galton's problem: The logic of cross-cultural analysis. *Social Research*, 32(4), pp. 428–451.

Naroll, R., 1967. The proposed HRAF probability sample. *Cross-Cultural Research. Sage Publications*, 2(2), pp. 70–80.

Nettle, D., 2009. Ecological influences on human behavioural diversity: a review of recent findings. *Trends in ecology & evolution. Elsevier*, 24 (11), pp. 618–624.

Neuberg, S.L., *et al*.2014. Religion and Intergroup Conflict: FindingsFrom the Global Group Relations Project. *Psychological Science* 25(1) 198–206.

Newell, R.R., 1973. The post glacial adaptations of the indigenous populations of the North Western European Plain. In S.K. Kozolski, eds. 1073. *The Mesolithic in Europe*. Warsaw: University Press.

Nilsson Stutz, L., 2003. Embodied Rituals and Ritualised Bodies: Tracing ritual practise in Late Mesolithic burials, *Acta Archaeologica Lundensia*, 46.

Nilsson Stutz, L., 2009. Coping with Cadavers: ritual practises in Mesolithic cemeteries In: S. McCarten, ed. *Mesolithic Horizons.* Oxford: Oxbow. pp. 656-663.

Notroff, J. et al, 2014. Building Monuments – Creating Communities. Early monumental architecture at Pre-Pottery Neolithic Göbekli Tepe. In J. Osborne, ed. 2014. *Approaching Monumentality in the Archaeological Record*. Albany, NY: SUNY Press. pp. 83-105.

Nowell, A., 2001.The Re-emergence of Cognitive Archaeology. In: A. Nowell, ed. 2001. *In the Mind's Eye: Multidisciplinary Approaches to the Evolution of Human Cognition*. Ann Arbor, Michigan: International Monographs in Prehistory. pp. 20-33.

Novembre, J. Ramachandran, S. 2011. Perspectives on human population structure at the cusp of the sequencing era. Annu. Rev. *Genomics Hum. Genet*. 12, 245 http://brown.edu/Research/Ramachandran_Lab/files/publications/novembre2011ARGHG.pdf

Accessed 12-03-16

O'Kelly, M.J., 2004. *Newgrange Archaeology Art and Legend*. London: Thames and Hudson.

O'Brien, M.J. and Lyman, R.L., 2000. *Applying Evolutionary Archaeology*. Plenum Press. New York.

Özdoğan, M. and Basgelen, N., 1999. *The Neolithic in Turkey. The Cradle of Civilization: New discoveries . Western Turkey*. Istanbul: Archaeology & Art Publications.

Pachis, P. and Martin, L. H. 2009. *Imagistic Traditions in the Graeco-Roman World, Thessaloniki*. Greece: Vanias

Parker Pearson, M. 1999. The Archaeology of Death and Burial. Stroud: Sutton Publishing Ltd.

Park, H.S., 2004. Receiver Operating Characteristic (ROC) Curve: Practical Review for Radiologists. *Korean Journal of Radiology*, 5(1), pp. 11-18.

Park, J. H., M. Schaller, and Van Vugt, M. 2008. Psychology of human kin recognition: heuristic cues, erroneous inferences, and their implications. Review of General Psychology 12(3), 215–235

Parker Pearson, M., 1982. Mortuary Practices Society and Ideology: An Ethnoarchaeology Study. In: I. Hodder, ed. 1982. *Symbolic and Structural Archaeology*. Cambridge: Cambridge University Press.

Parker Pearson, M., 1984. Social Change, Ideology and the Archaeological record. In: M. Spriggs, ed. 1984. *Marxist Perspectives in Archaeology*. Cambridge: Cambridge University Press.

Parker Pearson, M., 1999. *The Archaeology of Death and Burial*. Stroud: Sutton.

Peel, J.D.Y., 2007. Divergent Modes of Religiosity in West Africia. In: H. Whitehouse and J. Laidlaw, eds. 2007. *Religion, Anthropology, and Cognitive Science*. Durham NC: Carolina University Press. pp. 11-30.

Peoples, H.C. and Marlowe, F.W., 2012. Subsistence and the Evolution of Religion. *Human Nature*, 23(3), pp. 253-269.

Peregrine, P.N. et al, 2004. Universal Patterns in Cultural Evolution: An Empirical Analysis Using Guttman Scaling. *American Anthropologist*, 106, pp. 145–149.

Pereira, L. *et al.* 2005. High-resolution mtDNA evidence for the late-glacial resettlement of Europe from an Iberian refugium. *Genome Res* 15, 19–24

Pernicka, E., Eibner, C., Öztunah, Ö., Wagener, G.A., 2003. Early Bronze Age Metallurgy in the Northeast Aegean. In: G.A. Wagner, E. Pernicka and H-P. Uerpmann, eds. 2003. *Troia and the Troad: scientific approaches.* Natural science in archaeology. Berlin/London: Springer. pp. 143–172.

Peters, J and Schmidt, K., 2004. Animals in the symbolic world of Pre-Pottery Neolithic Göbekli Tepe, south-eastern Turkey: a preliminary assessment. *Anthropozoologica*, 39(1), pp. 179–218.

Pfeiffer, J., 1982. *The Creative Explosion: An Inquiry into the Origins of Art and Religion*. New York: Harper and Row.

Pinhasi, R. et al., 2012. The genetic history of Europeans. *Trends in Genetics*, 28(10), pp. 1–10.

Plog, F., 1975. Demographic studies in Southwestern prehistory. In: A.C. Swedlund, ed. 1975. *Population studies in archaeology and biological anthropology: A symposium*. Society for American Archaeology, Memoirs 30. pp. 94-103.

Plog, S., 1995. Equality and Hierarchy: Holistic Approaches to Understanding Social Dynamics in the Pueblo Southwest. In: T.D. Price and G.M. Feinman, eds. 1995. *Foundations of Social Inequality*. New York: Plenum. pp. 189-206.

Pollard, J., 1990. Down through the ages: A reconsideration of the Oban Cave aits. *Scottish Archaeological review*, 7, pp. 57-84.

Pollard, J., 1996. Time and Tide: coastal environments, cosmology and ritual practice in early prehistoric Scotland. In: J. Pollard and A. Morrison, eds. 1996. *The early prehistory of Scotland*. Edinburgh: Edinburgh University Press. pp. 198-210.

Pollard, J., 2000. Ancestral Places in the Mesolithic Landscape. *Archaeological Review from Cambridge*, 17, pp. 123-138.

Pollet, T.V., Tybur, J.M., Frankenhuis, W.E. et al, 2014 . What can cross-cultural correlations teach us about human nature?. *Human Nature, 25*, pp. 410-429.

Porčić, M., 2011. An exercise in archaeological demographics: estimating the population size of Late Neolithic settlements in the Central Balkans. *Documenta Praehistorica* 38, pp. 323-332.

Postgate, N., Wang, T. and Wilkinson, T., 1995. The evidence for early writing: utilitarian or ceremonial?. *Antiquity*, 69(264), pp. 459–480.

Powell, B.B., 2012. *Writing: theory and history of the technology of civilization*. Oxford: John Wiley & Sons.

Price, D.T., 1991. *Transitions to Agriculture in Prehistory*. Madison: Prehistory Press.

Price, D.T. *et al.* 2007. New Information on the Stone Age Graves at Dragsholm, Denmark. *Acta Archaeologica* 78 (2), 193-219

Quintero, L.A. and Wilke, P.J., 1995. Evolution and economic significance of naviform core-andblade technology in the southern Levant. *Paléorient*, 21, pp. 17–33.

Radcliffe-Brown, A.R., 1956. *Structure and Function in Primitive Society*. London: Cohen and West.

Raetzel-Fabian, D., 2002. Monumentality and Communication-Neolithic Enclosures and Long Distance Tracks in West Central Europe. *Journal of Neolithic Archaeology* [online] Available at: <http://www.jna.uni-kiel.de/index.php/jna/article/view/83> [Accessed 14 May 2013]

Rappaport, R. A., 1968. *Pigs for the ancestors: Ritual in the ecology of a New Guinea people*. New Haven, Conn: Yale University Press.

Rappaport, R.A., 1999. *Ritual and Religion in the Making of Humanity.* Cambridge: Cambridge University Press.

Renfrew, C., 1972. Patterns of population growth in the prehistoric Aegean. In P.J. Ucko et al, eds. 1972. *Man, settlement and urbanism.* London: Duckworth. pp. 383-399.

Renfrew, C., 1973. Monuments, Mobilization and Social Organization in Neolithic Wessex. In C. Renfrew, ed. 1973. *The Explanation of Culture Change: Models in Prehistory*. Pittsburgh. pp. 539-58.

Renfrew, C., 1985. *The Archaeology of Cult: The sanctuary at Phylakopi.* London: Thames and Hudson.

Renfrew, C., 1993. Cognitive Archaeology: Some Thoughts on the Archaeology of Thought. *Cambridge Archaeological Journal*, 3(2), pp. 48-50.

Renfrew, C., 1994. The Archaeology of Religion. In: C. Renfrew and E. Zubrow, eds. 1994. *The Ancient Mind: Elements of Cognitive Archaeology*. Cambridge: Cambridge University Press. pp. 47-54.

Renfrew, C. 1998. Mind and Matter; Cognitive archaeology and External Symbolic Storage. In: C. Renfrew and C. Scarre, eds. 1998. *Cognition and Material Culture: The Archaeology of Symbolic Storage*. Cambridge: Mc Donald Institute for Archaeological Research. pp. 1-6.

Renfrew, C., 2007a. The archaeology of ritual, of cult, and of religion. In: E. Kyriakidis, ed. *The Archaeology of Ritual.* Los Angeles: Cotsen Institute of Archaeology at UCLA. pp. 109-22.

Renfrew, C., 2007b. *Prehistory: Making of the human mind.* London: Weidenfeld and Nicolson.

Renfrew, C., and Bahn, P. G. 1991. *Archaeology: theories, methods and practice*. London : Thames and Hudson

Rice, J., 1998. *Before the Great Spirit: The Many Faces of Sioux Spirituality*. University of New Mexico Press.

Richards, C., 1996. Monuments as Landscape: Creating the Centre of the World in Late Neolithic Orkney. *World Archaeology*, 28(2), pp. 190-208.

Richards M, *et al*. 1996. Paleolithic and Neolithic lineages in the European mitochondrial gene pool. *American Journal Human Genetics* 59, 185–203.

Richards M *et al*. 1998. Phylogeography of mitochondrial DNA in Western Europe. *American Journal Human Genetics* 62, 241–260.

Richards, M. 2003. The Neolithic transition in Europe: archaeological models and genetic evidence. *Documenta Praehistorica XXX, Neolithic Studies* 10:159–167.

Richards, M. *et al.* 2000. Tracing European founder lineages in the Near Eastern mtDNA pool. *American Journal Human Genetics* 67, 1251–1276

Richerson ,P.J and Boyd, R.2001. Institutional evolution in the Holocene: The rise of complex societies. In: Runciman, W.G (eds). *The Origin of Human Social Institutions*. Oxford: University Press, 197–234

Richerson, P. J. and R. Boyd 2005. Not by genes Alone : how culture transformed human Evolution. Chicago ; London, University of Chicago Press.

Rindos, D., 1984. The *Origins of Agriculture: An Evolutionary Perspective*. Orlando: Academic Press.

Ringner, M., 2008. What is principal component analysis? *Nature Biotechnology*, 26(3), pp. 303-305.

Robinson, S.A. et al, 2006. A review of palaeoclimates and palaeoenvironments in the Levant and Eastern Mediterranean from 25,000 to 5000 years BP: setting the environmental background for the evolution of human civilisation. *Quaternary Science Reviews*, 25(13–14), pp. 1517–1541.

Roche, H. 1989. Pre-tomb habitation found at Knowth, Co Meath. *Archaeology Ireland*, 3. p.101-103.

Rollefeson, G.O., 1996. The Neolithic Devolution: Ecological Impact and Cultural Compensation at Ain Ghazal, Jordan. In: J.S. Seger, ed. 1996. *Retrieving the Past: Essays on Archaeological Research and Methodology*. Indiana: Eisenbrauns. pp. 219-229.

Rollefson, G.O., 2000. Ritual and Social Structure at Neolithic ‘Ain Ghazal. In: I. Kuijt, ed. 2000. *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*. New York: Kluwer Academic/Plenum Publishers. pp. 165–190.

Rollefson, G. O., 2001. Jordan in the seventh and sixth millennia B.C. *Studies in the History and Archaeology of Jordan*, VII, pp. 95–100.

Rollefson, G. O., Simmons, A. et al, 1992. Neolithic Cultures at 'Ain Ghazal, Jordan. *Journal of Field Archaeology* ,19 (4), pp. 443-470.

Roomp, K. et al, 2006. Springer Lecture Notes in Computer Science 4075: Arevir: A secure platform for designing personalized antiretroviral therapies against HIV. In: Leser et al, eds. 2006. *Third International Workshop on Data Integration in the Life Sciences. Lecture Notes in Computer Science*, 4075, pp. 185-194.

Rosen, B., 1986. Subsistence Economy of Stratum II. In: I. Finkelstein, ed. 1986. *lzbet Sartah*. BAR International Series 299. Oxford: British Archaeological Reports. pp. 156-185.

Rosenan, N., 1978. A Note on the Water Storage and Size of Population. In: R. Amiran, ed. 1978. *Early Arad I*. Jerusalem: Israel Exploration Society.

Rosenberg, M., 1998. Cheating at Musical Chairs Territoriality and Sedentism in an Evolutionary Context. *Current Anthropology*, 39(5), pp. 653-681.

Ross, M.H. and Homer, E., 1976. Galton's problem in cross-national research. *World Politics*, 29(1). Cambridge University Press. pp. 1-28.

Rosser, Z.H. et al, 2000. Y-Chromosomal Diversity in Europe is Clinal and Influenced Primarily by Geography, Rather than by Language. *The American Journal of Human Genetics*, 67(6), pp.1526–1543.

Rothman, M.S., 1994. Evolutionary Complexities and cultural complexities. In: G. Stein and M.S. Rothman, eds. 1994. *Chiefdoms and early states in the Near East: The organisation dynamics of complexity*. Monographs in World Archaeology, 18. Wisconsin: Prehistoric Press. pp. 1-10.

Rothman. M.S., 2004. Studying the Development of Complex Society: Mesopotamia in the Late Fifth and Fourth Millennia BC. *Journal of Archaeological Research*, 12(1), pp. 75-119.

Rowley-Conwy, P., 1999. Economic prehistory in southern Scandinavia. In: J.Coles, R.M. Bewley and P. Mellars. World Prehistory. Studies in Memory of Grahame Clark. Oxford: Oxford University Press. pp. 125-159.

Rowley-Conwy, P., 2011. West Ward Ho! The Spread of Agriculture from Central Europe to the Atlantic. *Current Anthropology*, 52(4), pp. 431-451.

Sage, R.F., 1995. Was Low Atmospheric CO2 a Limiting Factor in the Origin of Agriculture? *Global Change Biology*, 1, pp. 93-106.

Salali, G., Whitehouse, H., Hochberg M.E.2015. A Life-Cycle Model of Human Social Groups Produces a U-Shaped Distribution in Group Size. PLoS One. 18;10(9):

Salamini, F, *et al*., 2002. Genetics and Geography of Wild Cereal Domestication in the Near East. *Nature reviews*, 3, pp. 429-441.

Salmon, W.C., 1990. *Four Decades of Scientific Explanation.* Minneapolis: University of Minnesota Press.

Sampietro M.L, *et al.* 2007. Palaeogenetic evidence supports a dual model of Neolithic spreading into Europe. *Proc R Soc B* 274: 2161–2167.

Sanders, W.T., 1972. Population, agricultural history, and societal evolution in Mesoamerica. In: B. Spooner, ed. 1972. *Population growth. Anthropological implications*. Cambridge, Mass.: MIT Press. pp. 101-153.

Saporta, G. and Niang, N., 2009. Principal component analysis: application to statistical process control. In: G. Govaert, ed. *Data Analysis*. London: John Wiley and Sons. pp. 1–23.

Saxe, A., A. 1970. *Social Dimensions of Mortuary Practices*. Miuchican: Michican Press

Scarre, C., 2001. Modelling prehistoric populations : the case of Neolithic Brittany. *Journal of anthropological archaeology,* 20(3), pp. 285-313.

Scarre, V., 2008. Shrines on the Land and Places of Power: Religion and the Transition to Farming in Western Europe. In: K. Hays-Gilpin and D.S. Whitley, eds. 2008. *Belief in the past; Theoretical Approaches to the archaeology of Religion*. California: Left Coast Press. pp. 209-226.

Schact, R.M., 1981. Estimating past population trends. *Annual Review of Anthropology,* (10), pp. 119-140.

Schacter, D.L., Gilbert, D.T. and Wegner, D.M., 2011. wat"Semantic and episodic memory". *Psychology.* 2nd ed. New York: Worth, Incorporated. Pp. 240-241.

Schmidt, K., 2001. Göbekli Tepe, southeastern Turkey: A preliminary report on the 1995–1999 Excavations. *Paléorient*, 26(1), pp. 45–54.

Schmidt, K., 2002. The 2002 excavations at Göbekli Tepe (southeastern Turkey): Impressions from an enigmatic site. *Neo-Lithics,* 2(02), pp. 8–13.

Schmidt, K., 2003. The 2003 campaign at Göbekli Tepe (southeastern Turkey). *Neo-Lithics*, 2(03), pp. 3–8.

Schmidt, K., 2010. Göbekli Tepe—the Stone Age Sanctuaries: New results of ongoing excavations with a special focus on sculptures and high reliefs. *Documenta Praehistorica* XXXVII, pp. 239–256.

Schulting, R.J., 2006. Skeletal evidence and contexts of violence in the European Mesolithic and Neolithic. In: R. Gowland and C. Knüsel, eds. *The Social Archaeology of Funerary Remains*. Oxford: Oxbow. pp. 224-237.

Schulting, R.J. and Wysocki, M., 2005. "In this chambered tumulus were found cleft skulls...": an assessment of the evidence for cranial trauma in the British Neolithic. *Proceedings of the Prehistoric Society*, 71, pp. 107-138.

Schulting, R.J., *et al*. 2012. New dates from the north, and a proposed chronology for Irish court tombs. Proceedings of the Royal Irish Academy, 112C: 1-60 NB citation

Searle, J., 1984. *Minds, Brains and Science*. Harvard: Harvard University Press.

Semino, O. et al, 2000. The Genetic Legacy of Paleolithic Homo sapiens sapiens in Extant Europeans: A Y Chromosome Perspective. *Science*, 290(5494), pp. 1155–1159.

Semino, O., Magri, C., Benuzzi, G. et al., 2004. Origin, Diffusion, and Differentiation of Y-Chromosome Haplogroups E and J: Inferences on the Neolithization of Europe and Later Migratory Events in the Mediterranean Area. *The American Journal of Human Genetics*, 74(5), pp. 1023–1034.

Seyfarth, R.M., 2013. Affiliation, empathy, and the origins of theory of mind. *Proceedings of the National Academy of Sciences of the United States of America*, 110(S2).

Shennan, S., 2002. *Genes, memes and human history: Darwinian archaeology and cultural evolution*. London: Thames and Hudson.

Shennan, S. and Edinborough, K., 2007. Prehistoric population history: from the Late Glacial to the Late Neolithic in Central and Northern Europe. *Journal of Archaeological Science*, 34, pp. 1339–1345.

Sheridan, A., 1985-86. Megaliths and Megalomania; an account, and interpretation, of the Development of Passages tombs in Ireland. *Journal of Irish Archaeology* 3, pp. 17-30.

Sherratt, A., 1990. The Genesis of Megaliths: Monumentality, Ethnicity and Social Complexity in Neolithic North-West Europe. *World Archaeology*, 22(2) Monuments and the Monumental. pp. 147-167.

Simon, B., and Klandermans, B. 2001. Politicized collective identity: A social psychological analysis. *American Psychologist* 56,319–331.

Simmons, A.H., 2007. *The Neolithic Revolution in the Near East*. Tuscon: University of Arizona Press.

Skaarup, J., 1990. Burials, votive offerings and social structure in Early Neolithic farmer society of Denmark. In: D.Jankowska and P.T. Poland, eds. 1990. *Die Trichterbecherkultur: Neue Forschungen und Hypothesen.* pp. 73-91.

Skoglund, P. *et al*. 2012. Origins and genetic legacy of Neolithic farmers and hunter-gatherers in Europe. *Science* 336, 466–469

Sokal ,R.R, *et al*. 1991. Genetic evidence for the spread of agriculture in Europe by demic diffusion. *Nature* 351, 143–145.

Sørensen L., Karg S., 2014. The expansion of agrarian societies towards the north e new evidence for agriculture during the Mesolithic/Neolithic transition in Southern Scandinavia. *Journal of Archaeological Science*, 51(2014), pp. 98–114.

Smith, O., G. Momber, R. Bates, P. Garwood, S. Fitch, M. Pallen, V. Gaffney, and F.G. Allaby. 2015. Sedimentary DNA from a submerged site reveals wheat in the British Isles 8000 years ago. *Science* 347: 998-1001.

Smith, E.L., *et al.* 1983. *Principles of Biochemistry: Mammalian Biochemistry* . New York: McGraw-Hill Book Company.

Smyth, J.2012. *Settlement in the Irish Neolithic*. Oxford : Oxbow

Soares, P. *et al.* 2010. The archaeogenetics of Europe. *Current Biology* 20, R174–R183

Sperber, D., 1975. *Rethinking symbolism*. Cambridge: Cambridge University Press.

Sperber, D., 1996. *Explaining culture: a naturalistic approach*.nOxford: Blackwell.

Sperber, D., 2000. An objection to the memetic approach to culture. In: R. Aunger, ed. 2000. *Darwinizing Culture: The Status of Memetics as a Science*. Oxford: Oxford University Press. pp. 163–173.

Sperber, D., 2001. In Defense of massive modularity. In: E. Dupoux, ed. 2001. *Language, Brain and Cognitive Development: Essays in Honor of Jacques Mehler*. Cambridge, Mass. MIT Press. pp. 47-57.

Sperber, D. and Hirschfeld, L., 1999. Culture, Cognition, and Evolution. In: R. Wilson and F. Keil, eds. 1999. *MIT Encyclopedia of the Cognitive Sciences*. Cambridge, Mass : MIT Press. pp. cxi–cxxxii.

Sperber, D., & Claidière, N. 2008. Defining and explaining culture (comments on Richerson and Boyd, Not by genes alone). *Biology and Philosophy*, 23, 283–292.

Stein, G., 1994. Economy, Ritual and Power in 'Ubaid Mesopotamia. In: G. Stein and M.S. Rothman, eds. 1994. *Chiefdoms and early states in the Near East: The organisation dynamics of complexity*. Monographs in World Archaeology, 18. Wisconsin: Prehistoric Press. pp. 1-10.

Stein, G. and Rothman, M.S., eds. 1994. *Chiefdoms and early states in the Near East: The organisation dynamics of complexity*. Monographs in World Archaeology, 18. Wisconsin: Prehistoric Press. pp. 1-10.

Stevens, C.J and Fuller, D.Q., 2012. Did Neolithic farming fail? The case for a Bronze Age agricultural revolution in the British Isles. *Antiquity*, 86(333), pp. 707-722.

Steward, J.H., 1937. Ecological aspects of southwestern society. *Anthropos*, 32, pp. 87-104. 1949 Cultural causality and law: A trial formulation of the development of early civilizations. Bobbs-Merrill Reprint in Social Sciences No. A216. (Reprinted from American Anthropologist 51.)

Steward, J.H., 1955. *Theory of Culture Change.* Urbana: University of Illinois press.

Sujun, L. et al, 2006. Predicting O-glycosylation sites in mammalian proteins by using SVMs. *Computational Biology and Chemistry*, 30, pp. 203–208.

Swann, W.B, *et al* . 2014a. Contemplating the Ultimate Sacrifice: Identity Fusion Channels Pro-Group Affect, Cognition, and Moral Decision Making. Journal of Personality and Social Psychology 106 (5), 713–727

Swann, W.B, *et al* .2014b. What makes a group worth dying for? Identity fusion fosters perception of familial ties, promoting self-sacrifice. Journal of Personality and Social Psychology 106(6):912–926.

Swann, W.B., *et al*,. 2010a. Dying and Killing for One's Group: Identity Fusion Moderates Responses to Intergroup Versions of the Trolley Problem. Psychological Science 21(8), 1176–1183

Swann, W.B., *et al*. 2010b. Identity Fusion and Self-Sacrifice: Arousal as a Catalyst of Pro-Group Fighting, Dying, and Helping Behavior. Journal of Personality and Social Psychology 99 (5), 824–841

Swann, W.B., *et al*. 2009. Identity fusion: the interplay of personal and social identities in extreme group behavior. Journal of Personality and Social Psychology 96, 995–1011

Swann, W.B., *et al*,. 2012. When group membership gets personal: A theory of identity fusion. Psychological Review 119, 441–456.

Madsen, T. and Jensen, H.J., 1982. Analecta Praehistorica Leidensia. *Prehistoric Settlement Patterns Around the Southern North Sea: Papers Presented at a Colloquium, Held in Honour of Professor Dr. P.J.R. Modderman, Leiden, 3-7 May 1982.*

Tainter, J. A. 1978. Mortuary Practices and the Study of Prehistoric Social Systems. *Advances in Archaeological Method and Theory* 1, 105-141

Tarlow, S., 1999. *Bereavement and Commemoration: An archaeology of mortality*. Oxford: Blackwell.

Taylor, J., 2000. Cultural depositional processes and post-depositional problems. In: R. Francovich, H. Patterson and G. Barker, eds. *The Archaeology of Mediterranean Landscapes 5: Extracting Meaning from Ploughsoil Assemblages.* Oxford. pp. 16-26.

Tchernov, E., 1998. An Attempt to Synchronize the Faunal Changes with the Radiometric Datesand the Cultural Chronology in Southwest Asia. In: H. Buitenhuis, L. Bartosiewicz, and A.M. Choyke, eds. *Archaeozoology of the Near East IV.* Groningen: Centre for Archaeological Research and Consultancy, ARC Publication, 18, pp. 7-44.

Tetlock, P.E . 2003. Thinking the unthinkable: Sacred values and taboo cognitions. *Trends in Cognitive Science* 7(7), 320–324.

Thomas, J., 1987. Relations of Production and Social Change in The Neolithic Of North-West Europe. *Man,* 22(3), pp. 205-430.

Thomas, J., 1990. Monuments from the Inside: The Case of the Irish Megalithic Tombs. *World Archaeology,* 22, pp. 168-78.

Thomas, J., 1991. Reading the Neolithic. *Anthropology Today,* 7(3), pp. 9-11.

Thomas, J., 1993, The Hermeneutics of Megalithic Space. In: C. Tilley, ed. 1993. *Interpretative Archaeology*. Oxford: Berg Press.

Thomas, J., 2000. Reconfiguring the social, reconfiguring the material. In: M.B. Schiffer, ed. 2000. *Social Theory in Archaeology*. Salt Lake City: University of Utah Press. pp. 143-155.

Thomas, J., 2007. Mesolithic-Neolithic Transitions in Britain: From Essence to Inhabitation. *Proceedings of the British Academy* 144, pp. 423-439.

Tilley, C., 1984. Ideology and legitimacy of power in Neolithic Southern Scandinavia. In: D.Miller and C. Tilley, eds. 1984. *Ideology, power, and prehistory*. Cambridge: Cambridge University Press. pp. 111-147.

Tilley, C., ed. 1993. *Interpretative Archaeology*. Oxford: Berg Press.

Tilley, C., 1994. *A Phenomenology of Landscape: Places, Paths and Monuments*. Oxford: Bergh Press.

Tilley, C., 1996. *An ethnography of the Neolithic: early prehistoric societies in southern Scandinavia*. Cambridge: Cambridge University Press.

Trigger, B.G., 2006. *A History of Archaeological Thought*. 2nd ed. New York: Cambridge University Press.

Trolle-Lassen, T., 1984, A preliminary report on the archaeological and zoological evidence of fish exploitation from a submerged site in Mesolithic Denmark. *C.N.R.S. Centre de Recherches Archéologiques. Notes et Monographies Techniques,* 16, pp. 133-143.

Tudge, C., 1998. *Neanderthals, Bandits and Farmers*. London: Yale University Press.

Turchin, P., 2011. Warfare and the Evolution of Social Complexity: a Multilevel Selection Approach. *Structure and Dynamics,* 4,(3), pp. 1-37.

Turchin, P. et al, 2012. A Historical Database of Sociocultural Evolution. *Cliodynamics,* 3(2), pp. 271-293.

Turnbull, C., 1972. Demography of small–scale societies. In: G.A. Harrison and A.J. Boyce, eds. *The Structure of Human Populations*. Oxford: Oxford University Press. pp. 283-312.

Turner, C.G. and Lofgren, L., 1966. Household size of prehistoric western Pueblo Indians. *Southwestern Journal of Anthropology,* 22(1), pp. 117-132.

Turner, V., 1969. *The Ritual Process: Structure and anti-structure.* Chicago: Aldine.

Turner, V., 1982. *From Ritual to Theatre and Back: The human seriousness of play.* New York: PAJ Publications.

Twiss, K.C., 2007. The Neolithic of the Southern Levant. *Evolutionary Anthropology,* 16, pp. 24-35.

Ubelaker, D.H., 1974. Reconstruction of demographic profiles from ossuary skeletal samples: A case study from the Tidewater Potomaco. *Smithsonian Contributions to Anthropology, 18*. Washington, D. C: Smithsonian Institution Press.

Van Beek, G.W., 1982. A Population Estimate for Marib: A Contemporary Tell Village in North Yemen. *Bulletin of the American Schools of Oriental Research*, 248, pp. 61-67.

Van Zeist, W., 2002. Plant husbandry of tell Gomolava, Vojvodina, Yugoslavia. *Palaeohistoria,* 43/44, pp. 87–115.

Venables, W.N. and Dichmont, C.M., 2004. GLMs, GAMs and GLMMs: an overview of theory for applications in fisheries research. *Fisheries Research,* 70, pp. 319–337.

Verhoeven, M., 1999. *An Archaeological Ethnography of a Neolithic Community: Space, Place and Social Relations in the Burnt Village at Tell Sabi Abyad, Syria*. Istanbul: Nederlands Historisch-Archaeologisch Instituut.

Verhoeven, M., 2000. Death, fire and abandonment: Ritual practice at Late Neolithic Tell Sabi Abyad, Syria. *Archaeological Dialogues,* 7(1), pp. 46–83.

Verhoeven, M., 2001. Person or penis? Interpreting a 'new' PPNB anthropomorphic statue from the Taurus foothills. *Neo-Lithics,* 1(01), pp. 8–9.

Verhoeven,M., 2002a. Transformations of society: The changing role of ritual and symbolism in the Pre-Pottery Neolithic B and Pottery Neolithic Periods in the Levant and South-East Anatolia. *Paléorient,* 28(1), pp. 5–14.

Verhoeven, M., 2002b. Ritual and Its investigations in Prehistory. In: H.G.K. Gebel, B.D. Hermansen and C. Hoffmann Jensen, eds. 2002. *Magic practices and ritual in the Near Eastern Neolithic: Studies in Early Near Eastern Production, Subsistence, and Environment, Vol. 8, proceedings of a workshop held at the 2nd International Congress on the Archaeology of the Ancient Near East (ICAANE), Copenhagen University*. Berlin : Ex Oriente. pp. 5-40.

Verhoeven, M., 2002c. Ritual and ideology in the Pre-Pottery Neolithic B of the Levant and South-East Anatolia. *Cambridge Archaeological Journal,* 12(2), pp. 233–258.

Verhoeven, M., 2004. Beyond Boundaries: Nature, Culture and a Holistic Approach to Domestication in the Levant. *Journal of World Prehistory* , 18(3), pp. 179-282.

Verhoeven, M., 2010. Social complexity and archaeology a contextual approach. In D. Bolger and L.C. Maguire, eds. *The Development of Pre-State Communities in the Ancient Near East: Studies in Honour of Edgar Peltenburg*. Oxford: Oxbow books.

Vita-Finzi, C., 1978. *Archaeological Sites in their Setting*. London: Thames and Hudson.

Waddell, J., 2005. *The Prehistoric Archaeology of Ireland*. Galway: Galway University Press.

Wahl, J., and König, H., 1987. *Anthropologisch-Traumologische Untersuchung der Menschlichen Skelettreste aus dem Bandkeramischen Massengrab bei Talheim, Kreis Heilbronn*. Fundberichte aus Baden-Wurtemberg, 12, pp. 65-193.

Walker, R.F., 2011. Representation and theory of mind development. *Developmental psychology*, 48(2), pp. 509-520.

Warren, G., 2007. Mesolithic myths. In: A. Whittle and V. Cummings, ed. 2007. *Going over: The Mesolithic-Neolithic transition in north-west Europe.* London: British academy, Proceedings of the British academy. pp. 311-328.

Warren. G., 2013. The Adoption of Agriculture in Ireland: Perceptions of Key Research Challenges. *Journal of Archaeological Method and Theory,* 20 (4), pp. 525-551.

Wason, P.K., and Baldia, M.O., 2000. Religion, Communication, and the Genesis of Social Complexity in the European Neolithic. In: Kradin, Korotayev, Bondarenko, de Munck, and Wason, eds. 2000. *Alternatives of Social Evolution*. Vladivostok: Far Eastern Branch of the Russian Academy of Sciences Press. pp. 138–148

Watkins, T., 1990. The Origins of House and Home. *World Archaeology,* 21(3), pp. 336–347.

Watkins, T., 1992. The Beginning of the Neolithic: Searching for Meaning in Material Culture Change. *Paléorient,* 18(1), pp. 63–75.

Watkins, T., 2002. Memes, memeplexes and the emergence of religion in the Neolithic. In: H.G.K. Gebel, B. Dahl Hermansen and C. Hoffmann-Jensen, eds. 2002. *Magic Practices and Ritual in the Near Eastern Neolithic, Studies in Early Near Eastern Production, Subsistence, and Environment 8.* Berlin: Ex Oriente. pp. 41–47.

Watkins, T., 2004. Building Houses, Framing Concepts, Constructing Worlds. *Paléorient,* 30(1), pp. 5-23.

Watkins, T., 2010. New light on Neolithic revolution in south-west Asia. *Antiquity,* 84(325), pp. 621-634.

Watson, P. J., 1979. Archaeological Ethnography in Western Iran. *Viking Fund Publications in Anthropology 57*. Tucson: University of Arizona.

Webb J., 1999. *Ritual architecture, iconography and Practice in the Late Cypriot Bronze Age*. Jonsered: Paul Astroms Forlag.

Wellman, B., 2012. Is Dunbar's number up?. *British Journal of Psychology,* 103(2), pp. 174–176.

Weninger, B. et al, 2009. A radiocarbon database for the Mesolithic and Early Neolithic in north- western Europe. In: M. Crombé, et al, eds. 2009. *Chronology and evolution within the Mesolithic of North-West Europe: Proceedings of an international meeting, Brussels May 30th–June 1st 2007*. Brüssel , pp. 143-176.

Wheat, J.B., 1972. The Olsen-Chubbuck site: A Paleo-Indian bison kill. *Society for American Archaeology, Memoirs,* 26.

Whitehouse, H., 2000. *Argument and Icons: Divergent Modes of Religiosity*. Oxford: Oxford University Press.

Whitehouse, H., 2002. Modes of Religiosity: Towards a Cognitive Explanation of Socio Political Dynamics of Religion. *Method and Theory in the Study of Religion,* 14(3-4), pp. 293-315.

Whitehouse, H., 2004. *Modes of Religiosity. A Cognitive Theory of Religious Transmission*. California: AltaMira Press.

Whitehouse, H., 2005. The Cognitive Foundations of Religiosity. In: R. McCauley, ed. *Mind and Religion: Psychological and Cognitive Foundations of Religion*. Walnut Creek, California: AltaMira Press. pp. 207-232.

Whitehouse, H., 2008. Cognitive Evolution and Religion; Cognition and Religious Evolution. In: J. Bulbulia et al., ed. 2008. *The Evolution of Religion: Studies, theories, and critiques*. Santa Margarita, California: Collins Foundation Press. pp. 19-29.

Whitehouse, H., and L. Martin. 2004. *Theorizing religions past: archaeology, history, and cognition*. Walnut Creek, CA: AltaMira.

Whitehouse, H. and Laidlaw, J. 2004 .(eds). *Ritual and Memory: Toward a Comparative Anthropology of Religion.* Walnut Creek; CA: AltaMira Press.

Whitehouse, H. and McCauley, R.N., eds., 2005. *Mind and Religion: Psychological and Cognitive Foundations of Religiosity*. California: AltaMira Press.

Whitehouse, H. and Laidlaw, J., eds., 2007. *Religion, Anthropology, and Cognitive Science*. Durham NC: Caroline Academic Press.

Whitehouse, H. and Laidlaw, J., eds., 2007. *Ritual and Memory: Toward a Comparative Anthropology of Religion*. New York: AltaMira Press.

Whitehouse, H. and Hodder, I., 2010. Modes of Religiosity at Catalhoyuk. In I. Hodder, ed. *Religion in the Emergence of Civilization: Catalhoyuk as a Case Study*. Cambridge: Cambridge University Press. pp. 122-146.

Whitehouse, H and McQuinn, B. 2013. Divergent Modes of Religiosity and Armed Struggle. In Jerryson, M., Juergensmeyer, M., and Kitts M. (eds) *The Oxford Handbook of Religion and Violence*. Online Publication Date: Mar 2013. http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199759996.001.0001/oxfordhb-9780199759996-e-39

Accessed on 04 Dec. 2015

Whitehouse, H., Lanman, J.A. 2014. The ties that bind us: ritual, fusion and identification. *Current Anthropology* 55, 674–695.

Whitehouse, H., *et al.*, 2014. Modes of Religiosity and the Evolution of Social Complexity at Çatalhöyük . In: I. Hodder, ed. 2014. *Religion at Work in a Neolithic Society*. Cambridge: Cambridge University Press. pp. 134-156.

Whitehouse, H., *et al*. 2014. Brothers in Arms: Libyan Revolutionaries Bond Like Family. *Proceedings of the National Academy of Sciences* 111, (50), 17702-17703.

Whitehouse, H., François, P., Turchin, P. 2015. The Role of Ritual in the Evolution of Social Complexity: Five Predictions and a Drum Roll. *Cliodynamics*, 6(2) https://evolution-institute.org/focus-article/the-role-of-ritual-in-the-evolution-of-social-complexity-five-predictions-and-a-drum-roll/

accessed Jan 2016

Whitehouse, N.J., Schulting, R.J., et al., 2014. Neolithic Agriculture in the European western Frontier: the Boom and Bust of Early farming in Ireland. *Journal of Archaeological Science*, 51, pp. 181-205.

Whitehouse, R., 1990. Caves and Cult in Neolithic Southern Italy. *The Accordia Research Papers*, 1, pp. 19-37.

Whitehouse, R., 1996. Ritual Objects. Archaeological Joke or Neglected Evidence? In: J. Wilkins, ed. 1996. *Approaches to the Study of Ritual: Italy and the Ancient Mediterranean*. London: Accordia Research Centre. pp. 9-30.

Whitelaw, T.M., 2011. The Urbanization of Prehistoric Crete. In: Schoep et al, eds. 2011. *Back to the Beginning*. Oxford: Oxbow Books. pp. 114-176.

Whitley, J., 2002. Too many ancestors. *Antiquity*, 76, pp. 19-126.

Whittle, A., 1996. *Europe in the Neolithic: The Creation of New Worlds*. Cambridge: Cambridge University Press.

Whittle, A., 2003. *The Archaeology of People: Dimensions of Neolithic life*. London: Routledge.

Whittle, A., 2007. The Temporality of Transformation: Dating the Early Development of the Southern British Neolithic. *Proceedings of the British Academy*, 144, pp. 377-398.

Whittle, A., et al, 2011. *Gathering Time: Dating the Early Neolithic Enclosures of Southern Britain and Ireland*. Oxford: Oxbow Books.

Wiesner, P., 1974. A Functional Estimator of Population From Floor Area. *American Antiquity*, 39, pp. 343–350.

Wiessner, P., 1982. Beyond willow smoke and dogs' tails. *American Antiquity*, 47, pp. 171–178.

Wilson, P.J., 1988. *The Domestication of the Human Species*. New Haven and London: Yale University Press.

Williams, H., 1998. The Past in the Past: The Reuse of Ancient Monuments, World Archaeology, 30(1), pp. 90-108.

Wobst, H.M., 1974. Boundary conditions for Palaeolithic social systems: A simulation approach. *American Antiquity*, 39(2), pp. 147-178.

Woodhead-Galloway, J., 1980. *Collagen: The Anatomy of a Protein*. London: E. Arnold.

Wright, H.T., 1977. Recent research on the origin of the state. *Annual Review of Anthropology*, 6, pp. 319-391.

Wright, J.H.E. and Thorpe, J.L., 2003. Climatic change and the origin of agriculture in the Near East. In: A. Mackay, R.W. Battarbee, J. Birks and F. Oldfield, eds. 2003. *Global change in the Holocene*. London: Arnold.

Wright, T. and Johnson, G.A., 1975. Population, exchange, and early state formation in south-western Iran. *American Anthropologist*, 11, pp. 267-289.

Wynn, T., 2001. The Role of Archaeology in Cognitive Science. In A. Nowell, ed. 2001. *In the Mind's Eye: Multidisciplinary Approaches to the Evolution of Human Cognition*. Ann Arbor, MI: International Monographs in Prehistory. pp. 9-19.

Wynn, T., 2002. Archaeology and Cognitive Evolution. *Behavioural and Brain Sciences*, 25, pp. 389-438.

Xygalas, D., 2007. *Fire walking in Northern Greece: A cognitive Approach to High Arousla Rituals*. PhD. Queens University Belfast.

Xygalatas, D., et al. 2013. Extreme rituals promote prosociality. *Psychological Science* 24, 1602–5.

Yengoyan, A., 1968. Demographic and ecological influences on Australian aborigine marriage sections. In: R.B. Lee and I. DeVore, eds. *Man the hunter*. Chicago: Aldine Press. pp. 185–199.

Yessner, D.R., 1977. Resource Diversity and Population Stability Among Hunter-Gatherers. *Western Canadian Journal of Anthropology*, 3(2), pp. 18-59.

Yoffee , N., 2005. *Myths of the Archaic State Evolution of the Earliest Cities, States, and Civilizations*. Cambridge: Cambridge University Press.

Zeder, M.A., 2008. Domestication and early agriculture in the Mediterranean Basin: Origins, diffusion, and impact. *Proceedings of the national Academy of Sciences*, 105(33), pp. 11597-11604.

Zeder, M.A., 2009. The Neolithic macro-(r) evolution: macroevolutionary theory and the study of culture change. *Journal of Archaeological research*, 17(1), pp. 1-63.

Zeder, M.A., 2011. The Origins of Agriculture in the Near East. *Current Anthropology*, 52(S4), pp. S221-S235.

Zimbardo, P. 2007. *The Lucifer effect*. New York: Random House

Zohary, D. and Hopf, M., 2000. *Domestication of Plants in the Old World*. Oxford: Oxford University Press.

Zohary, D., Tchernov, E. and Horwitz, L.K., 1998. The Role of Unconscious Selection in the Domestication of Sheep and Goats. *Journal of Zoology*, 245, pp. 129–135.

Zorn, J.R., 1994. Estimating the Population Size of Ancient Settlements: Methods, Problems, Solutions, and a Case Study. *Bulletin of the American Schools of Oriental Research*, 295, pp. 31-48.

Zubrow, E.B.W., 1971. Carrying capacity and dynamic equilibrium in the prehistoric Southwest. *American Antiquity*, 36(2), pp. 127-138.

Zvelebil, M., 2000. The social context of Agricultural transition in Europe. In: C. Renfrew and K. Boyle, eds. *Archaeogenetic: DNA and Population Prehistory of Europe.* Cambridge: Mc Donald Institute. pp. 57-79.

Online sources

Data gathering for the eHRAF

eHRAF World cultures database:

http://ehrafworldcultures.yale.edu/ehrafe/

Data gathering the south-west Asian archaeology

Exoriente Platform for Neolithic radiocarbon dates:

http://www.exoriente.org/

Utz Böhner and Daniel Schyle, radiocarbon CONTEXT database 2002-2006:

http://context-database.uni-koeln.de/c14.php?vonlit=68

Data gathering for the north-western European archaeology

The Heritage Council, Ireland:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

Database of Irish excavation reports (Excavation.ie):

http://www.excavations.ie/

INSTAR project Web Archive:
www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

The National Roads Authority (NRA) (Ireland) Archaeology Magazine (Seanda):

http://www.nra.ie/archaeology/seanda-the-nra-archaeology-magazine/

Council for British archaeology: Archaeological site index to radiocarbon dates from Great Britain and Ireland:

http://www.britarch.ac.uk/info/c14.html

Bibliography for South west Asian sites

Contents

Bibliography for South west Asian sites 480
Abu Hureyra 481
‘Ain Ghazal 482
Ain Mallah (Ein Mallaha) 485
‘Ain Rahub 487
Atlit-Yam 487
Basta 488
Beidha 489
Cafer Höyük 490
Çatalhöyük: 492
    Before the 1970s 492
    Between the 1970's and 1990's 493
    The 1990's - Present Excavations 494
Cayonu I and II 502
Dhra 504
Ein Gev1 504
Ghoraife 505
Gilgal 505
Göbekli Tepe 506
Hatoula 507
Hayonim 508
Hallan Çemi 509
Hilazon Tachtit (cave) 510
Iraq ed-Dubb 511
Jebel Abu Thawwab 511
Jericho 512
Jerf el Ahmar 513
Kfar Hahoresh 515
Kharaneh IV 515
Khirbet Hammam 516
Kortik 516
Mureybit (Mureybet) 516
Nemrik 9 517
Netiv Hagdud 518
Nevalı Çori 519
Neve David 520
Ohalo II 521
Salibiya IX 521

Tell Aswad 522
Tell el-Kerkh I and II 523
Tell Halula 524
Tell Ramad (Ramad) 524
Tell Sabi Abyad 525
Tell Qaramel 527
Wadi el Hammeh (EL Hammeh, Wadi Hammeh, Wadi al Hammeh) 527
Wadi el-Jilat 528
Wadi Shu'eib 529
Yiftahel 530

Abu Hureyra

College, S. and Conolly, J., 2010. Reassessing the Evidence for the Cultivation of wild Crops During the Younger Dryas at Tell Abu Hureyra Syria. *Enviromental Archaelogy,* 15(2), pp. 124-138.

Henry, D.O., 1998. *The Prehistoric Archaeology of Jordan*. Oxford: BAR, International Series, 705.

Hillman, G.C., 1975. Appendix A: The plant remains from Tell Abu Hureyra: A Preliminary Report. *Proceedings of the Prehistoric Society*, 41, p. 73.

Hillman, G.C. and Davies, M.S., 1990. Measured Domestication Rates in Wild Wheats and Barley Under Primitive Cultivation, and Their Archaeological Implications. *Journal of World Prehistory,* 4(2), pp. 157-222.

Moore, A.M.T., 1979. A Pre-Neolithic Farmer's Village on the Euphrates. *Scientific American,* 24(2), pp. 50-58.

Moore, A.M.T., 1999. *Village on the Euphrates: from Foraging to Farming at Abu Hureyra*. Oxford: Oxford University Press

Moore, A.M.T. et al., 1975. The Excavation of Tell Abu Hureyra in Syria: A Preliminary Report. *Proceedings of the Prehistoric Society*, 41, pp. 50-77.

Moore, A.M.T et al., 1986. Radiocarbon Accelerator (AMS) Dates for the Epipaleolithic Settlement at Abu Hureyra. Syria *Radiocarbon,* 28, pp. 1068-1076.

Moore, A.M.T. et al., 2000. *Village on the Euphrates. From Foraging to Farming at Abu Hureyra*. Oxford: Oxford University Press.

de Moulins, D., 1997. *Agricultural Change at Euphrates and Steppe Sites in the Mid-8th to the 6th Millennium BC*. Oxford: BAR, International Series 683.

Molleson, T., 1994. The Eloquent Bones of Abu Hureyra. The daily grind in an early Near Eastern agricultural community left revealing marks on the skeletons of the inhabitants. *Scientific American* 6, pp. 60-65.

Molleson, T. and Jones, K., 1991. Dental Evidence for Dietary Change at Abu Hureyra. *Journal of Archaeological Science* 18, pp. 525-539.

Molleson, T. et al., 1993. Dietary Change and the Effect of Food Preparation on Microwear Patterns in the Late Neolithic of Abu Hureyra, Northern Syria. *Journal of Human Evolution* 24, pp. 455-468.

Olszewski, D.I., 1986. *The North Syrian late Epipaleolithic: the earliest occupation at Tell Abu Hureyra in the context of the Levantine late Epipaleolithic*. Oxford: BAR, International Series 309.

Olszewski, D.I., 1989. Tool Blank Selection, Debitage and Cores from Abu Hureyra 1, Northern Syria. *Paléorient,* 15(2), pp. 29-37.

‘Ain Ghazal

Banning, E.B. and Byrd, B.F., 1984. The Architecture of PPNB Ain Ghazal, Jordan. *Bulletin of the American Schools of Oriental Research,* 255, pp. 15-20.

Banning, E.B. and Byrd, B.F., 1987. Houses and Changing Residential Unit: Domestic Architecture at PPNB `Ain Ghazal Jordan. *Proceedings of the Prehistoric Society,* 53, pp. 309-325.

Butler, C., 1989. The Plastered Skulls of Ain Ghazal: Preliminary Findings. In: Hershkovitz, ed. *People and Culture in Change.* Oxford: BAR, Internatinal Series 508. pp. 141-145.

El-Najjar, M. et al., 1997. Cases of Tuberculosis at `Ain Ghazal, Jordan. *Paléorient,* 22, pp. 123-128.

Griffin, P.S. et al., 1998. Three Late Eighth Millennium Plastered Faces from ´Ain Ghazal, Jordan. *Paléorient,* 24, pp. 59-70.

Kafafi, Z., 1990. Early Pottery Contexts from Ain Ghazal, Jordan. *Bulletin of the American Schools of Oriental Research* 280, pp. 15-30.

Kafafi, Z., 1995. Decorative Elements on the Excavated Neolithic Pottery at `Ayn Ghazal. *Studies in the History and Archaeology of Jordan* 5, pp. 545-553.

Kafafi, Z., 2004a. The 'Collapse' of the LPPNB Settlement Organization: The Case of Ain Ghazal. In: Bienert et al., ed. 2004. *Central Settlements in Neolithic Jordan,*

Proceedings of the Symposium Held in Petra, July 1997. Studies in Early Near Eastern Production, Subsistence, and Environment 5. Berlin: Ex Oriente. pp. 113-118.

Kafafi, Z., 2004b. A Unique PPNC Female Figurine from Ain Ghazal. In: Stager et al., eds. 2000. *The Archaeology of Jordan and Beyond. Essays in Honor of James A. Sauer, Studies in the Archaeology and History of the Levant 1*, pp. 235-237.

Kafafi, Z. et al., 1990. The 1989 Season at Ain Ghazal. Preliminary Report. *Annual of the Department of Antiquities of Jordan* 34, pp. 11-25.

Köhler-Rollefson, I., 1989a. Changes in Goat Exploitation at ´Ain Ghazal Between the Early and Late Neolithic: A Metrical Analysis. *Paléorient* 15, pp. 141-146.

Köhler-Rollefson, I., 1989b. The Aftermath of the Levantine Neolithic Revolution in the Light of ecological and ethnographic evidence. *Paléorient* 14, pp. 87-93.

Köhler-Rollefson, I., 1997a. Proto-Élevage, Pathologies, and Pastoralism: a Post-Mortem of the Process of Goat Domestication. In: H.G. Gebel et al. eds. 1997. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4*. Berlin: Ex Oriente. pp. 557-565.

Köhler-Rollefson, I. and Rollefson, G.O., 1989. The Collapse of Early Neolithic Settlements in the Southern Levant. In: Hershkovitz, ed. 1989. *People and Culture in Change*. Oxford: BAR International Series 508. pp. 73-90.

Köhler-Rollefson, I. et al., 1988. The Fauna from Neolithic ´Ain Ghazal. In: A.N. Garrard and H.G. Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986.* Oxford: BAR International Series 396. pp. 423-430.

McAdam, E., 1997. The Figurines from the 1982-5 Seasons of Excavations at Ain Ghazal. *Levant*, 29, pp. 115-145.

Neef, R., 2004. Vegetation and Climate. A Comparison Between PPNB 'Ain Ghazal and Basta. In H-D. Bienert et al., eds. 2004. *Central Settlements in Neolithic Jordan, Proceedings of the Symposium Held in Petra, July 1997. Studies in Early Near Eastern Producton, Subsistence, and Environment 5.* Berlin: Ex Oriente. pp. 289-299.

Rollefson, G.O., 1983. Ritual and Ceremony at Neolithic Ain Ghazal (Jordan). *Paléorient* 9, pp. 29-37.

Rollefson, G.O., 1984. Ain Ghazal: An Early Neolithic Community in Highland Jordan, Near Amman. *Bulletin of the American Schools of Oriental Research,* 255, pp. 1-14.

Rollefson, G.O., 1986. Early Neolithic `Ain Ghazal (Jordan). Ritual and Ceremony II. *Paléorient,* 12, pp. 45-52.

Rollefson, G.O., 1989. The Aceramic Neolithic of the Southern Levant: The View from Ain Ghazal. *Paléorient,* 15, pp. 135-140.

Rollefson, G.O., 1993. The Origins of the Yarmoukian at Ain Ghazal. *Paléorient,* 19, pp. 91-100.

Rollefson, G.O., 1997. Changes in Architecture and Social Organization at Ain Ghazal. In H.G. Gebel et al., eds. 1997. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4*. Berlin: Ex Oriente, Berlin. pp. 287-308.

Rollefson, G.O., 1998a. Ain Ghazal (Jordan): Ritual and Ceremony III. *Paléorient*, 24, pp. 43-58.

Rollefson, G.O., 1998b. The Aceramic Neolithic of Jordan. In: Henry, ed. 1998. *The Prehistoric Archaeology of Jordan.* Oxford: BAR, International Series 705. pp. 102-126.

Rollefson, G.O., 1998c. The Neolithic Settlement at Ain Ghazal. In A.N. Garrard and H.G. Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986*. Oxford: BAR, International Series 396. pp. 393-421.

Rollefson, G.O., 2000. Ritual and Social Structure at Neolithic 'Ain Ghazal. In: Kuijt, eds. 2000. *Life in Neolithic Farming Communities. Social Organization, Identity, and Differentiation.* New York: Kluwer, pp. 165-190.

Rollefson, G.O. and Simmons, A.H., 1984a. The 1983 Season at ´Ain Ghazal: Preliminary Report. *Annual of the Department of Antiquities of Jordan,* 28, pp. 13-30.

Rollefson, G.O. and Simmons, A.H., 1984b. Neolithic ´Ain Ghazal (Jordan): Interim Report on the First Two Seasons, 1982-1983. *Journal of Field Archaeology* 11, pp. 387-395.

Rollefson, G.O. and Suleiman, E., 1984. Survey of PPNB Structures at Ain Ghazal. *Annual of the Department of Antiquities of Jordan,* 27, pp. 471-479.

Rollefson, G.O. et al., 1994a. The Neolithic Village of ´Ain Ghazal, Jordan: Preliminary Report on the 1989 Season. *Annual of the American Schools of Oriental Research* 51, pp. 107-126.

Rollefson, G.O. et al., 1994b. The 1993 Season at Ain Ghazal. Preliminary Report. *Annual of the Department of Antiquities of Jordan* 38, pp. 11-32.

Rollefson, G.O. et al., 1999. A Decorated Skull from MPPNB Ain Ghazal. *Paléorient,* 24(2), pp. 99-104.

Schmandt-Besserat, D., 1989. Ain Ghazal "Monumental Figurines. *Bulletin of the American Schools of Oriental Research,* 310, pp. 1-17.

Simmons, A.H., 1995. Town Planning in the Neolithic- is 'Ayn Ghazal Normal? In: Amr et al., eds. 1995. *Studies in the History and Archaeology of Jordan V,* Amman: Department of Antiquities of Jordan, Amman. pp. 119-122.

Simmons, A.H. and Kafafi, Z., 1988. Preliminary Report on the ´Ain Ghazal Archaeological Survey, 1987. *Annual of the Department of Antiquities of Jordan,* 32, pp. 27-39.

Tubb, K.W. and Grisson, C.A., 1995. 'Ain Ghazal: A Comparative Study of the 1983 and 1985 Statuary Caches. *Studies in the History and Archaeology of Jordan*, 5, pp. 437-447.

von den Driesch, A. and Wodtke, U., 1997. The Fauna of ´Ain Ghazal, a Major PPN and Early PN Settlement in Central Jordan. In Gebel et al., eds. 1997. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4*. Berlin: Ex Oriente. pp. 511-556.

Wasse, A., 1997. Preliminary Results of an Analysis of the Sheep and Goat Bones from Ain Ghazal, Jordan. In Gebel et al., eds. 1997. *The Prehistory of Jordan II:*

Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4. Berlin: Ex Oriente. pp. 575-592.

Ain Mallah (Ein Mallaha)

Lechevallier, M. and Perrot, J., 1973. Eynan and Beisamoun. *Israel Exploration Journal,* 23(2), pp. 107-108.

Mithen, S.J., 2003. *After The Ice: A Global Human History, 20,000-5000 BC* Harvard: University Press.

Perrot, J., 1957. Eynan (Ein Mallaha). *Israel Exploration Journal* 7, pp. 125-127.

Perrot, J., 1960. Excavations at Eynan (Ein Mallaha), 1959 Season. Preliminary Report. *Israel Exploration Journal* 10, pp. 14-22.

Perrot, J., 1974. Mallaha (Eynan), 1975. *Paléorient,* 2(2), pp. 485-486.

Perrot, J., 1976 Eynan (Ein Mallaha) 1975. *Israel Exploration Journal* 26, pp. 47-48.

Sillen, A., 1984. Dietary change in the Epi-Palaeolithic and Neolithic of the Levant: The Sr/Ca Evidence. *Paléorient* 10(1), pp. 149-155.

Valla, F.R., 1977. Eynan (Mallaha) 1976. *Israel Exploration Journal* 27, p. 42.

French references

Bar-Yosef, O. and Valla, F., 1979. L'évolution du Natoufien. Nouvelles suggestions. *Paléorient,* 5, pp. 145-152.

Bocquentin, F. et al., 2001. La population Natoufienne de Mallaha (Eynan, Israel): Dénombrement, âge au décès et recrument funéraire. *Paléorient,* 27 (1), pp. 89-106.

Cauvin, M.-C., 1966. L´industrie natoufienne de Mallaha (Eynan). *L'Anthropologie,* 70, pp. 485-494.

Desse, J., 1987. L'ichthyofaune. In: Bouchud, eds. *La faune du gisement natoufien de Mallaha (Eynan) Israel.* Paris: Association Paléorient. Mémoires et Travaux du Centre de Recherche Français de Jerusalem, 4, pp. 151-156.

Ferembach, D., 1978. Les Natoufiens et l'homme de Combe Capelle. *Bulletin et Mémoires de la Société d'Anthropologie de Paris,* 5(13), pp. 131-136.

Lechevallier, M., 1975. Eynan (Mallaha) 1974. *Israel Exploration Journal,* pp. 25,161.

Lechevallier, M. and Perrot, A., 1973. Eynan and Beisamoun. *Israel Exploration Journal,* 23, pp. 107-108.

Lechevallier, M. and Valla, F., 1974. Mallaha (Eynan). *Paléorient,* 2(1).

Leroi-Gourhan, A., 1984. L'environnement de Mallaha (Eynan) au Natoufien. *Paléorient* 10, pp. 103-105.

Mienis, H.K., 1987. Identification of Mollusc Material from the Mallaha Excavations. In: Bouchud, eds. 1987. *La faune du gisement natoufien de Mallaha (Eynan) Israel.* Paris: Association Paléorient. Mémoires et Travaux du Centre de Recherche Français de Jerusalem, 4, pp. 157-178.

Perrot, J., 1957a. Le Mésolithique de Palestine et les récentes découvertes a Eynan (Ain Mallaha). *Antiquity and Survival*, 2, pp. 91-110.

Perrot, J., 1957b. Eynan (Ein Mallaha). *Israel Exploration Journal* 7, pp. 125-127.

Perrot, J., 1960a. Excavation at Eynan (Ein Mallaha), 1959 season: preliminary report

Israel Exploration Journal 10, pp. 14-22.

Perrot, J., 1960b. Eynan (Ain Mallaha). *Israel Exploration Journal* 10, pp. 256-257.

Perrot, J., 1966a. Le Gisement Natoufien de Mallaha (Eynan), Israël. *L'Anthropologie* 70, pp. 437-484.

Perrot, J., 1969. Mallaha: les debuts de la vie sedentaire en Palestine il y a 10000 ans. *Atomes*, 261, pp. 4-10.

Perrot, J., 1975. Eynan (Mallaha). *Paléorient*, 2(2), pp. 485-486.

Perrot, J., 1976. Eynan (Mallaha) 1975. *Israel Exploration Journal*, 26, pp. 47-48.

Perrot, J and Ladiray, D., 1988. *Les hommes de Mallaha (Eynan) Israel. I. Les sépultures.* Paris: Mémoires et Travaux du Centre de Recherche français de Jérusalem. pp. 1-106.

Pichon, J., 1987. L 'avifaune. In: Bouchud, ed. 1987. *La faune du gisement natoufien de Mallaha (Eynan) Israel.* Paris: Association Paléorient. Mémoires et Travaux du Centre de Recherche Français de Jerusalem, 4, pp. 115-150.

Stordeur, D., 1988. *Outils et armes en Os du Gisement Natouflen de Mallaha (Eynan) Israël*. Paris: Association Paléorient. Mémoires et traveux du centre de recherche français de Jérusalem, 6, pp. 231-239.

Valla, F., 1975b. Note sur l'industrie lithique de Mallaha (Eynan). *Israel Exploration Journal*, 25, pp. 1-7.

Valla, F., 1977a. Mallaha (Eynan). *Revue Biblique*, 84, pp. 255-256.

Valla, F., 1977b. Eynan (Mallaha) 1976. Eynan (Mallaha) 1976. *Israel Exploration Journal*, 27, p. 42.

Valla, F., 1984. *Les Industries de Silex de Mallaha (Eynan).* Paris: Association Paléorient. Memoires et Travaux du Centre de Recherche Français de Jerusalem, 3. pp. 399-410.

Valla, F., 1988. Aspects du sol de l'abri 131 de Mallaha (Eynan). *Paléorient*, 14(2), pp. 283-296.

Valla, F. and Lechevallier, R., 1989. Notes à propos de quelques foyers natoufiens de Mallaha (Eynan, Israel). In: o.A. 1989. *Mémoires du Musée de Préhistoire d'Ile de France 2 (Actes du Colloque International de Nemours 12-13-14 mai 1987, Nature et fonction des foyers préhistoriques.* Nemours. pp. 293-302.

‘Ain Rahub

Gebel, H.G. and Muheisen, M., 1985. Note on `Ain Rahub, a new late Natufian site near Irbid, Jordan. *Paléorient,* 11, pp. 107-110.

Gebel, H.G and Muheisen, M. 1986. *‘Ain Rahub*. Archiv für Orientforschung, 33, pp. 172-175.

Gebel, H.G and Müller-Neuhof, B., 1994. Yarmoukian ´Ain Rahub, Northern Jordan. The Chipped Industry. In H.G. Gebel and S.K. Kozłowski, eds. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1*. Berlin: Ex Oriente. pp. 567-594.

Halim al-Shiyab, A., 1997. Animal Remains From ´Ain Rahub. In: Gebel et al., eds. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4*. Berlin: Ex Oriente, pp. 593-599.

Muheisen, M. et al. 1988. Excavations at ´Ain Rahub, a Final Natufien and Yarmoukien Site Near Irbid (1985). In: A.N. Garrard and H.G. Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986.* Oxford: BAR International Series 396ii. pp. 473-502.

Atlit-Yam

Barkai, R. and Galili, E., 2003. The PPNC Bifacial Tool Industry From The Submerged Site of Atlit-Yam, Israel. *Eurasian Prehistory* 1(2), pp. 139-162.

Galili, E., 1987. A Late Pre Pottery Neolithic B site on the sea floor near Atlit. *Journal of the Israel Prehistoric Society* 20, pp. 50-71.

Galili, E. and Nir, Y., 1993. The submerged Pre Pottery Neolithic water well of Atlit Yam northern Israel, and its paleoenvironmental implications. *The Holocene* 3, pp. 265-270.

Galili, E. et al., 1993. Atlit-Yam: A prehistoric site on the sea floor of the Israeli coast. *Journal of Field Archaeology* 20, pp. 133-157.

Galili, E. et al., 1999. Atlit-Yam Excavations 1993-1994. *Hadashot Arkheologiyot (Excavations and Surveys in Israel)* pp. 109, 30-31

Basta

Becker, C., 1998. The Role of Hunting in the Pre-Pottery Neolithic Pastoralism and its Ecological Implications: The Basta Example. *Anthropozoologica* 27, pp. 67-78.

Berner, M. and Schultz, M., 2004. Demographic and Taphonomic Aspects of the Skeletons from Late Pre-Pottery Neolithic B Population from Basta, Jordan. In: Bienert et al., eds. *Central Settlements in Neolithic Jordan, Proceedings of the Symposium Held in Petra, July 1997. Studies in Early Near Eastern Producton, Subsistenceand Environment 5*. Berlin: Ex Oriente. pp. 241-258.

Dahl Hermansen, B., 1997. Art and Ritual in Neolithic Basta. In: Gebel et al., eds. *Magic Practices and Ritual in the Near Eastern Neolithic, Studies in Early Near Eastern Production, Subsistence and Environment* 8. Berlin: Ex Oriente. pp. 333-343.

Gebel, H.G., 1996. Chipped Lithics in the Basta Craft System. In: Kozłowski and Gebel, eds. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment 3*. Berlin: Ex Oriente. pp. 261-270.

Gebel, H.G., 2002. Walls. Loci of Forces. In: Gebel et al., eds. *Magic Practices and Ritual in the Near Eastern Neolithic, Studies in Early Near Eastern Production, Subsistence and Environment* 8. Berlin: Ex Oriente, pp. 119-132.

Gebel, H.G. et al., 1988. Preliminary Report on the First Season of Excavations at Basta. The Prehistory of Jordan. The State of Research in 1986. Oxford: BAR, International Series 396. pp. 101-134.

Kinzel, M., 2004. Some Notes on the Reconstruction of PPNB Architecture. *Neo-Lithics*, 2004(2), pp. 18-22.

Nissen, H.J. et al., 1987. Report on the First Two Seasons of Excavations at Basta (1986-1987). *Annual of the Department of Antiquities of Jordan*, 31, pp. 548-554.

Nissen, H.J. et al., 1991. Report on the Excavation at Basta 1988. *Annual of the Department of Antiquities of Jordan*, 35, pp. 13-40.

Roehrer-Ertl, O. et al., 1988. *Preliminary Note on Early Neolithic Human Remains from Basta and Sabra. The Prehistory of Jordan. The State of Research in 1986.* Oxford: BAR International Series 396. pp. 135-136.

Starck, J.M., 1988. Stone *Rings from Baga and Basta. Geographical and Chronological Implications. The Prehistory of Jordan. The State of Research in 1986*. Oxford: BAR, International Series 396. pp 137-174.

Thaís Crepaldi Affonso, M. and Pernika, E., 1997. INAA-Analysis of Late Pre-Pottery Neolithic Rings from Basta.In: Gebel et al., eds. *Magic Practices and Ritual in the Near Eastern Neolithic, Studies in Early Near Eastern Production, Subsistence and Environment* 8. Berlin: Ex Oriente, pp. 641-650.

Beidha

Banning, E.B. and Köhler-Rollefson, I., 1983. Ethnoarchaeological Survey in the Beidha Area, Southern Jordan. *Annual of the Department of Antiquities of Jordan*, 27, pp. 375-383.

Byrd, B.F., 1988. The Natufian of Beidha: Report on Renewed Field Research. In: Garrard and Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986.* Oxford: BAR, International Series 396. pp. 175-197.

Byrd, B.F., 1991. Beidha: An Early Natufian encampment in southern Jordan. In: Bar-Yosef and Valla, eds. *The Natufian Culture in the Levant*, pp. 245-264.

Byrd, B.F., 1994. Public and Private, Domestic and Corporate: The Emergence of the Southwest Asian Village. *American Anthropology* 59, pp. 639-666.

Byrd, B.F., 2005. *Early Village Life at Beidha, Jordan: Neolithic Spatial Organization and Vernacular Architecture: The Excavations of Mrs Diana Kirkbride-Helbaek.* Oxford: Oxford University Press.

Hecker, H.M., 1982. Domestication revisited: its implications for faunal analysis. *Journal of Field Archaeology* 9, pp. 217-236.

Kirkbride, D.V.W., 1960. The Excavation of a Neolithic Village at Seyl Aqlat, Beidha, Near Petra. Interim Report. *Palestine Exploration Quarterly*, 93, pp. 136-145.

Kirkbride, D.V.W., 1966a.Five Seasons at the Prepottery B Neolithic Village of Beidha *Palestine Exploration Quarterly* 86, pp. 8-72.

Kirkbride, D.V.W., 1966b. Beidha, an Early Neolithic Village in Jordan. *Archaeology* 19, pp. 199-207.

Kirkbride, D., 1966c. *Five Seasons at the Pre-Pottery Neolithic Village of Beidha in Jordan*. Oxford: Oxford University Press.

Kirkbride, D.V.W., 1967. Beidha 1965: An Interim Report. *Palestine Exploration Quarterly* 87, pp. 5-13.

Kirkbride, D.V.W., 1968a. Beidha: early Neolithic village life south of the Dead Sea. *Antiquity* 42, pp. 263-274.

Kirkbride, D.V.W., 1968b. Beidha 1967: An Interim Report. *Palestine Exploration Quarterly* 88, pp. 90-96.

Kirkbride, D.V.W., 1984. Beidha 1983: An Interim Report. *Annual of the Department of Antiquities of Jordan* 28, pp. 9-12.

Mortensen, P., 1970. A preliminary study of the chipped stone industry from Beidha. *Acta Archaeologica* 41, pp. 1-54.

Cafer Höyük

Cauvin, J., 1984. Cafer Hoyuk Kazisi 982 yili raporu. V Kazi Sonuçlan Toplantisi, Istanbul 23-27 Mayis 1983. pp. 65-66.

Cauvin, J., 1985, Le Néolithique de Cafer Hoyuk (Turquie), bilan provisoire après quatre campagnes (1979-1983). *Cahiers de l'Euphrate* 4. Paris: Ed du CNRS. Pp. 123-135.

Cauvin, J., 1987. Cafer Hôyiik 986. *Anatolian Studies*, 37, p.182.

Cauvin, J., 1989. Les fouilles du village néolithique de Cafer Hôyiik. Catalogue d'Exposition « Anatolie Antique ». *Varia Anatolica* IV(1), pp. 10-13.

Cauvin, J., 1989. La stratigraphie de Cafer Hôyuk-Est (Turquie) et les origines du PPNB du Taurus. In: O. Aurenche, M-C. Cauvin and P. Sanlanville, eds. 1989. Préhistoire du Levant H, Colloque, CNRS, Lyon, mai 1988. *Paléorient*, 15, pp. 175-186.

Cauvin, J., 2000. *The Birth of the Gods and the Origins of Agriculture*. Cambridge: Cambridge University Press.

Cauvin, J. and Aurenche, O., 1980. Cafer Hóyiik (Malatya) 1979. *lian Studies*, 30, pp. 207-209.

Cauvin, J., and Aurenche, O., 1980. Premiers sondages sur le siteque de Cafer Hoyiik. *II Kasi Sonuçlan Toplantisi*, pp. 175-180.

Cauvin, J. and Aurenche, O., 1981. Cafer Hoyuk 1980. *Anatolian Studies*, 31, pp. 184-185.

Cauvin, J. and Aurenche, O., 1981. Cafer Hoyiik 1980. In *Kasiçlan Toplantisi*, 1, pp. 19-20.

Cauvin, J. and Aurenche, O., 1982. Le Néolithique de Cafer Hoyuk tya, Turquie. Fouilles 1979-1980. *Cahiers de l'Euphrate*, 3. Paris: Éd. du CNRS. pp. 123-138.

Cauvin, J. and Aurenche, O., 1984. Cafer Hôyiik 1983. *Anatolian Studies*, 34, pp. 209-210.

Cauvin, J. and Aurenche, O., 1985. La campagne de fouilles 1984 à Cafer Hoyiik. *VII Kasi Sonuçlan Toplantisi*, pp. 17-21.

Cauvin, J. and Aurenche, O., 1985. Cafer Hoyuk 1984. *Anatolian Studies* 35, pp. 183-186.

Cauvin, J. and Aurenche, O., 1986. Cafer Hoyuk 1985. *Anatolian Studies* 36, pp. 182-184.

Cauvin, J. and Aurenche, O., 1986. Cafer Hoyiik les fouilles de 1985. *VIII Kasi Sonuçlan Toplantisi*, pp. 39-49.

Cauvin, J. and Aurenche, O., 1987. Cafer Hoyiik et le Néolithique en Anatolie. *Dossiers Histoire et Archéologie*, 122, pp. 24-25.

Cauvin, J. and Molist, M., 1991. Les niveaux inférieurs de Cafer Hoyiik. Stratigraphie et architectures. Fouilles 84-86. *Cahiers de l'Euphrate*, 5-6, pp. 85-114. Paris: ERC.

Cauvin, J., Cauvin, M-C., Anderson-Geraud, P. and Helvier, D., 1991. *Les travaux de 1986-1988 sur le site néolithique pré-céramique de Cafer Hoyiik. Anatolia Antiqua, EskiAnadolu, (1FEA Istanbul XXXII)*. Paris: Maisonneuve. pp. 4-10.

Cauvin, J., Cauvin, M-C, Aurenche, O. And Balkan-Atli, N., 1999., The Pre-pottery Site of Cafer Hoyiik. In: M. Ôzdoan and N. Basgelen, eds. *Neolithic in Turkey*. Istanbul: Istanbul Arkeoloji ve Sanat Yayinlazi. pp. 87-103.

Cauvin, J., Chavanne, M-J. and Oziol, T., 1985. Le cimetière médiéval de Cafer Hôyiik (Malatya. Turquie). *Cahiers de l'Euphrate 4*, pp. 135-173.

Crabtree, P.M, Campana, D.V. and Ryan, K., 1989. *Early Animal Domestication and Its Cultural Context*. University of Pennsylvania. Museum of Archaeology. pp. 87-97.

Helmer, D., n.d. Révision de la faune de Cafer Höyük (Malatya, Turquie) : apports des méthodes de l'analyse des mélanges et de l'analyse de Kernel à la mise en évidence de la domestication. In: E. Vila, L. Gourichon, A. M. Choyke and H. Buitenhuis, eds. 2008. *Archaeozoology of the Near East VIII, (I).* Lyon: Maison de l'Orient et de la Méditerranée. pp. 153-168.

Çatalhöyük:

Before the 1970s

Angel, L., 1971. Early neolithic skeletons from Çatal Hüyük: demography and pathology. *Anatolian Studies,* 21, pp. 77-98.

Bialor, P., 1962. The chipped stone industry of Çatal Hüyük. *Anatolian Studies*, 12, pp. 67-110.

Burnham, H.B., 1965. Çatal Hüyük - the textiles and twine fabrics. *Anatolian Studies*, 15, pp. 169-74.

Helbaek, H., 1964. First impressions of the Çatal Hüyük plant husbandry. *Anatolian Studies*, 14, pp. 121-123.

Mellaart, J., 1962a. Çatal Hüyük excavations 1961, Archälogischer Anzeiger, pp. 1–11.

Mellaart, J., 1962b. Excavations at Çatal Hüyük, first preliminary report, 1961. *Anatolian Studies*, 12, pp. 41-65.

Mellaart, J., 1963a. Deities and Shrines of Neolithic Anatolia. Excavations at Çatal Hüyük 1962. *Archaeology*, 16(1), pp. 29-38.

Mellaart, J., 1963b. Excavations at Çatal Hüyük, second preliminary report, 1962. *Anatolian Studies*, 13, pp. 43-103.

Mellaart, J., 1964a. A Neolithic City in Turkey. *Scientific American*, April 1964, pp. 94-104.

Mellaart, J., 1964b. Excavations at Çatal Hüyük, third preliminary report, 1963. *Anatolian Studies* 14, pp. 39-119.

Mellaart, J., 1965a. Çatal Hüyük a Neolithic City in Anatolia. *Proceedings of the British Academy,* 51, pp. 201-213.

Mellaart, J., 1965b. Çatal Hüyük West. *Anatolian Studies*, 15, pp. 135-156.

Mellaart, J., 1965c. *Earliest Civilisations of The Near East*. London: Thames and Hudson. pp. 81-101.

Mellaart, J., 1966. Excavations at Çatal Hüyük, fourth preliminary report, 1965. *Anatolian Studies*, 16, pp. 15-191.

Mellaart, J., 1967. *Çatal Hüyük: A Neolithic Town in Anatolia*. London: Thames and Hudson.

Mellaart, J., 1975. *The Neolithic of the Near East*. London: Thames and Hudson. pp 98-111.

Mellaart, J., 1998. Çatal Hüyük: the 1960's seasons. In: R. Matthews, ed. 1998. *Ancient Anatolia: Fifty years' work by the British Institute of Archaeology at Ankara*. London: British Institute at Ankara. pp. 35–41.

Perkins, D., 1969. Fauna of Çatal Hüyük: evidence for early cattle domestication in Anatolia. *Science* 164, pp. 177-179.

Between the 1970's and 1990's

de Meester, T., 1970, Soils of the Great Konya Basin, Turkey. *Agricultural Research Report*, 740.

Gimbutas, M., 1990. Wall Paintings of Çatal Hüyük, 8th-7th Millenia B.C. *The Review of Archaeology*, 11(2), pp. 1-5.

Hays, K.A., 1993. When is a symbol archaeologically meaningful? Meaning, function, and prehistoric visual arts. In: N. Yoffee and A. Sherratt, eds. 1993. *Archaeological Theory: Who Sets the Agenda?. New Directions in Archaeology*. Cambridge: Cambridge University Press. pp. 81-92.

Hodder, I., 1987. Contextual archaeology: An interpretation of Catal Hüyük and a discussion of the origins of agriculture. *Bulletin of the Institute of Archaeology*, 24, pp. 43-56. London.

Johnson, G., 1982. Organizational structure and scalar stress. In: C. Renfrew, M. Rowlands and B. Segraves, eds. 1982. *Theory and Explanation in Archaeology: The Southampton Conference*. New York: Academic Press. pp. 389-421.

MacQueen, J.G., 1978. Secondary burial at Çatal Hüyük. *NUMEN - International Review for the History of Religions* 25(3), pp. 226-239.

Mallett, M., 1993. The Godess in Anatolia: An Updated View of the Çatal Hüyük Controversy. *Oriental Rug Review* 13(2).

Maréchal, A., 1985. The Riddle of Çatal Hüyük. *Hali*, 26, pp. 6-11.

Mellaart, J., 1976[1964]. A Neolithic city in Turkey. In: B. Fagan, ed. *Avenues to Antiquity: Readings from Scientific American. W. H. Freeman, San Francisco*. pp. 141-150.

Mellaart, J., 1979. Early Urban Communities in the Near East c.9000 - 3400 BC. In: P.R.S. Moorey, ed. *The Origins of Civilisation. Wolfson College lectures 1978*. Oxford: Clarendon Press. pp. 22-33.

Mellaart, J., 1989. Neolithic Chronology at Çatal Hüyük?. In: K. Emre, B. Hrouda, M. Mellink and N. Özgüç, eds. 1989. *Anatolia and the Ancient Near East. Studies in Honor of Tahsin Özgüç*. Ankara: Türk Tarih Kurumu Basimevi. pp. 315-318.

Mellaart, J., 1990. The Earliest Representations of the Goddess of Anatolia and Her Entourage. In: J. Rageth, ed. 1990. *Anatolische kelims; Symposium Basel.* Basel: Die Vorträge. pp. 27-46.

Mellaart, J., Balpinar, B. and Hirsch, U., 1989. *The Goddess from Anatolia*. Milan.

Omura, M., 1984. A reinterpretation of the figurines of Çatal Hüyük. *Orient,* 20, pp. 129-150.

Rice, M., 1997. *The Power of the Bull*. London: Routledge.

Roberts, N., 1982. A note on the geomorphological environment of Çatal Hüyük, Turkey, *Journal of Archaeological Science*, 9, pp. 341-348.

Roberts, N., 1991. Late Quaternary geomorphological change and the origins of agriculture in south central Turkey. *Geoarchaeology,* 6, pp. 1-26.

Singh, P., 1974. *Neolithic Cultures of Western Asia*. London: Seminar Press. pp 85-105.

The 1990's - Present Excavations

Andrews, P. and Bello, S., 2006 Pattern in human burial practice. In: R.Gowland and C. Knüsel, eds. 2006. *Social archaeology and funerary remains.* Oxford: Oxbow. pp. 14-29.

Asouti, E. and Austin, P., 2005. Reconstructing woodland vegetation and its exploitation by past societies, based on the analysis and interpretation of archaeological wood charcoal macro-remains. *Environmental Archaeology* 10, pp. 1-18.

Asouti, E. and Fairbairn A., 2002. Subsistence economy in Central Anatolia during the Neolithic - the archaeobotanical evidence. In: F. Gerard and L. Thissen, eds. *The Neolithic of Central Anatolia, internal developments and external relations during the 9th-6th millennia cal BC, being the proceedings of the International CANeW Table ronde held in Istanbul on 23-24 November 2001*. Ege Yanlari. pp. 181 - 192.

Asouti, E. and Hather, J., 2001. Charcoal analysis and the reconstruction of ancient woodland vegetation in the Konya Basin, south-central Anatolia, Turkey: results from the Neolithic site of Çatalhöyük East. *Vegetation History and Archaeobotany* 10, pp. 23-32.

Atalay, S. and Hastorf, C.A., 2006. Food, meals, and daily activities: Food habitus at Neolithic Çatalhöyük, *American antiquity*, pp. 283-319.

Baird, D., 2010. Was Çatalhöyük a centre? The implications of a late aceramic Neolithic assemblage from the neighbourhood of Çatalhöyük. In: D.Bolger and L.C. Maguire, eds. 2010. *Development of pre-state communities in the Near East*. Oxford: Oxbow. pp. 207–216.

Balter, M., 1998. Why settle down? The mystery of communities. *Science* 282(5393), pp 1442-1445.

Balter, M., 1999. A Long Season Puts Çatalhöyük in Context. *Science* 286(5441), pp 890-891.

Balter, M., 2001. Did Plaster Hold Neolithic Society Together? *Science* 14(294), pp 2278-2281.

Balter, M., 2005. The Goddess and the Bull: Catalhoyuk: An Archaeological Journey to the Dawn of Civilization. New York: Free Press.

Bar-Yosef Mayer, D.E., Gümüş, B. A. and İslamoğlu, Y., 2010. Fossil Hunting in the Neolithic: Shells from the Taurus Mountains at Çatalhöyük, Turkey. *Geoarchaeology: An International Journal*, 25(3), pp. 375–392.

Bezic, A., 2007. *Distribution of Flint in Turkey, from 10,000 to 6,000 cal BC. Case Study-Catalhoyuk*. Oxford: BAR international series, 1615, p. 68.

Bogaard, A. et al., 2009. Private pantries and celebrated surplus: Saving and sharing food at Neolithic Çatalhöyük, Central Anatolia. *Antiquity* 83(321), pp. 649-668.

Boyer, P., Roberts, N. and Merrick, J., i.p. KOPAL excavations at Çatalhöyük 1996-2000. In: I.Hodder, ed. *Excavations at Çatalhöyük 1996-2000*. McDonald Institute for Archaeological Research / British Institute of Archaeology at Ankara. Monograph.

Carter, T. and Shackley, M.S., 2007. Sourcing obsidian from Neolithic Çatalhöyük (Turkey). *Archaeometry*, 49, pp. 437–454.

Carter, T., Bressy, C. and Poupeau, G., 2001. 'People and place': New information on technical change at Çatalhöyük. *American Journal of Archaeology*, 105(2), pp. 280.

Carter, T., Dubernet, S., King, R., Le Bourdonnec, F.-X., Milić, M., Poupeau, G. and Shackley, M.S., 2008. Eastern Anatolian obsidians at Çatalhöyük and the reconfiguration of regional interaction in the Early Ceramic Neolithic. *Antiquity* 82(318), pp. 900-909.

Cessford, C., 2001. A New Dating Sequence for Çatalhöyük. *Antiquity* 75, pp. 717-25.

Cessford, C. 2002. Bayesian statistics and the dating of Çatalhöyük East. In: F. Gérard and L. Thissen, eds. 2002. *The Neolithic of Central Anatolia. Internal developments and external relations during the 9th-6th millennia CAL BC*. Istanbul: Eye Yayinlari. pp. 27-31.

Düring, B.S., 2001. Social dimensions in the architecture of Neolithic Çatalhöyük. *Anatolian Studies* 51, pp. 1-18.

Düring, B.S. and Marciniak, A., 2005. Households and communities in the central Anatolian Neolithic. *Archaeological dialogues*, 12(02), pp. 165-187.

Eastwood, W.J., Roberts, N. And Boyer, P., i.p. Pollen analysis at Çatalhöyük. In: I.Hodder, ed. *Excavations at Çatalhöyük 1996-2000*. McDonald Institute for Archaeological Research/ British Institute of Archaeology at Ankara. Monograph.

Edwards, Ceiridwen J. et al., 2004. Ancient DNA analysis of 101 cattle remains: Limits and prospects. *Journal of Archaeological Science* 31(6), pp. 695-710.

Evershed, R.P, Payne, S., Sherratt, A.G., Copley, M.S., Coolidge, J., Urem-Kotsu, D., Kotsakis, K., Özdoğan, M., Özdoğan, A., Nieuwenhuyse, O., Akkermans, P.M.M.G., Bailey, D., Andeescu, D., Campbell, S., Farid, S., Hodder, I., Yalman, N., Özbaşaran, M., Bıçakc, E., Garfinkel, Y., Levy., T and Burton, M.M., 2008. Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding. *Nature* 445, pp. 528-531.

Fairbairn, A., 2002. An archaeology of archaeobotany: re-investigating the Mellaart seed archive from Çatalhöyük. *Anatolian Archaeology* 8, pp. 16-17.

Fairbairn, A., 2005. A history of agricultural production at Neolithic Çatalhöyük East, Turkey. *World Archaeology*, 37(2), pp. 197-210.

Fairbairn, A., Asouti, E., Near, J. and Martinoli, D., 2002. Macro-botanical evidence for plant use at Neolithic Çatalhöyük south-central Anatolia, Turkey. *Vegetation History and Archaeobotany*, 11, pp. 41-54.

Fairbairn, A., Martinoli D., Butler, A. and Hillman, G., 2007. Wild plant seed storage at Neolithic Catalhoyuk East, Turkey. Veget. *Hist. Archaeobot*. 16, pp. 467-479.

Forest, J., 1994. Towards an interpretation of the Çatal Höyük reliefs and paintings. *1993 Yılı Anadolu Medeniyetleri Müzesi Konferensları*. Ankara: Museum of Anatolian Civilisations. pp. 118-136.

Hassan, F., 1997. Beyond the surface: comments on Hodder's 'reflexive excavation methodology'. *Antiquity* 71, pp. 1020-1025.

Hodder, I., 1996a. Çatalhöyük, *Anatolian Archaeology* 2, pp. 6-7.

Hodder, I., 1996b. Çatalhöyük: 9000 year old housing and settlement in central Anatolia. In: Y. Sey, ed. 1996. *Housing and Settlement in Anatolia, an historical perspective.* Istanbul. pp. 43-48.

Hodder, I., 1997a. Çatalhöyük, *Anatolian Archaeology* 3, pp. 4-5.

Hodder, I., 1997b. 'Always momentary, fluid and flexible': towards a reflexive excavation methodology. *Antiquity* 71, pp. 691-700.

Hodder, I., 1998a. Çatalhöyük, *Anatolian Archaeology* 4, pp. 8-10.

Hodder, I., 1998b. Çatalhöyük, Turkey: a summary of some recent results. *Documenta Praehistorica*, 25, pp. 71–80.

Hodder, I., 1998c. The past as passion and play: Çatalhöyük as a site of conflict in the construction of multiple pasts. In: L. Meskell, ed. 1998. *Archaeology Under Fire: nationalism, politics and heritage in the Eastern Mediterranean and Middle East*. London: Routledge. pp. 124-139.

Hodder, I., 1999a. Getting to the bottom of things: Çatalhöyük 1999. *Anatolian Archaeology*, pp. 4-7.

Hodder, I., 1999b. Symbolism at Çatalhöyük. In: J. Coles, R. Benley and P. Mellars, eds. 1999. *World Prehistory. Studies in Memory of Grahame Clark. Proceedings of the British Academy*. Oxford: Oxford University Press.

Hodder, I., 2000. Çatalhöyük 2000, *Anatolian Archaeology*, 6, pp. 5-7.

Hodder, I., 2001. Çatalhöyük, *Anatolian Archaeology*, 7, pp. 2-4.

Hodder, I., 2002. Çatalhöyük, *Anatolian Archaeology*, 8, pp. 5-7.

Hodder, I., 2004a. A season of great finds and new faces at Çatalhöyük. *Anatolian Archaeology*, 10, pp. 8–10.

Hodder, I., 2004b. Women and men at Çatalhöyük. *Scientific American*, 290, pp. 66-73.

Hodder, I., 2005. Socialization and feasting at Çatalhöyük: a response to Adams. *American Antiquity*, 70, pp. 189–191.

Hodder, I., 2006a. *Çatalhöyük: the Leopard's Tale, revealing the mysteries of Turkey's ancient 'town'*. London: Thames and Hudson.

Hodder, I., 2006b. The spectacle of daily performance at Çatalhöyük. In: T. Inomata and L. S. Coben, eds. *Archaeology of performance. Theathers of power, community, and politics*. Lanham: AltaMira. pp 81-102.

Hodder, I., 2007. Çatalhöyük in the context of the Middle Eastern Neolithic. *Annual Review of Anthropology* 36, pp. 105-120.

Hodder, I., 2008. Multivocality and social archaeology. In: J. Habu, C. Fawcett and J. Matsunaga, eds. 2008. *Evaluating multiple narratives. Beyond nationalist, colonialist, imperialist archaeologies*. New York: Springer. pp 196-200.

Hodder, I., 2010. *Religion in the emergence of civilization: Çatalhöyük as a case study*, illustrated ed. Cambridge/ New York: Cambridge University Press.

Hodder, I., ed. 1996. *On the Surface Çatalhöyük 1993-95*. McDonald Institute for Archaeological Research/ British Institute of Archaeology. Monograph No.22.

Hodder, I., ed. 2000. *Towards Reflexive Method in Archaeology: The Example at Çatalhöyük*. McDonald Institute for Archaeological Research/ British Institute of Archaeology. Monograph No.28.

Hodder, I., ed. 2005. *Inhabiting Çatalhöyük: reports from the 1995-99 seasons*. McDonald Institute for Archaeological Research/ British Institute of Archaeology. Monograph No.38.

Hodder, I., ed. 2005b. Changing materialities at Çatalhöyük: reports from the 1995-99 seasons. McDonald Institute for Archaeological Research/ British Institute of Archaeology. Monograph No.39.

Hodder, I., ed. 2005c. Çatalhöyük perspectives: themes from the 1995-99 seasons. British Institute of Archaeology. Monograph No.40.

Hodder, I., ed. 2007. Excavating Çatalhöyük: South, North and KOPAL Area reports from the 1995-99 seasons. McDonald Institute for Archaeological Research/ British Institute of Archaeology.

Hodder, I. and Cessford, C., 2004. Daily practice and social memory at Çatalhöyük. *American Antiquity* 69(1), pp. 17-40.

Hodder, I. and Matthews, R.J., 1998. Çatalhöyük: the 1990s seasons. In: R.J. Matthews, ed. 1998. *Ancient Anatolia: Fifty Years' work by the British Institute of Archaeology at Ankara*. London: British Institute of Archaeology at Ankara. pp. 43–52.

Jenkins, E., 2009. *Unwanted Inhabitants? The Microfauna from Çatalhöyük and Pınarbası*. Saarbrücken: VDM-Verlag.

Jenkins, E., 2010. Mice, Scats and Burials: unusual concentrations of microfauna found in human burials at the Neolithic site of Çatalhöyük, Anatolia. *Journal of Anthropological Archaeology*.

Koutsadelis, C., 2007. *Mortuary Practices in the Process of Levantine Neolithisation*. Oxford: BAR, International Series, 1685.

Last, J., 1998. A design for life. Interpreting the art of Çatalhöyük. *Journal of Material Culture* 3(3), pp. 355-78.

Marciniak, A., 2008. Communities, households and animals. Convergent developments in Central Anatolia and Central European Neolithic. *Documenta Praehistorica* 35, pp. 93-109.

Marciniak, A. and Czerniak, L., 2007. Social transformations in the Late Neolithic and the Early Chalcolithic periods in central Anatolia. *Anatolian Studies*, 57, pp. 115-130.

Martin, L. and Russell, N., 2006. The equid remains from Neolithic Çatalhöyük, central Anatolia: a preliminary report. In: S.L. Olsen, S. Grant, A.M. Choyke and L. Bartosiewicz, eds. 2006. *Horses and Humans: the evolution of human-equine relationships*. Oxford: BAR, International Series, 1560, pp. 115–126.

Meskell, L.M., 1998. Twin Peaks: the archaeologies of Çatalhöyük. In C. Morris and L. Goodison, eds. 1998. *Ancient Goddesses: Myths and Evidence*. London: British Museum Press. pp. 46-62.

Meskell, L.M., 2007. Refiguring the Corpus at Çatalhöyük. In: C. Renfrew and I. Morley, eds. *Material Beginnings: A Global Prehistory of Figurative Representation*. Cambridge: McDonald Institute Monographs.

Meskell, L., 2008. The nature of the beast: curating animals and ancestors at Çatalhöyük, *World Archaeology* 40(3), pp. 373-389.

Meskell, L., Nakamura, C., King, R., and Farid, S., 2008. Figured lifeworlds and depositional practices at Çatalhöyük. *Cambridge Archaeological Journal*, 18(2), pp. 139-161.

Mithen, S., 2004. From Ohalo to Çatalhöyük: The Development of Religiosity during the Early Prehistory of Western Asia, 20,000-7000 BCE. In: H. Whitehouse and L.H.Martin, eds. 2004. *Theorizing religions past: archaeology, history, and cognition*. California: AltaMira Press. p. 17.

Pearson, J., and Meskell, L., 2013. Isotopes and Images: Fleshing out Bodies at Çatalhöyük. *Journal of Archaeological Method and Theory*, pp. 1-22.

Richards, M.P., Pearson, J.A., Molleson, T.I., Russell, N. and Martin, L. 2003. Stable isotope evidence of diet at Neolithic Çatalhöyük, Turkey. *Journal of Archaeological Science* 30(1), pp. 67-76.

Roberts, N. and Rosen, A., 2009. Diversity and Complexity in Early Farming Communities of Southwest Asia: New Insights into the Economic and Environmental Basis of Neolithic *Current Anthropology* 50(3), pp. 393-402.

Ruff, C.B., Larsen, C.S., Cowgill, L.W. and Hager, L.D., 2006. Life in a Neolithic community: body size and activity levels at Çatalhöyük, Turkey. *American Journal of Physical Anthropology* 129(S42), pp. 155–156.

Russell, N. and Martin, L., 2000. Neolithic Çatalhöyük: Preliminary zooarchaeological results from the renewed excavations. In: M. Mashkour, H. Buitenhuis and F. Poplin, eds. 2000. *Archaeozoology of the Near East IV: Proceedings of the Fourth International Symposium on the Archaeozoology of Southwestern Asia and Adjacent Areas*. Groningen: ARC Publicatie 32. pp. 164-170.

Russell, N. and McGowan, K.J., 2003. Dance of the cranes: Crane symbolism at Çatalhöyük and beyond. *Antiquity* 77(297), pp. 445-455.

Russell, Nerissa, and Bogaard, A., 2010. Subsistence actions at Çatalhöyük. In: S.R. Steadman and J.C. Ross, eds. 2010. *Agency and Identity in the Ancient Near East: New Paths Forward*. London: Equinox. pp. 63-79.

Russell, Nerissa, and Düring, B.S., 2006. Worthy is the lamb: A double burial at Neolithic Çatalhöyük (Turkey). *Paléorien*t 32(1), pp. 73-84.

Russell, Nerissa, Martin, L., and Buitenhuis, H., 2005. Cattle domestication at Çatalhöyük revisited. *Current Anthropology* 46(5), pp. S101-S108.

Russell, Nerissa, Martin, L. and Twiss, K.C., 2009. Building memories: Commemorative deposits at Çatalhöyük. In: B. S. Arbuckle, C. A. Makarewicz, and A. L. Atici, eds. 2009. *Zooarchaeology and the Reconstruction of Cultural Systems: Case Studies from the Old World*. Paris: Anthropozoologica, 1: L'Homme et l'Animal, Société de Recherche Interdisciplinaire. pp. 103-128.

Ryan, P., 2011. Plants as material culture in the Near Eastern Neolithic: perspectives from the silica skeleton artifactual remains at Çatalhöyük. *Journal of Anthropological Archaeology* 30, pp. 292–305.

Twiss, K., 2006. A Modified Boar Skull From Çatalhöyük. *Bulletin of the American Schools of Oriental Research,* 342, pp. 1-12.

Twiss, K., 2008a. An assessment of the archaeological applicability of faunal ageing methods based on dental wear. *International Journal of Osteoarchaeology,* 18(4), pp. 329-351.

Twiss, K., 2008b. Transformations in an Early Agricultural Society: Feasting in the Southern Levantine Pre-Pottery Neolithic. *Journal of Anthropological Archaeology*, 27, pp. 418-442.

Twiss, K.C., Bogaard, A., Bogdan, D., Carter, T., Charles, M.P., Farid, S., Russell, N., Stevanovi, M., Yalman, E.N. and Yeomans, L., 2008. Arson or Accident? The Burning of a Neolithic House at Çatalhöyük. *Journal of Field Archaeology*, 33(1), pp. 41-57.

Twiss, K.C., Bogaard, A., Charles, M.P., Henecke, J., Russell, N., Martin, L. and Jones, G., 2009. Plants and animals together: Interpreting organic remains from Building 52 at Çatalhöyük. *Current Anthropology*, 50(6), pp. 885-895.

Voigt, M.M., 2000. Çatal Höyük in Context: Ritual at Early Neolithic Sites in Central and Eastern Turkey. In Kujit, I., ed. 2000. *Life in Neolithic Farming Communities. Social Organisation, Identity, and Differentiation*. London: Kluwer Academic/Plenum Publishers. pp. 253-293.

Cayonu I and II

Braidwood, R. J. and Çambel, H., ed. 1982. *Prehistoric village archaeology in south-eastern Turkey*. Oxford: BAR, International series, 138.

Caneva, D. et al., 1998. Chipped Stones at Aceramic Çayönü: Technology, Activities, Traditions, Innovations. In: J. Arsebük, et al., eds. 1998. *Light on Top of the Black Hill. Studies Presented to Halet Çambel - Karatepe´deki Işık.* Halet Çambel´ e sunulan yazılar, pp. 199-206.

Caneva, I., Iovino, M.R., Lemorini, C., Özdoğan, A. and Zambetti, D., 2001. A combined analysis of lithic assemblages from Çayönü. In: I. Caneva et al., ed. *Beyond the tools. Redefining the PPN lithic assemblages of the Levant*. Berlin: Ex Oriente. pp. 165-181.

Davis, M.K., 1998. Social Differentiation at the Village of Çayönü, Turkey. In: J. Arsebük. et al., eds. 1998. *Light on Top of the Black Hill. Studies Presented to Halet Çambel - Karatepe´deki Işık*. Halet Çambel´ e sunulan yazılar. pp. 257-266.

Erim-Özdoğan, A., 2012. Çayönü. In M. Özdoğan, N. Başgelen and P. Kuniholm, eds. 2012. *The Neolithic in Turkey: new excavations and new research*. Volume 1: the Tigris Basin. Istanbul: Archaeology & Art Publications. pp. 185-269.

Hongo, H. and Meadow, R.H., 2000. Faunal remains from prepottery Neolithic levels at Çayönü, southeastern Turkey: a preliminary report focusing on pigs (Sus sp.). In: M. Mashkour et al., eds. *Archaeozoology of the Near East IV*. Groningen: ARC Publications. pp. 122-140.

Le Mort, F., Erim-Özdoğan, A., Özbek, M. and Yilmaz, Y., 2000. Feu et archéoanthropologie au Proche-Orient (Épipaléolithique et Néolithique). Le lien avec les pratiques funéraires. Données nouvelles de Çayönü (Turquie). *Paléorient*, 26(2), pp. 37-50.

Matheson, C.D. and Loy, T.H., 2001. Genetic Sex Identification of 9400-year-old Human Skull Samples from Çayönü Tepesi. *Turkey Journal of Archaeological Science*, 28, pp. 569-575.

Miller, N.F., 2002. Tracing the development of the agropastoral economy in Southeastern Anatolia. In: Cappers and Bottema, eds. 2002. *The Dawn of Farming in the Near East, Studies in Early Near Eastern Production, Subsistence and Environment 6*, Berlin: Ex Oriente. pp. 85-94.

Morsch, M., 2002. Magic figurines? A view from Nevalı Çori. In: H.G.K. Gebel, B.D. Hermansen and C. Hoffmann Jensen, eds. 2002. *Magic Practices and Ritual in the Near Eastern Neolithic.* Berlin: Ex Oriente. SENEPSE 8.

Özdoğan, M. and Özdoğan, A., 1990. Çayönü. A conspectus of recent work. In: O. Aurenche and M.-C. Cauvin, eds. 1990. *Préhistoire du Levant II.* Lyon: Maison de l'Orient. pp. 65-74.

Özdoğan, M. and Özdoğan, A., 1999. Archaeological evidence on the early metallurgy at Çayönü Tepesi. The Beginning of Metallurgy. *Der Anschnitt*, 9, pp. 13-22.

van Zeist, W. and de Roller, G.J., 1994. Plant remains from aceramic Çayönü, SE Turkey. *Palaeohistoria* 33/34 (1991/1992), pp. 65-96.

Dhra

Bennett, C.M., 1980. Soundings at Dhra, Jordan. *Levant,* 12, pp. 30-39.

Finlayson, B. et al., 2002. Results from the 2001 Excavations at Dhra', Jordan: Chipped Stone Technology, Typology, and Intra-Assemblage Variability. *Paléorient,* 28(1), pp. 125-140.

Finlayson, B. et al., 2003 Dhra' Excavation Project, 2002: Interim Report. *Levant,* 35, pp. 1-38.

Goodale, N. et al., 2002. Results from the 2001 Excavations at Dhra´, Jordan: Chipped Stone Technology, Typology, and Intra-Assemblage Variability. *Paléorient,* 28(1), pp. 125-140.

Kuijt, I., 1994. Pre-Pottery Neolithic A Settlement Variability: Evidence for Sociopolitical Developments in the Southern Levant. *Journal of Mediterranean Archaeology* 7(2), pp. 165-192.

Kuijt, I., 1997. Trying to Fit Round Houses Into Square Holes: Reexamining the Timing of the South-Central Levantine Pre-Pottery Neolithic A and Pre-Pottery Neolithic B Cultural Transition. In: Gebel et al., eds. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4*. Berlin: Ex Oriente, Berlin. pp. 193-202.

Kuijt, I., 2001. Lithic Inter-assemblage Variability and Cultural-Historical Sequences: A Consideration of the Pre-Pottery Neolithic A Occupation of Dhra', Jordan. *Paléorient,* 27(1), pp. 107-125.

Kuijt, I. and Finlayson, B., 2001. The 2001 Excavation at the Pre-Pottery Neolithic A Period Settlement of Dhra', Jordan: Preliminary Results. *Neo-Lithics,* 2, pp. 12-15.

Kuijt, I. and Finlayson, B., 2002. The 2002 Excavation Season at Dhra' Jordan: Preliminary Results from the Jericho IX and Pre-Pottery Neolithic A Period Components. *Neo-Lithics,* 2, pp. 17-21.

Kuijt, I. and Hamzeh, M., 1998. Dhra: An Early Neolithic Village in the Southern Jordan Valley. *Journal of Field Archaeology* 25 (2), pp. 153-161.

Ziegler, M., 2003. Excavating a Neolithic Peace at Dhra (Jordan). *Near Eastern Archaeology,* 66 (3), pp. 140-142.

Ein Gev1

Bar-Yosef, O. and Arensburg, B., 1973. Human remains from Ein Gev I, Jordan Valley, Israel. *Paléorient,* 1(2), pp. 201-206.

Bar-Yosef, O. and Martin, G., 1975. Ein Gev III, Israel (1974-1975). *Paléorient,* 3, pp. 285-286.

Davis, S.J.M., 1974. Animal remains from the Kebaran Site of Ein Gev I, Jordan Valley, Israel. *Paléorient,* 2 (2), pp. 453-462.

Marom, N.G and Bar-Oz, G., 2008. ‘‘Measure for Measure’’: A Taphonomic Reconsideration of the Kebaran Site of Ein Gev I, Israel. *Journal of Archaeological Science,* 35, pp. 214-227.

Ghoraife

Cauvin, M.C., 1975. Outillage lithique et chronologie de Tell Ghoraifé C (Damascène

- Syrie) *Paléorient,* 3, pp. 295-304.

De Contenson, H., 1974 Nouvelles données sur le Néolithique précéramique dans la région de Damas (Syrie) d`après les fouilles de Ghoraifé en 1974. *Bulletin de la Société Préhistorique Française*, 73, pp. 80-82.

De Contenson, H., 1994. Remarques sur la Damascène et le Levant Sud au Néolithique.

Paléorient, 20(2), pp. 167-168.

De Contenson, H., 1995. *Aswad et Ghoraifé. Sites néolithiques en Damascène (Syrie) aux IXème et VIIIéme millémaires avant l'ère chrétienne*. Beyrouth.

Delibrias et al., 1982. GIF Natural Radiocarbon Measurements IX. *Radiocarbon* 24, pp. 291-343.

van Zeist, W. and Bakker-Heeres, J.A.H., 1982. Archaeobotanical Studies in the Levant 1. Neolithic Sites in the Damascus Basin: Aswad, Ghoraifé, Ramad. *Palaeohistoria,* 24, pp. 165-256.

Gilgal

Bar-Yosef, O. et al., 2005. Gilgal: Early Neolithic Occupations in the Lower Jordan Valley. In: O. Bar-Yosef et al., eds. 2005. *The Excavations of Tamar Noy American.* School of Prehistoric Research Monograph Series 4: Brill Academic Publishers.

Kuijt, I. and Bar-Yosef, O., 1994. Radiocarbon Chronology for the Levantine Neolithic: Observations and Data. *Radiocarbon,* 36, pp. 227-245.

Noy, T., 1979. Stone Cup-Holes and Querns from Gilgal 1: a Pre Pottery Neolithic A Site in Israel. *Paléorient,* 5, pp. 233-238.

Noy, T., 1989. Gilgal I - A Pre-Pottery Neolithic Site Israel - The 1985-1987 Seasons. *Paléorient,* 15(1), pp. 11-18.

Noy, T., 1994. Gilgal Truncation. A New Type of Tool from Early PPNA. In: Gebel and Kozłowski, eds. 1994. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1.* Berlin: Ex Oriente. pp. 423-426.

Noy, T. and Kozłowski, S.K., 1996. A Basket of Flint Artefacts from House 11 at Gilgal I, Locus 37/42. In: Kozłowski and Gebel, eds. 1996. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early*

Near Eastern Production, Subsistence and Environment 3. Berlin: Ex Oriente. pp. 271-288.

Noy, T. et al., 1980. Gilgal, A Pre-Pottery Neolithic A Site in the Lower Jordan Valley. *Israel Exploration Journal*, 30, pp. 63-82.

Göbekli Tepe

Banning, E.B., 2011. So Fair a House: Göbekli Tepe and the Identification of Temples in the Pre-Pottery Neolithic of the Near East. *Current Anthropology*, 52(5), pp. 619.

Curry, A., 2008a. Göbekli Tepe: The World's First Temple?. *Smithsonian Magazine*, (Nov 2008).

Curry, A., 2008b. Seeking the Roots of Ritual. *Science*, 319, pp. 278–80.

Dietrich, O. et al., 2010. The role of cult and feasting in the emergence of Neolithic communities. New evidence from Göbekli Tepe, south-eastern Turkey. *Antiquity*, 86(333), pp. 674–695.

Mann, C.C., 2011. The Birth of Religion: The World's First Temple. *National Geographic*, 219(?), pp. 34–59.

Mithen, S., 2004. *After the Ice: A global human history, 20,000-5000 BC*. Cambridge, MA: Harvard University Press.

Notroff, J. et al., 2014. Building Monuments – Creating Communities. Early monumental architecture at Pre-Pottery Neolithic Göbekli Tepe. In: J. Osborne, ed. 2014. *Approaching Monumentality in the Archaeological Record*. Chapter: Building Monuments – Creating Communities. Early monumental architecture at Pre-Pottery Neolithic Göbekli Tepe. Albany :SUNY Press. pp. 83-105.

Peters, J. and Schmidt, K., 2004. Animals in the symbolic world of Pre-Pottery Neolithic Göbekli Tepe, south-eastern Turkey: a preliminary assessment. *Anthropozoologica* 39(1), pp. 179–218.

Pustovoytov, K., 2000. Weathering rinds at exposed surfaces of limestone at Göbekli Tepe. *Neo-lithics*. Berlin: Ex Oriente. pp. 24–26.

Schmidt, K., 1998. Frühneolithische Tempel. Ein Forschungsbericht zum präkeramischen Neolithikum Obermesopotamiens. *Mitteilungen der deutschen Orient-Gesellschaft* 130. Berlin. pp. 17–49.

Schmidt, K., 2000a. Göbekli Tepe and the rock art of the Near East. *TÜBA-AR*, 3 (2000), pp. 1–14.

Schmidt, K., 2000b. Göbekli Tepe, Southeastern Turkey. A preliminary Report on the 1995–1999 Excavations. *Paléorient,* 26(1), pp. 45–54.

Schmidt, K., 2000c. "Zuerst kam der Tempel, dann die Stadt." Vorläufiger Bericht zu den Grabungen am Göbekli Tepe und am Gürcütepe 1995–1999. *Istanbuler Mitteilungen*, 50, pp. 5-41.

Schmidt, K., 2001. Göbekli Tepe, southeastern Turkey: A preliminary report on the 1995–1999 Excavations. *Paléorient,* 26(1), pp. 45–54.

Schmidt, K., 2002. The 2002 Excavations at Göbekli Tepe (Southeastern Turkey). Impressions from an enigmatic site. *Neo-Lithics*, 2, pp. 8-13.

Schmidt, K., 2003. The 2003 campaign at Göbekli Tepe (southeastern Turkey). *Neo-Lithics*, 2(03), pp. 3–8.

Schmidt, K., 2010c. Göbekli Tepe—the Stone Age Sanctuaries: New results of ongoing excavations with a special focus on sculptures and high reliefs. *Documenta Praehistorica*, XXXVII, pp. 239–256.

Hatoula

Anaïck, S., 1989. Occupation and a Khiamian sultanic to Hatoula (Israel)?. *Paléorient,* 15 (1), pp. 1-10.

Davis, S.J., 1985. A preliminary report of the fauna from Hatoula, a Natufian-PPNA site near Latroun, Israel. In: Lechevallier and Ronen, eds. 1985. *Le Site Natufien- Khiamien de Hatoula, près de Latroun, Israel*, Jerusalem. pp. 71-98.

Lechevallier, M. and Ronen, A., 1985. Le site Natoufien-Khiamien de Hatoula, près de Latroun, Israel. Fouilles 1980-1982, Rapport préliminaire. *Jerusalem Cahiers du Centre de Recherche Français de Jerusalem*, 1, pp. 1-120.

Lechevallier, M. and Ronen, A., 1994. The Lithics of the Early Neolithic Hatoula. In: Gebel and Kozłowski, eds. 1994. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1*. Berlin: Ex Oriente. pp. 395-406.

Lechevallier, M. and Ronen, A., eds. 1985. *Le Site Natufien- Khiamien de Hatoula, près de Latroun, Israel*. Jerusalem.

Lechevallier, M and Ronen, A., eds. 1994. *Le Gisement de Hatoula en Judée occidentale, Israël : rapport de fouilles 1980-1988*. Mémoires et Travaux du Centre de Recherche Français de Jérusalem 8.

Lechevallier, M. et al., 1989. Une occupation khiamienne et sultanienne à Hatoula (Israël)? *Paléorient*, 15(1), pp. 1-10.

Le Mort, F., 1989. PPNA Burials from Hatoula (Israel). In: Hershkovitz, ed. 1989. *People and Culture in Change*. Oxford: BAR, International Series 508. pp. 133-140.

Ronen, A. and Lechevallier, M., 1985. The Natufian and Early Neolithic site Hatula, near Latrun, Israel. *Quartär* 35(36), pp. 141-164.

Hayonim

Albert, R.M., 2003. Quantitive Phytolith Study of Hearths from Natufian and Middle Palaeolitic Levels of Hayonim Cave (Galilee, Israel). *Journal of Archaeological Sciance* 30, pp. 461-480.

Bar-Yosef, O. and Belfer-Cohen, A., 1999. Encoding information: unique Natufian objects from Hayonim Cave, Western Galilee, Israel. *Antiquity*, 73, pp. 402-10.

Bar-Yosef, O. and Hopf, M., 1987. Plant Remains from Hayonim Cave, Western Galilee. *Paléorient*, 13(1), pp. 117-120.

Belfer-Cohen, A., 1988. The Natufian Graveyard in Hayonim Cave. *Paléorient*, 14 (2), pp. 297-308.

Davis Simon J.M. and Henry Donald O., 1974. The 1974 Excavation of Hayonim Terrace (Israel): A Brief Report. *Paléorient* 2 (1), pp. 195-197.

Goldberg, P., 1979. Micromorphology of Sediments from Hayonim Cave Israel. *Catena*, 6, pp. 167-181.

Goren, N. and Bar-Yosef, O., 1973. Natufian Remains in Hayonim Cave. *Paléorient* 1 (1), pp. 49-68.

Henry, D.O. and Leroi-Gourhan, A., 1976. The Excavation of Hayonim Terrace: An Interim Report. *Journal of Field Archaeology* 3(4), pp. 391-406.

Henry, D.O. et al., 1981. The Excavation of Hayonim Terrace: An Examination of Terminal Pleistocene Climatic and Adaptational Changes. *Journal of Archaeological Science*, 8, pp. 33-58.

Lieberman, D.E., 1991. Seasonality and Gazelle Hunting at Hayonim Cave : New Evidence for "Sedentism" During the Natufian. *Paléorient*, 17 (1), pp. 47-57.

Smith, P.E.L., 1973. Family Burials at Hayonim. *Paléorient*, 1(1), pp. 69-71.

Hallan Çemi

Bar-Yosef, O. and Gopher, A., 1997. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43. pp. 247-266.

Kozlowski, S.K., 1996. The Trialetian "Mesolithic" Industry of the Caucasus, Transcaspia, Eastern Anatolia, and the Iranian Plateau. In: G. Kozlowski and R. Gebel, eds. 1996. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment* 3, Berlin: Ex Oriente. pp, 161-170.

Kuijt, I. and Bar-Yosef, O., 1994. Radiocarbon Chronology for the Levantine Neolithic: Observations and Data. *Radiocarbon*, 36, pp. 227-245.

Rosenberg, M., 1992a. The Hallan Çemi Excavation 1991, Kazı Sonuçlan. *Toplantısı*, XIV, pp. 117-130.

Rosenberg, M., 1992b. Hallan Çemi Kazısı 1992, Kazı Sonuçlan. *Toplantısı*, XVI, pp. 85-94.

Rosenberg, M., 1993a. Hallan Çemi and Early Settled Village Life in Eastern Anatolia. *American Schools of Oriental Research Newsletter*, 6.2, pp. 1-4.

Rosenberg, M., 1993b. The Hallan Çemi Excavation, 1992, Kazı Sonuçlan. *Toplantısı*, XV, pp. 123-129.

Rosenberg, M., 1994a. A Preliminary Description of the Lithic Industry from Hallan Çemi. In: G. Kozłowski and R. Gebel, eds. 1994. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment* 1. Berlin: Ex Oriente. pp. 223-238.

Rosenberg, M., 1994b. Hallan Çemi Excavation 1993, Kazı Sonuçlan. *Toplantısı*, XVI, pp. 79-83.

Rosenberg, M., 1994c. The Hallan Çemi Excavation 1994, Kazı Sonuçlan. *Toplantısı*, XVII, pp. 9-19.

Rosenberg, M., 1994d. Hallan Çemi Tepesi: Some Further Observations Concerning Stratigraphy and Material Culture. *Anatolica*, 20, pp. 121-140.

Rosenberg, M., 1999. Hallan Çemi. In: M. Özdoğan and Başgelen, eds. 1999. *Neolithic in Turkey. The Cradle of Civilization*. Istanbul: New Discoveries. pp. 25-33.

Rosenberg, M. and Davis, M.K., 1992. Hallan Çemi Tepesi: An Early Aceramic Neolithic Site in Eastern Anatolia: Some Preliminary Observations Concerning Material Culture. *Anatolica*, 18, pp. 1-18.

Rosenberg, M. and Redding, R.W., 2000. Hallan Çemi and Early Village Organization in Eastern Anatolia. In: I. Kuijt, ed. 2000. *Life in Neolithic Farming Communities. Social Organization, Identity, and Differentiation*. New York: Kluwer. pp. 39-61.

Rosenberg, M. and Togul, H., 1991.The Batman River Archaeological Site Survey. *Anatolica*, 17, pp. 241-254.

Rosenberg, M., Nesbitt, M., Redding, R.W. and Peasnall, B.L., 1998. Hallan Çemi, Pig Husbandry, and Post-Pleistocene Adaptations along the Taurus-Zagros Arc (Turkey). *Paléorient*, 24, pp. 25-41.

Rosenberg, M., Nesbitt, M., Redding, R.W. and Strasser, T.F., 1998. The Hallan Çemi Tepesi: Some Preliminary Observations Concerning Early Neolithic Subsistence Behaviors in Eastern Anatolia. *Anatolica*, pp. 21, 1-12.

Hilazon Tachtit (cave)

Bridault, A., Rabinovich, R., and Simmons, T., 2006. Human activities, site location and taphonomic process: A relevant combination for understanding the fauna of Eynam (Ain Mallaha), level Ib (final Natufan, Israel). In: E. Vila, L. Gourichon, A. Choyke and H. Butenhuis. 2006. *Proceedings of the 8th International Meeting of the ASWA*. Lyon, France: Maison de l'Orient et de la Méditerranée, Lyon, France. pp. 99–117.

Dubreuil, L. And Grosman, L., 2009. Ochre and hide-working at a Natufian burial place. *Antiquity*, 83(322), pp. 935-954.

Grosman, L. and Munro, N.D., 2007. The sacred and the mundane: Domestic activities at a Late Natufian burial site in the Levant. *Before Farming* 4(4), pp. 1-14.

Grosman, L., Munro, N.D. and Belfer-Cohen A., 2008. A 12,000-year-old burial from the southern Levant (Israel)- A case for early Shamanism. *Proceedings of the National Academy of Sciences*, 105(46), pp. 17665–17669.

Munro, N.D. and Grosman, L., 2010. Early evidence (ca. 12,000 B.P.) for feasting at a burial cave in Israel. *Proceedings of the National Academy of Sciences*, 107(35), pp. 15362-15366.

Winter-Livneh R., Svoray, T. and Gilead, I., 2012. Secondary burial cemeteries, visibility and land tenure: A view from the southern Levant Chalcolithic period. *Journal of Anthropological Archaeology*, 31(4), pp. 423-438.

Iraq ed-Dubb

de Vries, B., 1992. Archaeology in Jordan. *American Journal of Archaeology*, 96 (3), pp. 503-542.

Edwards, Y.H. and Martin, L., 2007. Fauna From the Natufian and PPNA Cave Site of Iraq Ed-Dubb in Highland Jordan. *Paléorient*, 33(1), pp. 143-174.

Kuijt, I., 1994. Pre-Pottery Neolithic A Settlement Variability: Evidence for Sociopolitical Developments in the Southern Levant. *Journal of Mediterranean Archaeology*, 7(2), pp. 165-192.

Kuijt, I., 2004. Pre-Pottery Neolithic A and Late Natufian at 'Iraq ed-Dubb, Jordan. *Journal of Field Archaeology*, 29(3-4), pp. 291-308.

Kuijt, I. et al., 1991. Early neolithic use of upland areas of Wadi el-Yabis: Preliminary evidence from the excavations of 'Iraq ed-dubb, Jordan. *Paléorient*, 17/(1), pp. 99-108.

Palumbo, G. et al., 1991. The Wadi el-Yabis Survey Report on the 1989 Field-Season. *Annual of the Department of Antiquities of Jordan*, 34, pp. 95-118.

Jebel Abu Thawwab

Kafafi, Z., 1985a. First Season of Excavation at Jebel Abu Thawwab, 1984. Preliminary Report. *Annual of the Department of Antiquities Jordan*, 29, pp. 31-42.

Kafafi, Z., 1985b. Late Neolithic Architecture From Jebel Abu Thawwab, 1985, Jordan. *Paléorient*, 11(1), pp. 125-127.

Kafafi, Z., 1986a. Gabal Abu Thawwab 1984. *Archiv für Orientforschung XXXIII*, pp. 156-157.

Kafafi, Z., 1986b. Gabal Abu Thawwab 1985. *Archiv für Orientforschung XXXIII*, pp. 157-158.

Kafafi, Z., 1987. Second Season of Excavation at Jebel Abu Thawwab, 1985. *Annual of the Department of Antiquities Jordan*, 30, pp. 57-69.

Kafafi, Z., 1988. Jebel Abu Thawwab: A Pottery Neolithic Village in North Jordan. In: Garrad and Gebel, eds. *The Prehistory of Jordan: The state of Research in 1986 Part ii*. Oxford: BAR International Series 396 ii, pp. 441-471.

Kafafi, Z., 1993. The Yarmoukians in Jordan. *Paléorient*, 19, pp. 101-114.

Jericho

Bar-Yosef, O., 1986. The Walls of Jericho: An Alternative Interpretation. *Current Anthropology,* 27 (2), pp. 157-162.

Burleigh, R. and Matthews, K., 1982a. British Museum natural radiocarbon measurements XIII. *Radiocarbon,* 24, pp. 151-170.

Burleigh, R. and Matthews, K., 1982b. British Museum natural radiocarbon measurements XV. *Radiocarbon,* 24, pp. 262-290.

Clutton-Brock, J., 1969. Carnivore remains from the excavations of the Jericho tell. In: Ucko and Dimbleby, eds. 1969. *The Domestication and Exploitation of Plants and Animals*. London, pp. 337-345.

Clutton-Brock, J., 1979. The mammalian remains from the Jericho tell. *Proceedings of the Prehistoric Society,* 45, pp. 135-158.

Clutton-Brock, J. and Uerpmann, H.P., 1974. The sheep of early Jericho. *Journal of Archaeological Science,* 1, pp. 261-274.

Crowfoot-Payne, J., 1983. The flint industries of Jericho. In: Kenyon and Holland, eds. 1983. *Excavations at Jericho, Volume V: The Pottery Phases of the Tell and Other Finds*. London: The British School of Archaeology in Jerusalem. pp. 622-759.

Hopf, M., 1969. Plant remains and early farming in Jericho. In: Ucko and Dimbleby, eds. 1969. *The Domestication and Exploitation of Plants and Animals.* London, pp. 355-359.

Hopf, M., 1983. Jericho Plant Remains. In: Kenyon and Holland, eds. 1983. *Excavations at Jericho, Volume V: The Pottery Phases of the Tell and Other Finds*. London: The British School of Archaeology in Jerusalem. pp. 576-621.

Kenyon, K.M., 1956. Jericho and its Setting in Near Eastern History. *Antiquity,* 30, pp. 184-197.

Kenyon, K.M., 1957. *Digging up Jericho*. London: Ernest Benn.

Kenyon, K.M., 1959. Earliest Jericho. *Antiquity,* 129, pp. 5-19.

Kenyon, K.M., 1960a. *Excavations at Jericho, Volume I: The Tombs Excavated in 1952-1954*. London: The British School of Archaeology in Jerusalem.

Kenyon, K.M., 1960b. Excavations at Jericho, 1957-58. *Palestine Exploration Quarterly,* 93, pp. 88-119.

Kenyon, K.M., 1965. *Excavations at Jericho, Volume II: The Tombs Excavated in 1955-1958*. London: The British School of Archaeology in Jerusalem.

Kenyon, K.M. and Holland, T.A, eds. 1981. *Excavations at Jericho, Volume III: The Architecture and Stratigraphy of the Tell.* London: The British School of Archaeology in Jerusalem.

Kenyon, K.M. and Holland, T.A, eds. 1983. *Excavations at Jericho, Volume V: The Pottery Phases of the Tell and Other Finds*. London: The British School of Archaeology in Jerusalem.

Kirkbride, D.V.W., 1960. A Brief Report on the Pre-Pottery Flint Cultures of Jericho. *Palestine Exploration Quarterly*, 93, pp. 114-119.

Strouhal, E., 1973. Five Plastered Skulls from Pre-Pottery Neolithic B Jericho. Anthropological Study. *Paléorient*, 1(2) pp. 231-247.

Jerf el Ahmar

Barker et al., 1969. British Museum natural radiocarbon measurements VI. *Radiocarbon*, 11, pp. 278-294.

Brenet et al., 2001. Les pierres de construction taillées en calcaire et les herminettes en silex du PPNA de Jerf el Ahmar (Syrie), analyses technologique et experimentale. In: Bourguignon et al. 2001. *Préhistoire et approche expérimentale*. Montagnac, pp. 121-164.

Fortin, M. and Aurenche, O., 1998. Espace naturel, espace habité en Syrie du Nord (10e-2e millénaires av. J-C) - Actes du Colloque fenu à l'Université Laval (Québec) du 5 au 7 mai 1997. *Canadian Society for Mesopotamian Studies* 33.

Fornite, S. and Willcox, G., 1999. Impressions of wild cereal chaff in pisé from the 10th millennium B.P. at Jerf el Ahmar and Mureybet: northern Syria. *Vegetation History and Archaeobotany*, 8 (1/2), pp. 21-24.

Mottram, M., 1991. Jerf el-Ahmar. *American Journal of Archaeology*, 95, pp. 688-689.

Mottram, M., 1997. Jerf el-Ahmar: The Chipped Stone Industry of a PPNA Site on the Middle Euphrates. *Neo-Lithics*, 1, pp. 14-16.

Raynaud, K., 1995. Fouilles de Jarf El Ahmar (Syrie), campagne 1995. *Orient-Express*, 3, pp. 76-78.

Stordeur, D., 1998. Espace naturel, espace construit à Jerf el Ahmar sur l'Euphrate. *Bulletin*, 33, pp. 93-109.

Stordeur, D., 1999. Organisation de l´espace construit et organisation sociale dans le Néolithique de Jerf el Ahmar (Syrie, Xe-IXe millénaire av. J.-C.). In: Braemer et al., eds.

1999. *Habitat et Société, XIXe Rencontres Internationales d´Archéologique et d´Histore d´Antibes*. Antibes, pp. 131-149.

Stordeur, D., 2000. Avant la ville l'appart de cultures néolithiques de Syrie. *Bulletin d'Études Orientales*, LII, pp. 31-52.

Stordeur, D., 2004. Quelques objets du Mureybetien de Jerf el-Ahmar. In: Aurenche et al., eds. 2004. *From the River to the Sea: The Paleolithic and the Neolithic on the Euphrates and the Northern Levant.* Studies in Honour of Loraine Copeland. Oxford: BAR International Series, 1263, pp. 309-322.

Stordeur, D. and Abbès, F., 2002. Du PPNA au PPNB: mise en lumière d´une phase de transition à Jerf el Ahmar (Syrie). *Bulletin de la Société Préhistorique Française,* 99, pp. 563-595.

Stordeur, D. and Jammous, B., 1995. Pierre à rainure à décor animal trouvée dans l´horizon PPNA de Jerf el Ahmar (Syrie). *Paléorient,* 21, pp. 129-130.

Stordeur, D. and Jammous, B., 1996. D'énigmatique plaquettes gravées néolithique. *Archéologia* 332, pp. 36-41.

Stordeur, D. et al., 1996. Jerf el-Ahmar: a new Mureybetian Site (PPNA) on the Middle Euphrates. *Neo-Lithics,* 2, pp. 1-22.

Stordeur, D. et al., 1997. Un nuveau site sur le Moyen-Euphrate. *Bulletin de la Société Préhistorique Française*, 93, pp. 1-44.

Stordeur et al., 2000. Jerf el Ahmar ein in einem Stausee untergegangenes neolithisches Denkmal. Rettung eines Kulturerbes. In: A. Weyer, ed. 2000. *Rettung des Kulturerbes. Projekte rund ums Mittelmeer / Sauvetage du patrimoine culturel*. Projets autour de la Méditerranée. Hamburg: Glöss Verlag. pp. 85-100.

Stordeur et al. 2001. Les bâtiments communautaires de Jerf el Ahmar et Mureybet Horizon PPNA (Syrie). *Paléorient*, 26(1), pp. 29-44.

Willcox, G., 2002. Charred plant remains from a 10th millennium B.P. kitchen at Jerf el Ahmar (Syria). *Vegetation History and Archaeobotany*, 11, pp. 55-60.

Yartah, T. et al., 2000. Un site néolithique englouti sous un lac de barrage. Une opération de sauvetage du patrimoine. In: A. Weyer, ed. 2000. *Rettung des Kulturerbes. Projekte rund ums Mittelmeer / Sauvetage du patrimoine culturel*. Projets autour de la Méditerranée. Hamburg: Glöss Verlag. pp. 85-100.

Kfar Hahoresh

Goring-Morris, A.N., 1994. Aspects of the PPNB Lithic Industry at Kfar HaHoresh, near Nazareth, Israel. In: Gebel and Kozłowski, eds. 1994. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1*. Berlin: Ex Oriente. pp. 427-444.

Goring-Morris, A.N., 2000. The Quick and the Dead. Social Context of Aceramic Neolithic Mortuary Practices as Sees from Kfar HaHoresh. In: Kuijt, ed. *Life in Neolithic Farming Communities. Social Organization, Identity, and Differentiation.* New York: Kluwer. pp. 103-136.

Goring-Morris, A.N. et al., 1995. The 1992 Season of the Excavation at the Pre-Pottery Neolithic B Settlement of Kfar Hahoresh. Mitekufat Haeven. *Journal of the Israel Prehistoric Society*, 26, pp. 74-121.

Horwitz L.K., and Goring-Morris N., 2004. – Animals and Ritual During the Levantine PPNB: A Case Study from the site of Kfar Hahoresh, Israel. *Anthropozoologica,* 39(1), pp. 165-178.

Twiss, K.C., 2008. Transformations in an Early Agricultural Society: Feasting in the Southern Levantine Pre-Pottery Neolithic. *Journal of Anthropological Archaeology*, 27, pp. 418-442.

Kharaneh IV

Damick, A., 2011. Landscapes of the Past: Place, Space, and the Construction of Meaning in the Azraq Community Archaeology Project. *Bulletin of the Council for British Research in the Levant* 6(1)

Maher, L.A. et al., 2012. Twenty-Thousand-Tear-Old Huts at a Hunter-Gatherer Settlement in Eastern Jordan. PloS ONE 7(2), pp. 1-10.

Maher, L. and Richter, T., 2007. Archaeological survey at the Epipalaeolithic site of Kharaneh IV. Annual of the Department of Antiquities of Jordan

Maher, L., Richter, T., Stock, J. and Jones, M., i.p. Preliminary Results from Recent Excavations at the Epipalaeolithic Site of Kharaneh IV. In: F. Khraysheh and G. Rollefson, eds. *Jordan's Prehistory: Past and Future Research. Amman.* Department of Antiquities of Jordan

Martin, L. et al., 2010. Hunting Practices at an Eastern Jordanian Epipalaeolithic Aggregation Site: The Case of Kharaneh IV. *Levant,* 42 (2), pp. 107-135.

Muheisen, M., 1985. L'Épipaléolithique dans le gisement de Kharaneh IV. *Paléorient*, 11(2), pp. 149-160.

Muheisen, M., 1988a. The Epipalaeolithic Phases of Karaneh IV. In: Garrard and Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986.* Oxford: BAR International Series, 396. pp. 353-367.

Muheisen, M., 1988b. Survey of prehistoric cave sites in the northern Jordan Valley (1985). In: Garrard and Gebel, eds. *The Prehistory of Jordan. The State of Research in 1986*. Oxford: BAR International Series, 396. pp. 503-523.

Muheisen, M., 1988c. Le Gisement de Kharaneh IV. Note sommaire sur la phase D. *Paléorient*, 14 (2), pp. 265-269.

Khirbet Hammam

Peterson, J.D., 2000. Origins and Development of an Early agricultural village in west-central Jordan: mapping and preliminary test excavations at Khirbet Hammam in the Wadi el-Hasa, Jordan. *American Schools of Oriental Research Newsletter*, 50(24).

Peterson, J.D., 2004. Khirbet Hammam (WHS 149): A Late Pre-Pottery Neolithic B Settlement in the Wadi el-Hasa, Jordan. *Bulletin of the American Schools of Oriental Research*, 334, pp. 1-18.

Rollefson, G.O. and Kafafi, Z., 1985. Z. Khirbet Hammam: A PPNB Village in the Wadi el-Hasa, Southern Jordan. *Bulletin of the American Schools of Oriental Research*, 258, pp. 63-69.

Kortik

Algaze, G. et al., 1994. The Tigris-Euphrates archaeological reconnaissance project: final report of the Birecik and Carkemish Dam survey areas. *Anatolica*, 20, pp. 1-96.

Özkaya, V. et al., 2002 Kortik Tepe 2000. In: P. Velibeyoğlu, ed. 2002. *Ilısu ve Karkamış Baraj Gölleri Altında Kalacak Arkeolojik Kültür Varlıklarını Kurtarma Projesi 2000 Yılı Çalışmaları*. Ankara: ODTÜ (TAÇDAM), pp. 752-759.

Mureybit (Mureybet)

Cauvin, M.C., 2004. Mureybet. In: Aurenche et al., eds. 2004. *From the River to the Sea: The Paleolithic and the Neolithic on the Euphrates and the Northern Levant. Studies in Honour of Loraine Copeland*. Oxford: BAR International Series, 1263, pp. 323-334.

Colledge, S., 2002. Identification Pre-domestication Cultivation in the Archaeobotanical Record Using Multivariate Analysis: Presenting the Case for Quantification. In: Cappers and Bottema, eds. 2002. *The Dawn of Farming in the Near East, Studies in Early Near Eastern Production, Subsistence and Environment* 6. Berlin: Ex Oriente. pp. 141-152.

Ducos, P., 1975. A new Find of an Equid Metatarsal Bone from Tell Mureybet in Syria and its Relevance to the Identification of Equids from the Early Holocene of the Levant. *Journal of Archaeological Science*, 2, pp. 71-73.

Skinner, J.H., 1968. The Oriental Institute Excavations at Mureybit, Syria: Preliminary Report on the 1965 Campaign, Part II: Chipped Stone Finds. *Journal of Near Eastern Studies* 27(4), pp. 282-290.

Van Loon, 1966. Mureybat: An Early Village in Inland Syria. *Archaeology* 19, pp. 215-216.

Van Loon, 1968. The Oriental Institute Excavations at Mureybet, Syria. Preliminary Report on the 1965 Campaign. Architecture and General Finds. *Journal of Near Eastern Studies* 27, pp. 265-282.

Van Zeit, W. and Bakker-Heeres J.A.H., 1984. Archaeobotanical Studies in the Levant 3. Late-Palaeolithic Mureybit. *Palaeohistoria*, 26, pp. 171-199.

Willcox, G. and Fornite, S. 1999. Impressions of wild cereal chaff in pisé from the 10th millennium uncal B.P. at Jerf et Ahmar and Mureybet: Northern Syria. *Vegetation History and Archaeobotany* 8 (1–2), pp. 21–24.

Nemrik 9

Kozlowski, S.K., 1989. Nemrik 9, A PPN Neolithic Site in Northern Iraq. *Paléorient*, 15(1), pp. 25-31.

Kozlowski, S.K., 1994. Radiocarbon Dates from Aceramic Iraq. *Radiocarbon*, 36, pp. 255-264.

Kozlowski, S.K., 2002. *Nemrik. An Aceramic Village in Northern Iraq*. Warsaw: Institute of Archaeology, Warsaw University.

Koslowski, S. and Kempisty, A., 1990. Architecture of the pre-pottery Neolithic Settlement in Nemrik, Iraq. *World Archaeology*, 21, pp. 348-362.

Kozlowski, S.K. and Szymczak, K., 1989. Flint Industry from House 1/1A/1B at the PPN Site in Nemrik 9, Northern Iraq. *Paléorient*, 15(1), pp. 32-42.

Mazurowski, R.F., 1994. Flint Balls and Chopper/Chopping Tools from Nemrik 9 and Tell M´lefaat. In: Gebel and Kozłowski, eds. *Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1*. Berlin: Ex Oriente. pp. 173-188.

Bar-Yosef, O., 1980. A human figurine from a Khiamian site in the Lower Jordan Valley. *Paléorient*, 6, pp. 193-199.

Bar-Yosef, O. and Gopher, A., 1997a. The Excavation of Netiv Hagdud. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud.* Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 41-69.

Bar-Yosef, O. and Gopher, A., 1997b. Discussion. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 247-266.

Bar-Yosef, O. and Gopher, A., 1997c. Miscellaneous Finds: The Human Figurines from the Netiv Hagdud. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud.* Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 177-180.

Bar-Yosef, O. and Gopher, A., eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43.

Bar-Yosef, O. and Kislev, M.E., 1986. Earliest domesticated barley in the Jordan Valley. *National Geographic Research*, 2, p.257.

Bar-Yosef, O. et al., 1980. Netiv Hagdud: A "Sultanian" mound in the Lower Jordan Valley. *Paléorient*, 6, pp. 201-206.

Bar-Yosef, O. et al., 1991. Netiv Hagdud: An Early Neolithic Village Site in the Jordan Valley. *Journal of Field Archaeology*, 18(4), pp. 405-424.

Campana, D.V., 1997. Miscellaneous Finds: The Bone Artefacts from Netiv Hagdud. In: Bar-Yosef and Gopher, eds. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 181-188.

Gopher, A., 1997. Groundstone Tools and Other Objects from Netiv Hagdud. In: Bar-Yosef and Gopher, eds. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud.* Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 151-176.

Gowlett, J.A.J. and Hedges, R.E.M., 1987. Radiocarbon Dating by Accelerator Mass Spectrometry. Applications to Archaeology in the Near East. In: Aurenche et al., eds. 1987. *Chronologies in the Near East: relative chronologies and absolute chronology 16.000-4.000 B.P*. Oxford: BAR International Series 379, pp. 121-144.

Hovers, E., 1997. The Physical Environment of Netiv Hagdud. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 1-11.

Kislev, M.E., 1986. Emergence of wheat agriculture. *Paléorient*, 10, pp. 61-70.

Kisler, M.E., 1997. Early Agriculture and Paleoecology of Netiv Hagdud. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 208-236.

Kislev, M.E. et al., 1986. Early neolithic domestication of wild barley from the Netiv Hagdud region of the Jordan Valley. Israel. *Journal of Botany*, 35, pp. 197-201.

Kuijt, I. and Bar-Yosef, O., 1994. Radiocarbon Chronology for the Levantine Neolithic: Observations and Data. *Radiocarbon*, 36, pp. 227-245.

Nadel, D., 1997. The Chipped Stone Industry of Netiv Hagdud. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*, Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 71-149.

Tchernov, E., 1994. An early Neolithic village in the Jordan Valley. Part II. The fauna of Netiv Hagdud. *American School of Prehistoric Research*. Bulletin 44

Tchernov, E., 1997. The Fauna of Netiv Hagdud: A Summary. In: Bar-Yosef and Gopher, eds. 1997. *An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud*. Cambridge, MA: American School of Prehistoric Research. Bulletin 43, pp. 237-245.

Nevalı Çori

Beile, M., 1996. The Glossed Blades from Nevalı Çori: Preliminary Results. In: Kozlowski and Gebel, eds. 1996. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment*, 3. Berlin: Ex Oriente, pp. 331-340.

Forest, J.D., 1996. Le PPNB de Çayönü et de Nevalı Çori: pour une approche archeo-ethnologique de la néolithisation du Proche-Orient Anatolia. *Antiqua*, 4, pp. 1-31.

Hauptmann, H., 1984. Recent archaeological research in Turkey: Nevalla Çori. *Anatolian Studies*, 34, p. 228.

Hauptmann, H., 1991/92. Nevalı Çori: Eine Siedlung des akeramischen Neolithikums am mittleren Euphrat (1991/92). *Nürnberger Blätter* 8/9, pp. 15-33.

Hauptmann, H., 1998. Nevalı Çori. Architektur. *Anatolica*, 15, pp. 99-110.

Hauptmann, H., 1990.,Nevalı Çori. *American Journal of Archaeology*, 94, pp. 127-129.

Hauptmann, H., 1992. Nevalı Çori. *American Journal of Archaeology*, 96, pp. 123-124.

Hauptmann, H., 1997. Nevalı Çori, Bd. 4. In: E.M. Meyers, ed. 1997. *The Oxford encyclopedia of archaeology in the Near East, prepared under the auspices of the American School of Oriental Research*. New York, Oxford.

Hauptmann, H., 1988. Nevalı Çori: Architektur. *Anatolica*, 15, pp. 99-110.

Hauptmann, H., 1999. The Urfa Region. In: M. Özdoğan and Başgelen, eds. 1999. *Neolithic in Turkey. The Cradle of Civilizatio*n. Istanbul: New Discoveries, pp. 65-86.

Hauptmann, H. and Schmidt, K., 2000. Frühe Tempel - frühe Götter? *DAI 2000, Archäologische Entdeckungen. Die Forschungen des Deutschen Archäologischen Instituts im 20*. Jahrhundert. Mainz, pp. 258-266.

Morsch, M., 2002. Magic figurines? Some Remarks About the Clay Objects of Nevali Çori. In: Gebel et al., eds. 2002. *Magic Practices and Ritual in the Near Eastern Neolithic, Studies in Early Near Eastern Production, Subsistence and Environment,* 8. Berlin: Ex Oriente, pp. 145-162.

Schmidt, K., 1996. Nevalı Çori. Chronology and Intrasite Distribution of Lithic Tool Classes. Preliminary Results. In: Kozłowski and Gebel, eds. 1996. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment,* 3. Berlin: Ex Oriente, pp, 363-376.

Schmidt, K. and Hauptmann, H., 2003. Göbekli Tepe et Nevali Çori. *Dossiers d'Archéologie,* 281, pp. 60-67.

Neve David

Bar-Oz, G. and Dayan, T., 1999. The Epipalaeolithic Faunal Sequence in Israel: A View from Neve David. *Journal of Archaeological Science,* 26, pp. 67–82.

Bar-Yosef, O. and Vogel, J.C., 1987. Relative and Absolute Chronology of the Epi-Palaeolithic in the Southern Levant. In: Aurenche et al., eds. 1987. *Chronologies in the Near East: relative chronologies and absolute chronology 16.000-4.000 B.P*. Oxford: BAR, International Series 379. pp. 219-245.

Kaufmann, D., 1987. Excavations at the Geometric Kebaran Site of Neve David, Israel. A preliminary report. *Quartär*, 37/38, pp. 189-199.

Kaufmann, D., 1988. New radiocarbon dates for the Geometric Kebaran. *Paléorient,* 14, pp. 107-109.

Kaufmann, D., 1989. Observations on the Geometric Kebaran: A view from Neve David. In: Bar-Yosef and Vandermeersch, eds. 1989. *Investigations in South Levantine Prehistory*. Oxford: BAR International Series, 479. pp. 275-284.

Ohalo II

Bar-Yosef, O. and Nadel, D., 1988. Ohalo - A prehistoric site in the Sea of Galilee. *Journal of the Israel Prehistoric Society,* 21, pp. 87-94.

Hershkovitz, I. et al., 1995. Ohalo II H2: A 19,000-Year-OldSkeleton From a Water-Logged Site at the Sea of Galilee. Israel *Journal of Physical Anthropology,* 96, pp. 215-236.

Kislev, M.E., et al., 1992. Epipalaeolithic (19,000 BP) Cereal and Fruit diet at Ohalo II, Sea of Galilee, Israel. *Review of Palaeobotany and Palynology,* 73, pp. 161-166.

Nadel, D., 1994. Levantine Upper Palaeolithic - Early Epipalaeolithic Burial Customs: Ohalo II as a Case Study. *Paléorient,* 20(1), pp. 113-121.

Nadel, D. and Hershkovitz, I., 1991. New Subsistence Data and Human Remains from the Earliest Levantine Epipalaeolithic. *Current Anthropology,* 32(5), pp. 631-635.

Nadel, D. and Werker, E., 1999. The oldest ever brush hut plant remains from Ohalo II, Jordan Valley, Israel. *Antiquity,* 73, pp. 755-764.

Nadel, D. et al., 1994. 19,000-Year-Old Twisted Fibers From Ohalo II. *Current Anthropology* 35(4), pp. 451-458.

Nadel, D. et al., 1995. Radiocarbon Dating of Ohalo II: Archaeological and Methodological Implications. *Journal of Archaeological Science,* 22(6), pp. 811-822.

Nadel, D. et al., 2001. New Dates from Submerged Late Pleistocene in the Southern Sea of Galilee, Israel. *Radiocarbon,* 43, pp. 1167-1178.

Nadel, D. et al., 2006. Wooden objects from Ohalo II (23,000 cal BP), Jordan Valley, Israel. *Journal of Human Evolution, 50,* pp. 644-662.

Salibiya IX

Bar-Yosef. O., 1986. A human figurine from a Khiamian site in the Lower Jordan Valley *Paléorient,* 6, pp. 193-199.

Bar-Yosef. O., 1991. Raw Material Exploitation in the Levantine Epipalaeolithic. In: Montet-White and Holen, eds. 1991. *Raw Material Economies among Prehistoric Hunter-Gatherers.* Lawrence, Kansas. University of Kansas, Publications in Anthropology 19. pp. 235-250.

Enoch-Shiloh, D. and Bar-Yosef, O., 1997 Salibya IX. In: Bar-Yosef and Gopher, eds. 1997. An Early Neolithic Village in the Jordan Valley. Part I. The Archaeology of Netiv Hagdud. Cambridge, MA: American School of Prehistoric Research. Bulletin 43. pp. 13-40.

Kuijt, I. and Bar-Yosef, O., 1994. Radiocarbon Chronology for the Levantine Neolithic: Observations and Data. *Radiocarbon,* 36, pp. 227-245.

Akkermans, P.M.M.G. and Schwartz, G.M., 2003. *The archaeology of Syria: from Complex Hunter-Gatherers to Early Urban Societies (c. 16,000-300 BC)*. Cambridge: University Press.

de Contenson, H., 1972. Tell Aswad. Fouilles de 1971. *Annales Archéologiques Arabes Syriennes,* XXII, pp. 75-84.

de Contenson, H., 1973. Chronologie absolue de Tell Aswad. *Bulletin de la Société Préhistorique Française,* 70, pp. 253-255.

de Contenson, H., 1974. Tell Aswad, site néolithique précéramique près de Damas (Syria). *Bulletin de la Société Préhistorique Française,* 71, pp. 5-6.

de Contenson, H., 1976. Précisions sur la stratigraphie de Tell Aswad (Syria). *Bulletin de la Société Préhistorique Française,* 73, pp. 198-199.

de Contenson, H., 1977-78. Tell Aswad. Fouilles de 1972. *Annales Archéologiques Arabes Syriennes, XXVII-XXVIII,* pp. 207-215.

de Contenson, H., 1978/79. Tell Aswad. *Archiv für Orientforschung XXVI,* pp. 151-152.

de Contenson, H., 1979. Tell Aswad (Damascène). *Paléorient,* 5, pp. 153-156.

de Contenson, H., 1989. L'Aswadien, un nouveau faciès du Néolithique syrien. *Paléorient,* 15(1), pp. 259-261.

de Contenson, H. 2007. Nouvelles données sur Tell Aswad et l'Aswadien (Damascène), *Syria,* 84, pp. 307-308.

Delibrias, G. et al., 1982. GIF Natural Radiocarbon Measurements IX. *Radiocarbon,* 24, pp. 291-343.

Harris. D.R., 1996. The origins and spread of agriculture and pastoralism in Eurasia. *Psychology Press*, pp. 207–223.

Kuijt, I., 1997. Trying to Fit Round Houses Into Square Holes: Reexamining the Timing of the South-Central Levantine Pre-Pottery Neolithic A and Pre-Pottery Neolithic B Cultural Transition. In: Gebel et al, eds. 1997. *The Prehistory of Jordan II: Perspectives from 1997, Studies in Early Near Eastern Production, Subsistence and Environment 4.* Berlin: Ex Oriente. pp. 193-202.

Stordeur, D., 2003a. Des crânes surmodelés à Tell Aswad de Damascène. (PPNB - Syrie). *Paléorient*, 29/2, pp. 109-116.

Stordeur, D., 2003b. Tell Aswad. Resultats préliminaires des campagnes 2001 et 2002. *Neo-Lithics*, 1/2003, pp. 7-15.

Stordeur, D. and Khawam, R., 2007. Les crânes surmodelés de Tell Aswad (PPNB, Syrie). Premier regard sur l'ensemble, premières réflexions. *Syria* 84, pp. 5-32.

Stordeur, D. et al., 2006. L'aire funéraire de Tell Aswad (PPNB). In: Huot et Stordeur, eds. Hommage à H. de Contenson. *Syria*, 83, pp. 39-62.

Van Zeist, W. and Bakker-Heeres, J.A.H., 1982. Archaeobotanical Studies in the Levant 1. Neolithic Sites in the Damascus Basin: Aswad, Ghoraifé, Ramad. *Palaeohistoria* 24, pp. 165-256.

Tell el-Kerkh I and II

Iwasaki, T. and Tsuneki, A., 2003. *Archaeology of the Rouj Basin. A Regional Study of the Transition from Village to City in Northwest Syria Al-Shark 2*. Ibaraki: University of Tsukuba, Studies for Western Asian Archaeology, Ibaraki.

Maeda, O., 2003. A Large Obsidian Core from Tell el-Kerkh, Northwest Syria. Neo-Lithics, 1, pp. 1-3.

Taniguchi et al., 2002. First Fake? Imitation turquoise Beads Recovered from a Syrian Neolithic Site, Tell er Kerkh. *Studies in Conservation*, 47/3, pp. 175-184.

Tsuneki, A., 1999. Tell el-Kerkh 1997. *Chronique Archéologique en Syrie, 2, 1998*. Le Ministere de la Culture et la Direction Generale des Antiquites et de Musees, pp. 141-142.

Tsuneki, A. and Myiake, Y., 1996. The Earliest Pottery Sequence of the Levant: New Data from Tell el-Kerkh 2, Northern Syria. *Paléorient*, 22/1, pp. 109-123.

Tsuneki, A. et al., 1995. The Prehistory of the Rouj Basin, Northwest Syria. A Preliminary Report. *Anatolica*, 21, pp. 143-187.

Tsuneki, A. et al., 1997. First Preliminary Report of the Excavations at Tell el-Kerkh (1997), Northwestern Syria. *Bulletin of the Ancient Orient Museum*, XVIII, pp. 1-40.

Tsuneki, A. et al., 1998. Second Preliminary Report of the Excavations at Tell el-Kerkh (1998), Northwestern Syria. *Bulletin of the Ancient Orient Museum*, XIX, pp. 1-40.

Tsuneki, A. et al., 1999. Third Preliminary Report of the Excavations at Tell el-Kerkh (1999), Northwestern Syria. *Bulletin of the Ancient Orient Museum*, XX, pp. 1-32.

Tell Halula

Cruells, W., 1996. La cerámica pintada Halaf. In: Molist, ed. *Tell Halula (Siria). Un yacimiento neolítico del valle medio del Eufrates. Campañas 1991 y 1992*. Madrid: Instituto del Patrimonio Histórico Español. Ministerio de Cultura. pp. 99-114.

Guerrero, E. et al. 2009. Seated Memory: New Insights into Near Eastern Neolithic Mortuary Variability from TellHalula, Syria. *Current Anthropology*, 50 (3), pp. 379-391.

Kuijt, I. et al., 2011. The changing Neolithic household: Household autonomy and social segmentation,Tell Halula, Syria. *Journal of Anthropological Archaeology*, 30, pp. 502-522.

Molist, M., 1998. Des représentations humaines peintes au IXe millénaire BP sur le site de Tell Halula (Vallée de l´Euphrate, Syrie). Notice Préliminaire. *Paléorient*, 24, pp. 81-87.

Molist, M. and Ferrer, A., 1996. Industries Lithiques de la Période 8000-7500 B.P. à Halula (Moyen Euphrate Syrien). In: Kozłowski and Gebel, eds. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment* 3. Berlin: Ex Oriente. pp. 431-442.

Molist, M. et al., 1994. Étude préliminaire sur les industries lithiques du PPNB moyen et récent de Tell Halula (Haute Vallée de l´Euphrate, Syrie). In: Kozłowski and Gebel, eds. *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions, Studies in Early Near Eastern Production, Subsistence and Environment* 3. Berlin: Ex Oriente. pp. 349-362.

Molist, M. et al., 2001. Élaboration et usage de'industrie taillée de Tell Halula (Syrie du Nord) depuis le 8700 jusqu'à 7500 b.p.: état de la recherché. In: Caneva et al., eds. *Beyond Tools. Redefining the PPN Lithic Assemblages of the Levant. Proceedings of the Third Workshop on PPN Chipped Lithic Industries (Ca'Foscari University of Venice, Nov. 1998), Studies in Early Near Eastern Production, Subsistence and Environment* 9. Berlin: Ex Oriente. pp. 243-256.

Tell Ramad (Ramad)

Akkermans, P.M.M.G. and Schwartz, G.M., 2003. *The archaeology of Syria: from Complex Hunter-Gatherers to Early Urban Societies (c. 16,000-300 BC*). Cambridge: University Press

de Contenson, H., 1966. Découvertes récentes dans la domaine du Néolithique en Syrie. *L'Anthropologie*, 70, pp. 388-391.

de Contenson, H. and van Liere, W.J., 1964. Sondages à Tell Ramad en 1963: rapport préliminaire. *Annales Archéologiques Arabes Syriennes*, 16, p. 190.

de Contenson, H. and van Liere, W.J., 1966. Premiers pas vers une chronologie absolue à Tell Ramad. *Annales Archéologiques Arabes Syriennes*, 16, pp. 175-176.

de Contenson, H. et al., eds. 2000. *Ramad. Site Néolitique en Damascène (Syrie) aux VIIIe et VIIe Millénaires Avant l´Ère Chrétienne*. Beirut: Bibliothèque Archéologique et Histoire, 157.

de Contenson, H., 1977. Le Néolithique de Ras Shamra V, d`après les campagnes 1972-1976 dans le sondage SH. *Syria*, 54, pp. 1-23.

Ferembach, D., 1969. Étude anthropologique des ossements humains néolithiques Tell Ramad (Syrie). *Annales archéologiques de Syrie*, 19, pp. 49-70.

Moore, A.M.T., 1978. *The Neolithic of the Levant*. Unpublished Ph.D. Thesis. Oxford University. pp. 192-198.

van Liere, W.J. and de Contenson, H., 1963. A Note on Fife Early Neolithic Sites in Inland Syria. *Annales archéologiques de Syrie*, 13, pp. 175-209.

van Zeist, W. and Bakker-Heeres, J.A.H., 1982. Archaeobotanical Studies in the Levant 1. Neolithic Sites in the Damascus Basin: Aswad, Ghoraifé, Ramad. *Palaeohistoria*, 24, pp. 165-256.

Tell Sabi Abyad

Akkermans, P.M.M.G., 1987. Late Neolithic and Early Halaf Village at Sabi Abyad, Northern Syria. *Paléorient*, 13, pp. 23-40.

Akkermans, P.M.M.G., 1988. Tell Sabi Abyad: 1986 Campaign. *Syria*, 65, pp. 399-401.

Akkermans, P.M.M.G., 1989. *Excavations at Tell Sabi Abyad - Prehistoric Investigations in the Balikh Valley, Northern Syria*. Oxford: BAR, International Series 468.

Akkermans, P.M.M.G., 1991. Sabi Abyad. *American Journal of Archaeology*, 95, pp. 695-697.

Akkermans, P.M.M.G., 1996. *Tell Sabi Abyad. The Late Neolithic Settlement. Report on the Excavations of the University of Amsterdam (1988) and the National Museum of Antiquities Leiden (1991-1993) in Syria*. Istanbul: Nederlands-Historisch Archaeologisch Instituut.

Akkermans, P.M.M.G., 1997. Excavations at Tell Sabi Abyad, 1996. *Orient-Express*, 2, pp.n38-40.

Akkermans, P.M.M.G., 1998. The 1997 Excavations at Tell Sabi Abyad, Syria. *Orient-Express*, 1, pp. 11-12.

Akkermans, P.M.M.G. and Duistermatt, K., 1997. Of Storage and Nomads - The Sealings from Late Neolithic Sabi Abyad, Syria. *Paléorient*, 22, pp. 17-44.

Akkermans, P.M.M.G. and Duistermatt, K., 2004. More Seals and Sealings from Neolithic Tell Sabi Abyad, Syria. *Levant*, 36, pp. 1-12.

Akkermans, P.M.M.G. and Le Mière, M., 1992. The 1988 Excavations at Tell Sabi Abyad, a Later Neolithic Village in Northern Syria. *American Journal of Archaeology*, 96, pp. 1-22.

Akkermans, P.M.M.G. and Verhoeven, M., 1995. An Image of Complexity - The Burnt Village at Late Neolithic Sabi Abyad, Syria. *American Journal of Archaeology*, 99, pp. 5-32.

Akkermans, P.M.M.G. et al., 2006. Investigating the Early Pottery Neolithic of Northern Syria: New Evidence from Tell Sabi Abyad. *American Journal of Archaeology*, 110, pp. 1-35.

Cavallo, C., 1997. Animal Remains Enclosed in Oval Clay Objects from the "Burnt Village" of Tell Sabi Abyad, Northern Syria. *Anthropozoologica*, 25-27, pp. 663-670.

Cavallo, C., 2000. *Animals in the Steppe - A Zooarchaeological Analysis of Later Neolithic Tell Sabi Abyad, Syria*. Oxford: BAR, International Series, 891.

Connan, J. et al., 2004. Bitumen in Early Ceramic Art: Bitumen-Painted Ceramics from Late Neolithic Tell Sabi Abyad (Syria). *Archaeometry*, 46, pp. 115-124.

Duistermaat, K. and Schneider, G., 1998. Chemical Analysis of Sealing Clays and the Use of Administrative Artefacts at Late Neolithic Tell Sabi Abyad (Syria). *Paléorient*, 24(1), pp. 89-106.

Nieuwenhuyse, O.P., 1996a. Late Neolithic Settlement in the Upper-Khabur, Syria. A Regional Survey Project. *Orient-Express*, 1, pp. 16-17.

Nieuwenhuyse, O.P., 1996b. The Later Halaf Period (Balikh IIIC) on Tell Sabi Abyad, Syria *Orient-Express*, 2, pp. 52-53.

Nieuwenhuyse, O.P., 1997. The Prehistoric Pottery of Tell Sabi Abyad 1996: an Interim Report. *Orient Express*, 2, pp. 60-61.

Nieuwenhuyse, O.P. et al., 2003. Painting Pots with Bitumen at Late Neolithic Tell Sabi Abyad (Syria). *Neo-Lithics*, 2/2003, pp. 22-25.

Verhoeven, M., 1999a. Space and Society at Neolithic Tell Sabi Abyad. *Orient-Express*, 2, pp. 57-59.

Verhoeven, M., 1999b. Traces and Spaces - Microwear Analysis and Spatial Context of Later Neolithic Flint Tools from Tell Sabi Abyad, Syria. *Paléorient*, 25(2), pp. 145-166.

Verhoeven, M., 2000. Death, Fire and Abandonment: Ritual Practice at Later Neolithic Tell Sabi Abyad, Syria. *Archaeological Dialogues*, 7(1), pp. 46-83.

Verhoeven, M., 2004. A Tale of Two Tells Comparing Neolithic Lifestyles at Tell Sabi Abyad II and Tell Sabi Abyad I, Northern Syria. In: Aurenche et al., eds. *From the River to the Sea: The Paleolithic and the Neolithic on the Euphrates and the Northern Levant.*

Studies in Honour of Loraine Copeland. Oxford: BAR International Series 1263. pp. 367-382.

Tell Qaramel

Kanjou, Y. et al., 2013. Neolithic Village of Tell Qaramel. *International Journal of Osteoarchaeology*

Kanjou, Y., 2009. Study of Neolithic human graves from Tell Qaramel in Northern Syria. *International Journal of Modern Anthropology*, 2, pp. 25–37.

Mazurowski, R.F., 1999. Tell Qaramel: Preliminary report on the first season, 1999. *Polish Archaeology in the Mediterranean*, 11, pp. 285–296.

Mazurowski, R.F., 2007. *Pre- and Protohistory in the Near East: Tell Qaramel (Syria). Newsletter 2006*. Polish Centre of Mediterranean Archaeology, Warsaw University.

Mazurowski, R.F. and Kanjou, Y., 2012. *Tell Qaramel 1999–2007. Protoneolithic and Early Pre-pottery Neolithic Settlement in Northern Syria*. Warsaw: Polish Centre of Mediterranean.

Mazurowski, R.F. et al., 2009. Chronology of the Early Pre-Pottery Neolithic Settlement Tell Qaramel, Northern Syria, in the Light of Radiocarbon Dating. *Radiocarbon*, 51(2), pp. 771–781.

Wadi el Hammeh (EL Hammeh, Wadi Hammeh, Wadi al Hammeh)

Asouti, E. and Fuller, D.Q., 2012. From foraging to farming in the southern Levant: the development of Epipalaeolithic and Pre-Pottery Neolithic plant management strategies. *Vegetation History and Archaeobotany*, 21(2), pp. 149-162.

Edwards, P.C., 1988. Natufian Settlement in Wadi Al-Hammeh. *Paléorient*, 14(2), pp. 309-315.

Edwards, P.C. and Webb, S.G., 2002 The Natufian human skeletal remains from Wadi Hammeh 27 (Jordan). *Paléorient*, 28(1), pp. 103-123.

Edwards, P.C., Bourke, S.J., Colledge, S.M., Head, H. and Macumber, P.G., 1988. Late Pleistocene Prehistory in the Wadi al-Hammeh, Jordan Valley. *The Prehistory of Jordan*, 1988.

Hardy-Smith, T. and Edwards, P.C., 2004. The Garbage Crisis in prehistory: artefact discard patterns at the Early Natufian site of Wadi Hammeh 27 and the origins of household refuse disposal strategies. *Journal of Anthropological Archaeology*, 23, pp. 253-289.

Makarewicz, C.N. et al., 2006. El Hemmeh: A Multi-Period Pre-Pottery Neolithic Site in the Wadi el- Hammeh, Jordan. *Eurasian Prehistory*, 1(2), pp. 183-220.

White, C.E. and Makarewicz, C.A., 2012. Harvesting Practices and Early Neolithic Barley Cultivation at el-Hemmeh, Jordan. *Vegetation History and Archaeoabotany,* 21, pp. 85-94.

Wadi el-Jilat

Baird, D., 1994. Chipped Stone Production Technology from the Azraq Project Neolithic Sites. In: Gebel and Kozlowski, eds. 1994. *Neolithic Chipped Stone Industries of the Fertile Crescent, Studies in Early Near Eastern Production, Subsistence and Environment 1*. Berlin: Ex Oriente, pp. 525-541.

Baird, D., 1995. Chipped Stone Raw Material Procurement and Selection in the Neolithic Azraq Basin: Implications for Levantine Neolithic Cultural Developments. In: Amr et al., eds. 1995. *Studies in the History and Archaeology of Jordan V.* Amman: Department of Antiquities of Jordan. pp. 505-514.

Betts, A.V.G. et al., 1998. *The Harra and the Hamad: Excavations and Surveys in Eastern Jordan, 1*. Sheffield Archaeological Monographs 9. Sheffield: Sheffield Academic Press.

Byrd, B.F. and Garrard, A., 1992. New Dimensions to the Epipalaeolithic of Wadi el-Jilat in Cenbtal Jordan. *Paléorient,* 18(1), pp. 47-52.

Garrard, A. et al., 1987a. Prehistoric Environment and Settlement in the Azraq Basin: An Interim Report on the 1984 Excavation Season. *Levant,* 18(20), pp. 5-24.

Garrard, A. et al., 1987b. Prehistoric Environment and Settlement in the Azraq Basin: an Interim Report on the 1985 Excavation Season. *Levant,* 9(21), pp. 5-25.

Harris, D.R., ed. 1997. *The Origins and Spread Of Agriculture And Pastoralism In Eurasia*. London: University College London. pp. 524-537.

Martin, L., 1999. Mammal Remains from the Eastern Jordanian Neolithic, and the Nature of Caprine Herding in the Steepe. *Paléorient,* 25(2), pp. 87-104.

Powell, A., 1992. *An Analysis of the Animal Bones from Area B, Wadi El-Jilat 13, a Late Neolithic Site from Northeast Jordan*. Sheffield: University of Sheffield

Wadi Faynan

Barker, G.W. et al., 1997. The Wadi Faynan Project, Southern Jordan: a Preliminary Report on Geomorphology and Landscape Archaeology. *Levant*, 29(22), pp. 19-40.

Barker, G.W. et al., 1998. Environment and Land Use in the Wadi Faynan, Southern Jordan: the Second Season of Geoarchaeology and Landscape Archaeology (1997). *Levant*, 30(21), pp. 5-25.

Barker, G.W. et al., 1999. Environment and Land Use in the Wadi Faynan, Southern Jordan: the Third Season of Geoarchaeology and Landscape Archaeology (1998). *Levant*, 31(38), pp. 255-292.

Barker, G.W. et al., 2000. Archaeology and Desertification in the Wadi Faynan: the Fourth (1999) Season of the Wadi Faynan Landscape Survey. *Levant*, 32(26), pp. 27-52.

Findlater, G., 1998. The Wadi Faynan Project: the South Cemetery Excavation, Jordan 1996: A Preliminary Report. *Levant*, 30(15), pp. 69-83.

Finlayson, B., 2000. The Dana-Faynan-Ghuwayr Early Prehistory Project. *Levant*, 32(26), pp. 1-26.

Finlayson, B. and Mithen, S.J., 2007. *The early prehistory of Wadi Faynan, Southern Jordan: archaeological survey of Wadis Faynan, Ghuwayr and al-Bustan and evaluation of the pre-pottery neolithic A site of WF16*. Council for British Research in the Levant. Oxford: Oxbow.

Finlayson, B. et al., 2000. New Evidence for Technology Diversity in the Pre-Pottery Neolithic A: Wadi Fynan 16. *Current Anthropology*, 41(4), pp. 655-663.

Finlayson, B. et al., 2011. Architecture, Sedentism and Social Complexity at the Pre-Pottery Neolithic A Wadi Fynan 16, Southern Jordan. *PNAS*, 108 (20), pp. 8183-8188.

Freeman, P.W.M. and McEwan, L.M., 1998. The Wadi Faynan Survey, Jordan: a Preliminary Report on Survey in Area WF2 in 1997. *Levant*, 30(8), pp. 61-68.

McQuitty, A., 1998. The Wadi Faynan Project: a Preface. *Levant*, 30(3), pp. 1-3.

Wright, K., 1998. The Wadi Faynan Fourth and Third Millennia Project, 1997: Report on the First Season of Test Excavations at Wadi Faynan. *Levant*, 30(28), pp. 33-60.

Wadi Shu'eib

Simmons, A.H., 2001. Wadi Shu'eib, A Large Neolithic Community in Central Jordan: Final Report of Test Investigations. *Bulletin of the American School of Oriental Research*, 321, pp. 1-39.

Simmons, A.H. et al., 1989. Test Excavations at Wadi Shu´eib, a Major Neolithic Settlement in Central Jordan. *Annual of the Department of Antiquities of Jordan* 33, pp. 27-42.

Kafafi, Z. et al., 1993. Test excavations at the Neolithic Community of Wadi Shu'eib, Central Jordan. *Syria* 70, pp. 235-239.

Yiftahel

Braun, E., 1994. *Yiftahel. Salvage and Rescue Excavations at a Prehistoric Village in Lower Galilee, Israel*. Jerusalem: Internal Publication of the Israel Antiquities Authority.

Garfinkel, Y., 1987a. Bead Manufacture at the Pre-Pottery Neolithic B Site of Yiftahel. Mitekufat Haeven. *Journal of the Israel Prehistoric Society*, 20, pp. 79–90.

Garfinkel, Y., 1987b. Burnt Lime Products and Social Implications in the Pre-Pottery Neolithic B Villages of the Near East. *Paléorient*, 13(1), pp. 68–75.

Garfinkel, Y., 1987c. Yiftahel: A Neolithic Village from the Seventh Millennium B.C. in Lower Galilee. Israel. *Journal of Field Archaeology,* 14, pp. 199–212.

Garfinkel, Y. and Horwitz, L.K., 1988. The Pre-Pottery Neolithic B Bone Industry of Yiftahel. *Paléorient*, 14(1), pp. 73–86.

Garfinkel, Y., Carmi, I. and Vogel, J.C., 1987. Dating of Horsebean and Lentil Seeds from the Pre-Pottery Neolithic B Village of Yiftahel. *Israel Exploration Journal*, 37, pp. 40-42.

Garfinkel, Y., Kislev, M.L. and Zohary, D., 1988. Lentil in the Pre-Pottery Neolithic B Yiftahel: Additional Evidence of its Early Domestication. *Israel Journal of Botany*, 37, pp. 49-51.

Hershkovitz, I., Garfinkel, Y. and Arensburg, B., 1986. Neolithic Skeletal Remains at Yiftahel, Area C. *Paléorient*, 12(1), pp. 73–81.

Horwitz, L.K., 2003. Temporal and Spatial Variation in Neolithic Caprine Exploitation Strategies: A Case Study of Fauna from the Site of Yiftah'el (Israel). *Paléorient*, 29, pp. 19–58.

Khalaily, H., Milevsky, I. and Marder, O., 2000. Yiftahel. *Hadashot Arkheologiyot*, 112, pp. 23-24.

Kislev, M.L., 1985. Early Neolithic Horsebean from Yiftahel, Israel. Science, 228, pp. 319–320.

Lamdan, M. and Davies, M., 1983. Le site de Yiftahel (Israel). *L'Anthropologie*, 87, pp. 273-274.

Yellin, J. and Garfinkel, Y., 1986. The Origin of Archaeological Obsidian from a Pre-Pottery Neolithic B Site at Yiftahel, Israel. *Paléorient*, 12(2), pp. 99–104.

North-western European Bibliography

Contents

Irish Sites 533
Mount Sandel 533
Lough Boora 534
Clowanstown 534
Gortore 535
Newferry 536
Ashleypark 536
Ballynagilly 536
Tankardstown 537
Carrowmore 537
Céiide fields complex 539
Lough Gur 540
Newgrange (Brú na Bóinne) complex 542
Knowth (Brú na Bóinne) 545
Dowth (Brú na Bóinne) 547
Poulnabrone 547
Lyles Hill 547
Gransha 548
Ballintaggart/Loughbrickland Co. Down 548
Southern Scandinavian Sites 550
Kanaljorden 550
Tybrind Vig 550
Skateholm 552
Vedbaek 554
Strandvägen 554
Tagerup 555
Mosegarden 556
Norsminde 556
Bjørnsholm 556
Grødbygard 557
Troldeberg 557

Karlsfalt 557
Lindebjerg 557
Sarup 557
Tustrup 558
Ferslev 558

Irish Sites

Mount Sandel

Collins, A.E.P., 1983. Excavations at Mount Sandel, lower site, Coleraine, County Londonderry [microliths, core-axes, etc]. *Ulster Journal of Archaeology*, 46, pp. 1-22.

Dumont, J.V., 1988a. *A microwear analysis of selected artefact types from the Mesolithic sites of Star Carr and Mount Sandel*. Oxford: BAR, British Series, 187, p. 531.

Dumont, J.V. 1988b. *A microwear analysis of flints from the Mesolithic sites of Star Carr, Yorkshire, and Mount Sandel, Northern Ireland*. Oxford: BAR, British Series, 187.

Mellars, P., 1978. *The early postglacial settlement of northern Europe: an ecological perspective*. London: Duckworth.

Murphy, E.M., 1996. Possible gender labour divisions at the Mesolithic Site of Mount Sandel, Co. Derry, Northern Ireland. *Kvinner I Arkeologi I Norge*, 21, pp. 103-24.

Price, T., 1987. The Mesolithic of Western Europe. *Journal of World Prehistory*, 1. pp. 225-305.

Sieveking, G.de G. and Newcomer, M.H., eds. 1983. *The human uses of flint and chert: proceedings of the Fourth International Flint Symposium held at Brighton Polytechnic, 10-15 April 1983*. Cambridge: Cambridge University Press.

Smith, C., 2012. *Late Stone Age Hunters of the British Isles*. London: Routledge.

Straus, L.G., ed. 1986. *The end of the Paleolithic in the Old World*. Oxford: BAR, International Series, 284. p. 229.

Todd, M. et al, 1986. *The first settlers in Ireland: Evidence from Mount Sandel*. University of Ulster.

Waddell, J., 1998. *The Prehistoric Archaeology of Ireland*. Galway: Galway University Press.

Woodman, A., Woodman, P. and Bayliss, A., 2009. A New Bayesian Chronology for Mesolithic Occupation at Mount Sandel, Northern Ireland. *Proceedings of the Prehistoric Society*, (75), pp. 101-123.

Woodman, P.C., 1977. Mount Sandel. *Current Archaeology*, 59, pp. 372-376.

Woodman, P.C., 1981a. Mesolithic camp in Ireland [Mount Sandel]. *Scientific American*, 245(2), pp. 92-100.

Woodman, P.C., 1981b. A Mesolithic camp in Northern Ireland. *Scientific American*, 245, pp. 120-32.

Woodman, P.C., 1985a. Excavations at Mount Sandel, 1973–77. *Northern Ireland Archaeological Monograph,* 2. Belfast: HMSO.

Woodman,P. C., 1985b. *Excavations at Mount Sandel, 1973-77, County Londonderry*. Belfast: HMSO.

Woodman, P.C., 1986. Problems in the colonisation of Ireland. *Ulster Journal of Archaeology*, 49, pp. 7-17.

Woodman P.C., 2009. Challenging times: reviewing Irish Mesolithic chronologies. In: P. Crombé, M. VanStrydonck, J. Sergant, M. Bats and M. Boudin, eds. *Proceedings of the international congress 'Chronologyand Evolution in the Mesolithic of NW Europe'*. Cambridge: Cambridge Scholar Publishing.

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

Lough Boora

Griffiths, H.I., 1998. Freshwater Ostracoda from the Mesolithic Lake Site at Lough Boora, Co. Offaly. *Ireland Irish Journal of Earth Science*, 17, pp. 39-49.

Ryan, M., 1980. An Early Mesolithic site in the Irish midlands. *Antiquity*, 54, pp. 46-47.

Ryan, M., 1981. Ireland's first inhabitants. *Ireland Today*, 987, pp. 13-16.

Ryan, M., 1984. Archaeological Excavations at Lough Boora, Broughal townland, Co. Offaly, 1977. In: M. O'Rourke, ed. *Proceedings of the 7th International Peat Congress, Dublin, June 18-23*, Vol. 1. Bord na Mona, Dublin. pp. 407-13.

Woodman, P.C., 1986. Problems in the colonisation of Ireland. *Ulster Journal of Archaeology*, 49. pp. 7-17.

Clowanstown

Clancy, P., 2009. A weave not to be forgotten: Mesolithic fish traps Clowanstown, Co. Meath (5300 – 4730 BC). *Seanda, The NRA Archaeology Magazine*, 4, pp. 40-42.

FitzGerald, M., 2007a. Revolutionising our understanding of Prehistoric Basketry. *Seanda, The NRA Archaeology Magazine*, 2, p. 49.

FitzGerald, M., 2007b. Catch of the day at Clowanstown, Co. Meath. *Archaeology Ireland*, 21(4), pp. 12–15.

McClatchie, M. et al, 2012. Neolithic Farming in North-Western Europe: Archaeobotanical Evidence from Ireland. *Journal of Archaeological Science*, 30, pp. 1-10.

Mossop, M. and Mossop. E., 2009. *M3 Clonee-Kells Motorway: Report on the Archaeological Excavation of Clowanstown 1, Co. Meath*. Archaeological Consultancy Dublin: Wordwell.

Mossop, M. and Ruddle. E., 2008. *M3 Clonee–Kells Motorway: Report on the Archaeological Excavation of Clowanstown 3 Co. Meath*. Archaeological Consultancy Dublin: Wordwell.

Whitehouse, N. J. et al. 2010. *Cultivating Societies: ASSESSING THE Evidence for Agriculture in Neolithic Ireland. Final Summary Report*. Hertiage Council: Dublin Instar Reference No. 16717

http://www.archaeologicalconsultancy.com/projects_clowanstown1.asp

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Gortore

McClatchie, M. et al., 2012. Neolithic Farming in North-Western Europe: Archaeobotanical Evidence from Ireland. *Journal of Archaeological Science*, 30, pp. 1-10.

O'Donoghue, J., 2010a. *Final excavation report of a Neolithic house atGortore,N8 Rathcormac - Fermoy,Co. Cork. Eachtra Journal, 6*. Dublin: Eachtra Archaeology.

O'Donoghue, J., 2010b. *Archaeological Excavation ReportE2410 - Gortore 1b, Co. CorkMesolthic, Neolithic, and Early Bronze Age activity on the banks of the River Funshion. Eachtra Journal, 10*. Dublin: Eachtra Archaeology.

Whitehouse, N. J. et al., 2010. *Cultivating Societies: Assessing the Evidence for Agriculture in Neolithic Ireland. Final Summary Report*. Dublin: Heritage Council. Instar Reference No. 16717.

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Newferry

Smith, A., 1971. The stratigraphy, palynology and archaeology of the diatomite deposits at Newferry, Co. Antrim. *Ulster Journal of Archaeology*, 34. pp .3-25.

Woodman, P. 1977. Recent excavations [of the Mesolithic site] at Newferry, Co. Antrim. *Proceedings of the Prehistoric Society*, 43. pp. 155-199.

Ashleypark

Manning. C. et al, 1985. A Neolithic burial mound at Ashleypark, Co. Tipperary. *Proceedings of the Royal Irish Academy*, 85(3), pp. 61-100.

McCormick, F., 1985. Faunal Remains from Prehistoric Irish Burials. *Journal of Irish Archaeology*, 3, pp. 37-48.

McCormick, F., 2007. Mammalian Bone Studies from Prehistoric Irish Sites. In: E.M. Murphy and N.J. Whitehouse, eds. 2007. *Enviromental Archaeology in Ireland*. Oxford: Oxbow. pp. 77-101. Oxford: Oxbow.

Ballynagilly

ApSimon, A. 1969. An Early Neolithic house in Co. Tyrone. *Journal of the Royal Society of Antiquaries of Ireland* 99, pp. 165-8.

ApSimon, A. 1971. Ballynagilly. *Current Archaeology* 24, pp. 11-32

ApSimon, A. 1976. Ballynagilly and the beginning and end of the Irish Neolithic. In S.J. de Laet (eds), *Acculturation and continuity in Atlantic Europe mainly during the Neolithic period and Bronze Age* Brugge: De Tempel.

Pilcher, J. 1968. Some applications of scanning electron microscopy to the study of modern and fossil pollen. Ulster Journal of Archaeology, 31, pp.87-91.

Pilcher, J. 1972. Pollen analyses and radiocarbon dating of a peat on Slieve Gallion, Co Tyrone, N Ireland. *New Phytologist*, 72, pp.681-689.

Whitehouse, N. J., *et al.* 2010. Cultivating Societies: *Assessing the Evidence for Agriculture in Neolithic Ireland*. Final Summary Report. Hertiage Council: Dublin Instar Reference No. 16717

McClatchie, M., *et al*. 2012. Neolithic Farming in North-Western Europe: Archaeobotanical Evidence from Ireland. *Journal of Archaeological Science* 30, pp. 1-10

Online:

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Tankardstown

Gowen, M., 1987. Tankardstown, Co Limerick: a Neolithic house. *Archaeology Ireland*, 1(1), pp. 6-10.

Gowen, M., 1988a. Third Season at Tankardstown. *Archaeology Ireland,* 2(4), pp. 156.

Gowen, M., 1988b. *Three Irish Gas Pipelines: New Archaeological Evidence in Munster*. Dublin: Wordwell Ltd. pp. 26-43.

Gowen, M. and Tarbett, C., 1988. Tankardstown South, Co. Limerick. In: I. Bennett, ed. *Excavations 1987*. Wordwell Ltd. Bray, p. 21.

Gowen, M. and Tarbett, C., 1989. Tankardstown South, Co. Limerick. In: I. Bennett, ed. *Excavations 1988*. Wordwell Ltd. Bray, pp. 24-26.

Gowen, M. and Tarbett, C., 1990. Tankardstown South, Co. Limerick. In: I. Bennett, ed. *Excavations 1989*. Wordwell Ltd. Bray, pp. 38-39.

McClatchie, M. et al., 2012. Neolithic Farming in North-Western Europe: Archaeobotanical Evidence from Ireland. *Journal of Archaeological Science,* 30, pp. 1-10.

Whitehouse, N. J. et al, 2010. *Cultivating Societies: Assessing the Evidence for Agriculture in Neolithic Ireland. Final Summary Report*. Dublin: Heritage Council. Instar Reference No. 16717.

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Carrowmore

Bergh, S., 1995. *Landscapes of the Monuments: A Study of the Passage Tombs in the Cuíl Irra Region*. Stockholm: University of Stockholm.

Bergh, S., 2002. Knocknarea; The Ultimate Monument. In: C. Scarre, ed. 2002. *Monuments and Landscape in Atlantic Europe*. London: Routledge. pp. 139-151.

Burenhult, G., ed. 2003. *Stones and Bones. Formal disposal of the dead in Atlantic Europe during the Mesolithic-Neolithic interface 6000-3000 BC. Proceedings from the Archaeological Conference in Honour of the Late Professor Michael J. O'Kelly in Sligo, Ireland, May 1-5, 2002*. Oxford: BAR International Series.

Burenhult, G., 1980., *The Archaeological Excavation at Carrowmore, Co. Sligo, Ireland. Excavation seasons 1977-79*. Stockholm: Institute of Archaeology, University of Stockholm, Theses and Papers in North-European Archaeology 9.

Burenhult, G., 1980. *The Carrowmore Excavations. Excavation Season 1980*. Stockholm: Institute of Archaeology, University of Stockholm. Stockholm Archaeological Reports 7.

Burenhult, G., 1981. *The Carrowmore Excavations. Excavation season 1981*. Stockholm: Institute of Archaeology, University of Stockholm. Stockholm Archaeological Reports 8.

Burenhult, G., 1984. *The archaeology of Carrowmore. Environmental archaeology and the megalithic tradition at Carrowmore*. Stockholm: G. Burenhults Förlag.

Burenhult, G., 1993. The Megalith-Builders in Europe: Stones, Tombs, and Temples Along the Atlantic Coast. In: G. Burenhult, ed. 1993-1994. *The Illustrated History of Humankind*, Vol. 2. San Francisco. American Museum of Natural History.

Burenhult, G., 1999a. KARTAGO as a viewer of GIS- and multivariate archaeological data in the Ajvide and Carrowmore projects – the full concept. In: J.A.Barceló, I. Briz, and A. Vila, eds. *New Techniques for Old Times*. CAA 98. Oxford: BAR, International Series 757.

Burenhult, G., 1999b. *Megalithic Symbolism in Ireland and Scandinavia in light of new evidence from Carrowmore*. Tomar: ARKEOS 6. Perspectivas em Diálogo, Tomo 1, pp. 49-108.

Burenhult, G., 2001a. Long-distance cultural interaction in megalithic Europe: Carrowmore and the Irish megalithic tradition in a western European and Mediterranean context. *Cultural Interactions in Europe and the Eastern Mediterranean during the Bronze Age (3000-500 BC)*. Oxford: BAR, International Series 985.

Burenhult, G., 2001b. *The Illustrated Guide to the Megalithic Cemetery at Carrowmore Co. Sligo: The Swedish Archaeological Excavation at Carrowmore*. Sweden: Tjörnarp.

Condit, T., 1991. A glimpse of Sligo's prehistory. *Archaeology Ireland*, 5(3). pp. 7-10.

Cooney, G., 1990. The Place of Megalithic Tomb Cemeteries in Ireland. *Antiquity*, 64, pp. 741-53.

Cooney, G., 2000. *Landscapes of Neolithic Ireland*. London: Routledge.

Cooney, G. and Grogan, E., 1999. Irish *Prehistory A Social Perspective*. Dublin: Wordwell.

Curran-Mulligan, P., 1994. Yes, but is it Art!. *Archaeology Ireland*, 8(1), pp. 14-15.

Darvil, T.C., 1979. Court Cairns, Passage Graves and Social Change in Ireland. *Man* 14(2), pp. 311-327.

DeValera, R. and Ó Nualláin, S., 1983. *Survey of the Megalithic Tombs of Ireland Vol .1,2,3,4*. Dublin: Stationery office.

Herity, M., 1970. Passage grave pottery from a "dolmen" at Carrowmore, Co Sligo. *The Journal of the Royal Society of Antiquaries of Ireland*, 100, pp. 185-190.

Kitchin, F.T., 1983. The Carrowmore megalithic cemetery, Co Sligo [field survey and history of earlier work]. *Proceedings of the Prehistoric Society*, 49, pp. 151-175.

Ó Nualláin, S., 1989. *Survey of the Megalithic Tombs of Ireland Vol .5, County Sligo*. Dublin: Stationery office.

Scarre, C. et al, 2003. Megalithic chronologies. In: G. Buenhult, ed. 2003. *Stones and Bones. Formal disposal of the dead in Atlantic Europe during the Mesolithic-Neolithic interface 6000-3000 BC*. Oxford: BAR International Series, 1201. pp. 65-111.

Scarre, C., 2008. Shrines of the land and places of power: religion and the transition to farming in western Europe. In: D.S. Whitley and K. Hays-Gilpin, eds. 2008. *Belief in the Past. Theoretical approaches to the archaeology of religion*. Walnut Creek, California: Left Coast Press. pp. 209-226.

Céiide fields complex

Byrne, G., 1989. *Unpublished report on the Excavation at Behy / Glenulra, Co Mayo*.

Byrne, G., 1989 –1992. *Unpublished report on Archaeological Excavation work completed and outstanding. Céide fields, Co Mayo*.

Byrne, G., 1990 - 1991. *Unpublished report on the Archaeological Excavation on the site of Céide fields Centre buildings, Co Mayo*.

Byrne, G., 1993. *Unpublished report on the Archaeological Excavation on the site of the Céide fields, Centre buildings, Co Mayo*.

Byrne, G.J., Warren, G.M., Walsh, P., McIlreavy, D. and Rathbone, S., 2009a. *Archaeological Excavations at the Glenulra Scatter (92E140): Stratigraphic Report.* UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Byrne, G.J., Warren, G.M., Walsh, P., McIlreavy, D. and Rathbone, S., 2009b. *Archaeological Excavations at Rathlackan (E580): Stratigraphic Report*. UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Byrne, G., Dunne, N., Caulfield, S., Warren, G.M., Walsh, P., McIlreavy, D. and Rathbone, S., 2009. *Archaeological Excavations in Association with the Construction of the Céide Visitor Centre (E494): Stratigraphic Report*. UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Caulfield, S., Byrne, G., Downes, M., Dunne, N., Warren, G.M., Rathbone, S., McIlreavy, D. Walsh, P., 2009. Archaeological *Excavations at Belderg Beg (E109): Stratigraphic Report*. UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Caulfield, S., Warren, G.M., Rathbone, S., McIlreavy, D. and Walsh, P., 2009. *Archaeological Excavations at the Glenulra Enclosure (E24): Stratigraphic Report*. UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Caulfield, S., O'Donnell, R.G. and Mitchell, P.I., 1998. C-14 dating of a neolithic field system at Céide Fields, County Mayo, Ireland. *Radiocarbon,* 40, pp. 629-640.

de Valéra, R. and Ó Nualláin, S., 1952. *A Cruciform Passage-Grave at Behy Townland, Co. Mayo. Journal of the Galway Archaeological and Historical Society*, XXV, pp. 47-51.

de Valéra, R. and Ó Nualláin, S., 1964. *Survey of the megalithic tombs of Ireland, vol. II. County Mayo*. Dublin: Stationary Office.

Molloy, K. and O'Connell, M., 1995. *Palaeological investigations towards the reconstruction of environment and land-use changes during prehistory at Céide Fields, western Ireland*. Problemeder Kustenforschung im sudlichen Nordseegebiet, 23, pp. 187-225.

O'Connell, M. and Molloy, K., 2001. Farming and Woodland Dynamics in Ireland During the Neolithic. Biology and Environment. *Proceedings of the Royal Irish Academy*, 101B(1-2), pp. 99-128.

Ó Nualláin, S., 1972. A Neolithic House at Ballyglass near Ballycastle, Co. Mayo. *Journal of the Royal Society of Antiquaries of Ireland*, 102, pp. 49-57.

Ó Nualláin, S., 1976. The central-court tombs of the north-west of Ireland. *Journal of the Royal Society of Antiquaries of Ireland,* 106, pp. 92-117.

Ó Nualláin, S., 1998. Excavation of the Smaller Court-Tomb and Associated Hut Sites at Ballyglass, Co. Mayo. *Proceedings of the Royal Irish Academy,* 98C, pp. 125-175.

Warren, G., 2009. Belderrig: A 'New' Later Mesolithic and Neolithic Landscape in Northwest Ireland. In: N.Finlay, S. McCartan, N. Milner and C.W. Jones, eds. *From Bann Flakes to Bushmills; Papers in Honour of Professor Peter Woodman*. Oxford: Prehistoric Society Research Paper, 1, pp. 143-152.

Warren, G.M., McIlreavy, D., Rathbone, S. and Walsh, P., 2009. Archaeological Excavations at Behy (E747): Stratigraphic Report. UCD School of Archaeology/INSTAR: Neolithic and Bronze Age Landscapes of North Mayo 2009, UCD.

Lough Gur

Ahlberg, K. et al. 2001. Holocene Stable-Isotope Stratigraphy at Lough Gur, County Limerick, Western Ireland. *Holocene*, 11(3), pp. 367-372.

ApSimon, A., 1969. An Early Neolithic house in Co. Tyrone. *Journal of the Royal Society of Antiquaries of Ireland,* 99, pp. 165-168.

ApSimon, A., 1971. Ballynagilly. *Current Archaeology*, 24, pp. 11-13.

ApSimon, A., 1976. Ballynagilly and the beginning and end of the Irish Neolithic. In: S.J.

de Laet, ed. *Acculturation and continuity in Atlantic Europe mainly during the Neolithic period and Bronze Age.* Brugge: De Tempel. pp. 15-30.

Cleary, R. A., 1980. A Cist-burial at Ballynagallagh, near Lough Gur, Co Limerick. *North Munster Antiquarian Journal*, 22, pp. 3-7.

Cleary, R., 1982. Excavations [of a multi-period site] at Lough Gur, Co Limerick, 1977-8: part 1. *Journal of Cork Historical and Archaeological Society,* 87. pp. 3-20.

Cleary, R., 1984a. Bone tempered Beaker potsherd [from Neolithic Lough Gur]. *Journal of Irish Archaeology* 2, pp. 73-75.

Cleary, R., 1984b. Excavations at Lough Gur, Co Limerick, 1977-1978: Part IV [appendices on seeds and cereals, human and animal bones]. *Journal of Cork Historical and Archaeological Society*, 89, pp. 33-54.

Cleary, R. et al., 1995. Later Bronze Age settlement and prehistoric burials, Lough Gur, Co. Limerick. *Proceedings of the Royal Irish Academy* 95C, pp. 1-92.

Cleary, R. M., 2003. Enclosed Late Bronze Age habitation site and boundary wall at Lough Gur, Co. Limerick. *Proceedings of the Royal Irish Academy,* 103C. pp. 4-189.

Cooney, G., 2007. In retrospect Neolithic Activity at Knockadoon, Lough Gur, Co. Limerick, 50 Years on. *Proceedings of the Royal Irish Academy*, 107C, pp. 215-225.

Doyle, I., Jennings, D. et al, 2001. *Unpublished Excavations Survey 1930-1997*. Oxford Archaeological Unit for the Heritage Council of Ireland.

French, R., 1892. On two rare stone implements found at Lough Gur, County Limerick. *Journal of the Royal Society of Antiquaries of Ireland*, 2, pp. 42-45.

Grogan, E. et al, 1987. Lough Gur excavations by Seán P Ó Riordáin: Further Neolithic and Beaker habitations on Knockadoon. *Proceedings of the Royal Irish Academy* 87C, pp. 299-506.

Liversage, D., 1957. Garrett Island, Lough Gur, Co Limerick. *Proceedings of the Prehistoric Society*, 23, p. 220.

Liversage, G., 1958. An Island Site at Lough Gur. *Journal of the Royal Society of Antiquaries of Ireland* 88(1), pp. 67-81.

McClatchie, M. et al, 2012. Neolithic Farming in North-Western Europe: Archaeobotanical Evidence from Ireland. *Journal of Archaeological Science*, 30, pp. 1-10.

Mitchell, G., 1954. A Pollen-Diagram from Lough Gur, County Limerick. *Proceedings of the Royal Irish Academy*, 56C, pp. 481-488.

Ó Nualláin, S., 1996. A Re-examination of Four Sites in Grange Townland, Lough Gur, Co Limerick. *North Munster Antiquarian Journal*, 37, pp. 3-14.

O Ríordáin, S., 1947. Lough Gur Excavations: Site J, Knockadoon. *Journal of the Royal Society of Antiquaries of Ireland,* 77(1), pp. 39-52.

O Ríordáin, S., 1949a. Lough Gur excavations, Carraig Aille and the 'Spectacles. *Proceedings of the Royal Irish Academy*, 52C, pp. 39-111.

O Ríordáin, S., 1949b. Lough Gur Excavations: Three Marshland Habitation Sites. *Journal of the Royal Society of Antiquaries of Ireland*, 79, pp. 126-139.

O Ríordáin, S., 1950. Lough Gur Excavations, Ballingoola, V. *Journal of the Royal Society of Antiquaries of Ireland*, 80, pp. 262-263.

O Ríordáin, S., 1951. Lough Gur excavations: The Great Stone Circle (3) in Grange Townland. *Proceedings of the Royal Irish Academy*, C54, pp. 37-74.

O Ríordáin, S., 1954. Lough Gur Excavations: Neolithic and Bronze Age houses on Knockadoon. *Proceedings of the Royal Irish Academy*, C56, pp. 297-459.

O Ríordáin, S.,1955. Lough Gur Excavations: the Megalithic Tomb. *Journal of the Royal Society of Antiquaries of Ireland*, 85(1), pp. 34-50.

O'Kelly, M. J. and O'Kelly, C., 1981. *Illustrated guide to Lough Gur, Co Limerick*. Houston: Cork.

Pilcher, J., 1968. Some applications of scanning electron microscopy to the study of modern and fossil pollen. *Ulster Journal of Archaeology*, 31. pp. 87-91.

Pilcher, J., 1972. Pollen analyses and radiocarbon dating of a peat on Slieve Gallion, Co Tyrone, N Ireland. *New Phytologist*, 72. pp. 681-689.

Twohig, E., 1993. *Past Perceptions: The Prehistoric Archaeology of South-west Ireland*. Cork: Cork University Press.

Whitehouse, N. J. et al, 2010. *Cultivating Societies: assessing the Evidence for Agriculture in Neolithic Ireland. Final Summary Report*. Dublin: Heritage Council. Instar Reference No. 16717.

Windle, B., 1913. Megalithic Remains surrounding Lough Gur, County Limerick. Proceedings *of the Royal Irish Academy*, C30, pp. 283-306.

Newgrange (Brú na Bóinne) complex

Boylan, H., 1988. *The Boyne: A Valley of Kings*. Dublin : O'Brien Press.

Brady, C., 1996. Surface-collected flint from Site A, Newgrange, Co. Meath. *Trowel*, 7. pp. 63-69.

Candon, A., n.d. An early 19th century description of Newgrange, County Meath. *Journal of the Royal Society of Antiquaries of Ireland*, 114, pp. 24-27.

Condit, T., 1993. On the outside looking in. *Archaeology Ireland*, 7(4), pp. 15-16.

Condit, T. and Cooney, G., 1999. *Newgrange, Co. Meath: Neolithic religion and the midwinter sunrise*. Archaeology Ireland Heritage Guide 8. Bray: Archaeology Ireland Ltd.

Cooney, G., 2006. Newgrange - a view from the platform. *Antiquity*, 80(309), pp.697-710.

Cooney, G. et al., 1997. *Brú na Bóinne: Newgrange, Knowth, Dowth and the River Boyne*. Archaeology Ireland, 11(S3). Bray: Archaeology Ireland Ltd.

Devereux, P., 1996. Preliminary investigations and cognitive considerations of the acoustical resonances of selected archaeological sites. *Antiquity*, 70(269), pp. 665-666.

Eogan, G. and Grogan, E., 1991. Prehistoric and Early Historic Culture Change at Brugh na Bóinn. *Proceedings of the Royal Irish Academy*, 91C, pp. 105-132.

Eriksen, P., 2006. The rolling stones of Newgrange. *Antiquity*, 80(309), pp. 709-710.

Flanagan, L., 1960. Bone beads and ring from Newgrange, Co Meath. *Ulster Archaeology Journal*, 23. pp. 61-62.

Garnett, J., n.d. Structural relationships at Newgrange [beam walling vs corbelling debate]. *Antiquity*, 57, pp. 214-216.

Harbison, P., 2003.*Treasures of the Boyne Valley: Landscape and History*. Dublin: Gill & Macmillan in association with the Boyne Valley Honey Company.

Hartnett, P., 1954. Newgrange Passage Grave, Co Meath. Journal of *the Royal Society of Antiquaries of Ireland*, 84(2). pp. 181-182.

Ingalls , J., 2008. *New grange Speaks for Itself: Forty Carved Motifs & Related Site Features*. Garnett. Trafford Publishing.

Keane, E., 2003. *Brú na Bóinne*. Wicklow: Archaeology Ireland.

Kearns, H., 1997. Newgrange and the lost sand solution. *Archaeology Ireland*, 11(4), pp. 15-17.

Lewis, H. et al, 2009. *An integrated, comprehensive GIS model of landscape evolution and land use history in the River Boyne valley Phase II*. Dublin: The Heritage Council Have

Mac Uistin, L., 2007. *Exploring Newgrange*. Dublin: O'Brien Press.

McCormick, F., 1985. Faunal Remains from Prehistoric Irish Burials. *Journal of Irish Archaeology*, 3, pp. 37-48.

McCormick, F., 2007. Mammalian Bone Studies from Prehistoric Irish Sites. In: E.M. Murphy and N.J. Whitehouse, eds. 2007. *Environmental Archaeology in Ireland*. Oxford: Oxbow. pp. 77-101.

McGuinness, D., 1996. Edward Lhuyd's contribution to the study of Irish megalithic tombs. *Journal of the Royal Society of Antiquaries of Ireland*, 126, pp. 62-85.

Meighan, I., 2003. Sourcing the quartz at New grange, Brú na Bóinne, Ireland. In: G. Burenhult, S. Westergaard, eds. 2003. *Stones and Bones. Proceedings of the Stones and Bones Conference, Sligo 2003*. Oxford: BAR, International Series 1201. pp. 247-251.

Mitchell, F., 1994. Notes on some non–local cobbles at the entrances to the passage–graves at Newgrange and Knowth, county Meath. *Journal of the Royal Society of Antiquaries of Ireland*, 122, pp. 128-145.

Mount, C., 1994. Aspects of ritual deposition in the Late Neolithic and Beaker periods at Newgrange, Co. Meath. *Proceedings of the Prehistoric Society*, 60. p. 433-443.

Nelms, H., 1981. The structure of Newgrange. *Antiquity*, 55. pp. 54-55.

Riordain, S.P.O., 1956. Trial Excavation at Newgrange. *Journal of the Royal Society of Antiquaries of Ireland*, 86(1), pp. 52-61.

O'Kelly, M., 1982. *Newgrange: Archaeology, Art and Legend*. London: Thames & Hudson.

O'Kelly, M., Cleary, R. and Lehane, D., 1983. *Newgrange: County Meath, Ireland: The late Neolithic/ Beaker period Settlement*. Oxford: BAR.

O'Brien, T., 1988-89. Winter solstice and decoration at Newgrange. Ríocht na Midhe. *Records of the Meath Archaeological and Historical Society*, 8(2), pp. 50-59.

O'Kelly, C., 1978. *Illustrated guide to Newgrange and the other Boyne monuments*. Cork: O'Kelly, Ardnalee, Blackrock.

O'Kelly, M., 1964. Newgrange, Co Meath. *Antiquity*, 38, pp. 288-290.

O'Kelly, M., 1972a. Excavations [of chambered tomb] at Newgrange, Co Meath. *Antiquity*, 42, pp. 40-42.

O'Kelly, M., 1972b. Further radiocarbon dates from Newgrange, Co Meath, Ireland. *Antiquity*, 46, pp. 226-227.

O'Kelly, M., 1978. Three passage-graves at Newgrange, Co Meath. Proceedings *of the Royal Irish Academy*, C78, pp. 249-352.

O'Kelly, M., 1979. The restoration of Newgrange [passage grave, Meath]. *Antiquity*, 53, pp. 205-210.

O'Kelly, M., 1981. The roofing of Newgrange. *Antiquity*, 55, pp. 218-219.

O'Sullivan, M., 1989. A stylistic revolution in the megalithic art of the Boyne Valley. *Archaeology Ireland*, 3(4), pp. 138-142.

O'Sullivan, M., 1986. Approaches to passage tomb art. *Journal of the Royal Society of Antiquaries of Ireland*, 116, pp. 68-83.

Patrick, J., 1974. Mid-winter sunrise at Newgrange. *Nature*, 249, pp. 517-519.

Phillips, W.E.A., Corcoran, M. and Eogan, E., 2001. *Identification of the source area for megaliths used in the construction of the Neolithic passage graves of the Boyne Valley, Co. Meath*. Unpublished report for the Heritage Council.

Powell, A., 1994. Newgrange - Science or Symbolism. *Proceedings of the Prehistoric Society*, 60, pp. 85-96.

Ray, T., 1989. The winter solstice phenomenon at Newgrange, Ireland: accident or design?. *Nature*, 337. pp. 343-345.

Shee Twohig, E., 1972. Recent work on Irish passage graves art. *Bollettino del Centro Camuno di Studi Preistorici*, 8. pp. 199-224.

Shee Twohig, E., 1973. Techniques of Irish passage grave art. In: G Daniel and P Kjærum, eds. 1973. *Megalithic graves and ritual: papers presented at the III Atlantic colloquium, Moesgård 1969*. Copenhagen: Jutland Archaeological Society. pp. 163-72.

Shee Twohig, E., 1981. *The megalithic art of western Europe*. Oxford: Clarendon Press.

Shee Twohig, E., 1993. Megalithic Tombs and Megalithic Art in Atlantic Europe. In: C. Scarre and F. Healy, eds. *Trade and Exchange in Prehistoric Europe. Proceedings of a Conference held at the University of Bristol, April 1992*. Oxford: Oxbow. pp. 87-99.

Shee Twohig, E., 2000. Frameworks for the megalithic art of the Boyne valley. In: A. Desmond, G. Johnstone, M. McCarthy, J. Sheehan and E. Shee Twohig, eds. *New agendas in Irish prehistory: papers in commemoration of Liz Anderson.* Bray: Wordwell. pp. 89-105.

Smyth, J. et al., 2009. *Brú na Bóinne World Heritage Site Research Framework*. Dublin: The Heritage Council.

Stout, G. and Stout, M., 2002. *Newgrange and the Bend of the Boyne*. Cork: Cork University Press.

Stout, G. and Stout, M., 2008. *Newgrange*. Cork : Cork University Press .

Sweetman, P., 1987. Excavation of a late Neolithic/Early Bronze Age site at Newgrange, Co Meath.*Proceedings of the Royal Irish Academy*, C87, pp. 283-298.

Swift, C., 2003. The gods of Newgrange in Irish literature and Romano-Celtic tradition. In: G. Burenhult and S. Westergaard, eds. 2003. *Proceedings of the Stones and Bones Conference in Sligo, Ireland, May 1-5, 2002*. Oxford: BAR, International Series. pp. 53-63.

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Knowth (Brú na Bóinne)

May, J., 2003. Eogan of Knowth. *Current Archaeology*, 188, pp. 328-334.

Bennett, I., 1988. *Excavations 1987: summary accounts of archaeological excavations in Ireland Organisation of Irish Archaeologists* .Dublin: Wordwell.

Eogan, G., 1967. The Knowth (Co Meath) excavations. *Antiquity*, 41. pp. 202-204.

Eogan, G., 1968. Excavations at Knowth, Co Meath, 1962-1965. *Proceedings of the Royal Irish Academy*, C, pp. 299-400.

Eogan, G., 1969. Excavations at Knowth, Co Meath, 1968. *Antiquity*, 43, pp. 8-14.

Eogan, G., 1973. A decade of excavations at Knowth, Co Meath. *Irish University Review*, 3, pp. 66-79.

Eogan, G., 1974. Report on the excavations of some passage graves, unprotected inhumation burials and a settlement site at Knowth, Co Meath. *Proceedings of the Royal Irish Academy*, 74C, pp. 11-112.

Eogan, G., 1977.Two decorated stones from Knowth, Co Meath. *Antiquity*, 51. pp. 48-49.

Eogan, G., 1978. The entrance stones at Knowth, Ireland. *Antiquity*, 52. pp. 134-135.

Eogan, G., 1980. Objects with Iberian affinities from Knowth, Ireland. *Guimarães*, 89. pp. 275-279.

Eogan, G., 1982. Two maceheads from Knowth, county Meath [decorated flint]. Journal of the Royal *Society of Antiquaries of Ireland*, 112, pp. 123-138.

Eogan, G., 1983. A flint macehead [with elaborate decoration] at Knowth [passage grave], Co Meath, Ireland. *Antiquity*, 57, pp. 45-46.

Eogan, G., 1986. *Knowth and the passage-tombs of Ireland*. London: Thames & Hudson.

Eogan, G., 1993. Neolithic ritual at Knowth? Co Meath. *Archaeology of Ireland*, 7(4). pp.16-18.

Eogan, G., 1994. A Grooved Ware wooden structure at Knowth, Boyne Valley, Ireland. *Antiquity*, 68(259). pp. 322-330.

Eogan, G., 1997. Pre-tomb Neolithic house discovered at Knowth, Co Meath. *Archaeology of Irerland*, 11(2).

Eogan, G., 1998. Knowth before Knowth. *Antiquity*, 72(275), pp. 162-172.

Eogan, G. and Roche, H., 1997a. *Excavations at Knowth.* Dublin:Royal Irish Academy, (1-4).

Eogan, G. and Roche, H., 1997b. *Excavations at Knowth 2: Settlement and Ritual Site of the Fourth and third Millennia BC*. Dublin:Royal Irish Academy.

Fenwick, J., 1995. The manufacture of the decorated macehead from Knowth, county Meath. *Journal of the Royal Society of Antiquaries of Ireland*, 125, pp. 51-60.

Herity, M., 1967. From Lhuyd to Coffey: new information from unpublished descriptions of the Boyne Valley tombs. *Studia Hibernica*, 7, pp. 127-145.

MacAlister, R., 1944. Preliminary report on the excavation at Knowth. *Proceedings of the Royal Irish Academy*, 49, pp. 131-166.

Ó Danachair, C., ed. 1976. *Folk and farm: essays in honour of A T Lucas*. Dublin: Royal Society of Antiquaries of Ireland.

O'Sullivan, M., 1986. Approaches to passage tomb art. *Journal of the Royal Society of Antiquaries of Ireland*, 116, pp. 68-83.

Roche, H., 1989. Pre-tomb habitation found at Knowth, Co Meath, spring 1989. *Archaeology of Ireland*, 3, pp. 101-103.

Dowth (Brú na Bóinne)

Coffey, G., 1897. On stone markings (ship figure) recently discovered at Dowth, in the County of Meath. *Proceedings of the Royal Irish Academy*, 4, pp. 586-588.

Cooney, G. et al., 1997. *Brú na Bóinne: Newgrange, Knowth, Dowth and the River Boyne*. Archaeology Ireland, 11(S3). Bray: Archaeology Ireland Ltd.

Harbison, P., 2007. In retrospect the Royal Irish Academy's only archaeological excavation: Dowth in the Boyne Valley. *Proceedings of the Royal Irish Academy*, C107, pp. 205-213.

Herity, M., 1967. From Lhuyd to Coffey: new information from unpublished descriptions of the Boyne Valley tombs. *Studia Hibernica*, 7, pp. 127-145.

O'Kelly, M., 1983. The tumulus of Dowth, County Meath [survey, history of research, description].*Proceedings of the Royal Irish Academy*, 83C, pp. 135-190.

Sweetman, P., 1974. A find of obsidian from Dowth, Co Meath. *Journal of the Royal Society of Antiquaries of Ireland*, 104, p. 156.

Poulnabrone

Beckett, J., 2011. Interactions with the dead a taphonomic analysis of burial practices in three megalithic tombs in County Clare, Ireland. European Journal Archaeology, 14(3), pp. 394-418.

Gilmore, H., 1997. Ancient burial places. The Other Clare, 21, pp. 34-35.

Harbison, P., 1997. The Limerick area: Proceedings of the 142nd Summer Meeting of the Royal Archaeological Institute. The Archaeological Journal, 153, pp. 352-353.

Hedges, R. et al, 1990. Radiocarbon dates from the Oxford AMS system: Archaeometry date list 10. Archaeometry, 32, pp. 101-108.

Lynch, A., 1988. Poulnabrone - a stone in time. Archaeology of Ireland, 2. pp. 105-107.

Lynch, A. and Donnabháin, B., 1994. Poulnabrone Portal Tomb. The Other Clare, 18, pp. 5-7.

Lyles Hill

Evans, E.E., 1953. *Lyles Hill: a Late Neolithic site in County Antrim*. Belfast: Archaeological Research Publications (Northern Ireland) No. 2.

Gibson, A. M. and Simpson, D.D.A., 1987. Lyles Hill, Co. Antrim. *Archaeology Ireland* ,1.2, pp. 72-75.

McCorry, M., 1977. A Petrological Analysis of Lyles Hill Pottery. *Irish Archaeological Research Forum*, 4.1, pp. 9-12.

Nelis, E., 2003. Donegore Hill and Lyles Hill, Neolithic enclosed sites in Co. Antrim: the lithic assemblages. In: I. Armit, E. Murphy, E. Nelis, and D. Simpson, eds. *Neolithic settlement in Ireland & western Britain*. Oxford. pp. 203-217.

Simpson, D.D.A. and Gibson, A.M., 1989. Lyles Hill. *Current Archaeology*, 114, pp. 214-215.

Gransha

Chapple, R.M., 2003. *Preliminary Report on Archaeological Excavations at Oakgrove Integrated College, Gransha Td., Londonderry, Co.Londonderry*. Northern Archaeological Consultancy Ltd. Unpublished report submitted to EHS (NI).

Chapple, R.M., 2004. 389. Oakgrove Integrated College, Gransha, Derry. In: I. Bennett, ed. 2004. *Excavations 2002: Summary Accounts of Archaeological Excavations in Ireland*. Bray, pp. 103–106.

Chapple, R.M., 2008. The Absolute Dating of Archaeological Excavations in Ulster Carried out by Northern Archaeological Consultants. *Ulster Journal of Archaeology*, 67, pp. 153-181.

Chapple, R M., 2008b. The Excavation of Early Neolithic and Early Bronze Age Sites at Oakgrove, Gransha County Londonderry. *Ulster Journal of Archaeology*, 67, pp. 22-59.

Chapple, R.M., 2009. Oakgrove *Integrated College, Gransha, Londonderry, Co. Londonderry. Archaeological Excavation Report (Sites 1–12)*.Northern Archaeological Consultancy Ltd. Unpublished report submitted to EHS (NI).

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

Ballintaggart/Loughbrickland Co. Down

Chapple, R.M., 2008a. The Absolute Dating of Archaeological Excavations in Ulster Carried out by Northern Archaeological Consultants. *Ulster Journal of Archaeol*ogy, 67, pp. 153-181.

Chapple, R.M., 2008b. The Excavation of Early Neolithic and Early Bronze Age Sites at Oakgrove, Gransha County Londonderry. *Ulster Journal of Archaeology*, 67, pp. 22-59.

Chapple, R.M., Dunlop, C., Gilmore, S. and Large, S., 2007. *A1- Loughbrickland Dualling: Archaeological Excavation Report*. Northern Archaeological Consultancy Ltd. Unpublished report submitted to EHS (NI).

Chapple, R.M., Dunlop, C., Gilmore, S. and Heaney, L., 2009. *Archaeological Investigations Along the A1 Dualling Scheme, Loughbrickland to Beech Hill, Co. Down, N. Ireland*. Oxford: BAR, British Series, 479.

Online:

http://heritagecouncil.ie/archaeology/welcome/

http://heritagecouncil.ie/unpublished_excavations/section3.html

http://www.excavations.ie/

www.heritagecouncil.ie/archaeology/initiatives/instar-web-archive

Southern Scandinavian Sites

Kanaljorden

Hallgren, F., 2011. Mesolithic Skull Depositions at Kanaljorden. *Current Swedish Archaeology*, 19, pp. 244-246.

Hallgren, F., 2010. *Ancestors in the lake? On the ritual display and deposition of human skulls at Kanaljorden, Motala, Sweden Stockholm University, Faculty of Humanities, Department of Archaeology and Classical Studies, Archaeology. Papers presented at the 8th International Conference on the Mesolithic in Europe, Santander, 13th to 17th September 2010*. Oxford: Oxbow books.

Hallgren, F., 2013. *Skulls on stakes and skulls in water. Mesolithic mortuary rituals at Kanaljorden, Motala, Sweden 7000 BP*. Paper presented at Mesolithic burials – Rites, symbols and social organisation of early postglacial communities Mesolithische Bestattungen – Riten, Symbole und soziale Organisation früher postglazialer Gemeinschaften Landesmuseum für Vorgeschichte, Halle (Saale) 18- 21. September 2013. Saale: Landesmuseum für Vorgeschichte Halle. pp. 19.

Tybrind Vig

Andersen,S. H., 1981 Tybrind Vig: A preliminary report on a submerged Ertebolle settlement on the Little Belt. *Mesolithic Miscellany*, 2(1), pp. 10-12.

Andersen, S.H., 1985. Tybrind Vig. A preliminary report on a submerged Ertebelte settlement on the west coast of Fyn. *Journal of Danish Archaeology*, 4, pp. 52-69.

Andersen, S.H., 1987a. Mesolithic dug-outs and paddles from Tybrind Vig, Denmark. *Acta Archaeologica*, 57, pp. 87-106.

Andersen, S.H., 1987b. Tybrind Vig: A submerged Ertebolle settlement in Denmark. In: J.M. Coles and A.J. Lawson, eds. *European Wetlands in Prehistory*. Oxford: Clarendon Press. pp. 253-280.

Andersen, S.H. et al, 2013. *Tybrind Vig Submerged Mesolithic settlements in Denmark*. Jutland Archaeological Society Publications: Aarhus University Press

Carter, R.J., 2001. Dental indicators of seasonal human presence at the Danish Boreal sites of Holmegaard I, IV and V and Mullerup and the Atlantic sites of Tybrind Vig and Ringkloster. *The Holocene*, 11(3), pp. 359-365.

Christensen, C., 1990, Stone Age Dug-out Boats in Denmark: Occurrence, Age, Form and Reconstruction. In: D.E. Robinson, ed. *Symposia of the Association for Environmental Archaeology 9*. Oxford: Oxbow Books.

Christensen, C., 1993. Land and sea. In: S. Hvass, and B. Storgaard, eds. *Digging into the past. 25 years of archaeology in Denmark*. Århus. Aarhus University Press. pp. 20-23.

Larsson, L., 2004. *The Mesolithic period in Southern Scandinavia: with special reference to burials and cemeteries, Mesolithic Scotland and its neighbours*. In: A. Saville, ed. 2004. Edinburg: Society of Antiquaries of Scotland. pp. 371-392.

Nielsen, P.O., 1986. The Beginning of the Neolithic—Assimilation or Complex Change?. *Journal of Danish Archaeology*, 5(1), pp. 240-243.

Nygaard, S.E., 1987. Late Mesolithic hunter-gatherers and the transition to farming in southern Scandinavia. In: P. Rowley-Conwy, M. Zvelebil, and H.P. Blankholm, eds. Mesolithic *Northwest Europe: Recent Trends*. Sheffield: Department of Archaeology & Prehistory. pp. 147-154.

Petersen, E.B., 1973. A survey of the Late Palaeolithic and the Mesolithic of Denmark. In: S.K. Kozlowski, ed. *The Mesolithic in Europe*. Warsaw: University Press. pp. 77-127.

Petersen, K.S., 1985. The Late Quaternary History of Denmark. Journal of Danish Archaeology, 4, pp. 7-22.

Pickard, C., and Bonsall, C., 2004. Deep-Sea Fishing in the European Mesolithic: Fact or Fantasy? *European Journal of Archaeology*, 7(3), pp. 273-290.

Price, D.T., 1991. The Mesolithic of Northern Europe. *Annual Review of Anthropology*, 20, pp. 211-233.

Price, D.T. and Petersen, E.B., 1987. Prehistoric coastal settlement in Mesolithic Denmark. Scientific *American*, March, pp. 112-121.

Rowley-Conwy, P., 1984. The Laziness of the Short-Distance Hunter: The Origins of Agriculture in Western Denmark. *Journal of Anthropological Archaeology* 3, pp. 300-324.

Skaarup, J., 1993. Submerged settlements. In: S. Hvass, and B. Storgaard, eds. *Digging into the past. 25 years of archaeology in Denmark*. Århus. Aarhus University Press. pp. 70-75.

Trolle-Lassen, T., 1984, *A preliminary report on the archaeological and zoological evidence of fish exploitation from a submerged site in Mesolithic Denmark*. C.N.R.S. Centre de Recherches Archéologiques. Notes et Monographies Techniques 16, pp. 133-143.

Trolle-Lassen T., 1986. Human exploitation of the pine marten (Martes martes (L.)) at the late Mesolithic settlement of Tybring Vig in Western Funen. *Striae*, 24, pp. 119-124.

Trolle-Lassen, T., 1990. Butchering of Red Deer (Cervus Elaphus L.) A Case Study From the Late Mesolithic Settlement of Tybrind Vig, Denmark. *Journal of Danish Archaeology*, 9, pp. 7-37.

Skateholm

Alexandersen, V., 1988. Description of the human dentitions from the Late Mesolithic grave fields at Skateholm, Southern Sweden. In: L. Larsson, ed. *The Skateholm Project*. I Man and Environment. Stockholm: Almqvist & Wiksell International. pp. 106-163.

Bjelm, L. and Larsson, L., 1984. Application of Georadar in Archaeological Research. Results from a test at Skateholm, Southern Sweden. *Meddelanden från Lunds universitets historiska museum 1983–1984*. pp. 39–46.

Carter, R.J., 2004. Seasonal Human Presence at the Late Mesolithic sites of Tegerup, Segebro, Skateholm I, Bvkeberg III and Ageröd V from the Developing Mandibular Dentition of Red Deer 44(Cervus elaphus) and Roe Deer (Capreolus capreolus). *Lund Archaeological Review*. pp 5-20.

Eriksson, G. and Lidén, K., 2003. Skateholm revisited: New stable isotope evidence on Human and Fauna. *Norm and Difference: Stone Age Dietary Practice in the Baltic Region*. Stockholm: Stockholm University. pp. 1-11.

Fahlander, F., 2003. *The materiality of serial practice. A microarchaeology of burial*. Gotarc series B, n23. Gothenburg: Gothenburg University.

Fahlander, F., 2008. A Piece of the Mesolithic Horizontal Stratigraphy and Bodily Manipulations at Skateholm. In: F. Fahlander and T. Oestigaard, eds. 2008. *The Materiality of Death: Bodies, Burials, Beliefs*. London: British Archaeological Reports. pp. 29-45.

Fahlander, F., 2010. Messing with the dead: Post-depositional manipulations of burials and bodies in the South Scandinavian Stone Age. *Documenta Praehistorica*, 37, pp. 23-31.

Jonsson, L., 1986. *Fish bones in the late Mesolithic Graves at Skateholm, Scania, South Sweden. Fish and Archaeology : studies in osteometry, taphonomy, seasonality, and fishing methods*. Oxford: BAR International Series, 294. pp. 62-79.

Jonsson, L., 1988. The vertebrate faunal remains from the Late Atlantic settlement Skateholm in Scania, South Sweden. In: L. Larsson, ed. *The Skateholm Project*. I Man and Environment. Stockholm: Almqvist & Wiksell International. pp. 56-88.

Juel Jensen, H., 1988. A functional analysis of flake axes from Skateholm I. In: L. Larsson, ed. *The Skateholm Project*. I Man and Environment. Stockholm: Almqvist & Wiksell International. pp. 175-178.

Larsson, L., 1981. The Mesolithic settlement and graveyard from Skateholm, southern Sweden. *Mesolithic Miscellany*, 2 (1), pp. 4-5.

Larsson, L., 1982. A 7000 years old site at the southern coast. New things about old things from Skateholm. *Mesolithic Miscellany*, 3(1), pp. 3-5.

Larsson, L., 1984a. *The Skateholm Project. A Late Mesolithic settlement and cemetery complex at a south Swedish Bay*. Papers of the Archaeological Institute University of Lund 1983-1984, pp. 5-38.

Larsson, L., 1984b. The Skateholm Project. Hunters-fishers-farmers. *Mesolithic Miscellany*, 5(I), pp. 5-9.

Larsson, L., 1985a. Of house and hearth. The excavation, interpretation and reconstruction of a Late Mesolithic house. *Archaeology and Environment*, 4, pp. 197-209.

Larsson, L., 1985b. The Skateholm Project. On the trail of changes in burial customs, ritual areas and tame foxes. *Mesolithic Miscellany,* 6(1), pp. 1-5.

Larsson, L., 1988c. *The Skateholm Project. I. Man and environment*. Stockholm: Almqvist & Wiksell International.

Larsson, L., 1989a. Late Mesolithic settlement and cemetries at Skateholm, southern Sweden. In: C. Bonsall, ed. *The Mesolithic in Europe, Papers Presented at the Third International Symposium, Edinburgh, 1985, John Donald, Edinburgh.* Edinburgh: Department of Archaeology, University of Edinburgh. pp. 367-378.

Larsson, L., 1993. The Skateholm Project: Late Mesolithic Coastal Settlement in Southern Sweden. In: P.I. Bogucki, ed. *Case Studies in European Prehistory*. CRC Press. pp. 31-62.

Larsson, L., 2002. Food for the living, food for the dead. In: University of Aberdeen, *Hunting and gathering societies 2002, ninth international conference*, University of Aberdeen, Available at: <http://www.abdn.ac.uk/chags9/1larsson.htm>. [Accessed 13 November 2013].

Larsson, L., 2004. *The Mesolithic period in Southern Scandinavia: with special reference to burials and cemeteries, Mesolithic Scotland and its neighbours*. In: A. Saville, ed. 2004. Edinburg: Society of Antiquaries of Scotland. pp. 371-92.

Midgley, M.S., 2005. *The monumental cemeteries of prehistoric Europe*. Stroud: Tempus

Nilsson L., 1998. Dynamic Cadavers. A field-anthropological analysis of the Skateholm II burials. *Lund Archaeological Review*, 4, pp. 5–17.

Persson, O. and Persson ,E., 1984. *Anthropological report on the Mesolithic graves from Skateholm, southernSweden. I. Excavation seasons 1980–1982*. Institute of archaeology, report series No. 21. Lund: University of Lund.

Price, D.T., 1991. The Mesolithic of Northern Europe. *Annual Review of Anthropology,* 20, pp. 211-233.

Schmidt, R.A., 2004. The Contribution of Gender to Personal Identity in the Southern Scandinavian Mesolithic. In: E.C. Casella and C.Fowler, eds. 2004. *The archaeology of plural and changing identities*. New York: Springer. Pp 79-108.

Stilborg, T. O. and Bergenstråhle, I., 2000. Traditions in transition: a comparative study of the patterns of Ertebølle lithic and pottery changes in the late Mesolithic ceramic phase at Skateholm I, III and Soldattorpet in Scania, Sweden. *Lund archaeological review*, pp 23-41.

Strassburg, J., 2000. *Shamanic shadows. One hundred generations of undead, subversion in southern Scandinavia 7,000-4,000 BC*. Stockholm: Stockholm University.

Stutz, L.N., 2003. *Embodied rituals & ritualized bodies: tracing ritual practices in late mesolithic burials*. Stockholm: Wallin & Dahlholm.

Vedbaek

Aaris-Sørensen, K., 1980. *Atlantic Fish, Reptile and Bird Remains from the Mesolithic Settlement at Vedbaek, North Zealand*. Viedenskabelige Meddelelser Fra Dansk Naturhistorisk Forening, 142. pp. 139-149.

Albrethsen , S.E. and E. Petersen, B.E., 1977. Excavation of a Mesolithic Cemetery at Vedbæk, Denmark. *Acta Archaeologica*, 47, pp. 1-28.

Enghoff, I.B., 1983. *Size distribution of cod gadus morhua and whiting merlangius merlangus pisces gadidae from a mesolithic settlement at vedbaek north zealand denmark*. Videnskabelige Meddelelser Fra Dansk Naturhistorisk Forening, pp. 83-98.

Johansen, L., 1998. Refitting Analysis of the Mesolithic Site at Vaenget Nord in Denmark. In: N.J. Conard, and C. Kind, eds. *Aktuelle Forschungen zum Mesolithikum.* Tübingen: Tübingen-Druck. pp. 75-87.

Juel Jensen, H., and Petersen, E.B., 1985. A functional study of lithics from Vænget Nord, a Mesolithic site at Vedbæek, N.E. Sjælland. *Journal of Danish Archaeology* 4, pp. 40-51.

Larsson, L., 2004. *The Mesolithic period in Southern Scandinavia: with special reference to burials and cemeteries, Mesolithic Scotland and its neighbours*. In. A. Saville, ed. 2004. Edinburg: Society of Antiquaries of Scotland. pp. 371-92.

Meiklejohn, C. and Wymann, J.M., 1993. *The skeletal Material from Feature N. Gongehusvej 7 Vedbæk, North Sjaelland, Denmark: A preliminary Report*. Winnipeg: Department of Anthropology, University of Winnipeg .

Petersen,E.B., 1989b. Vengæt Nord: Excavation, documentation and interpretation of a Mesolithic site at Vedbæk. In: C. Bonsall, ed. 1989. *The Mesolithic in Europe, Papers Presented at the Third International Symposium, Edinburgh, 1985*, *John Donald*, Edinburgh, pp. 325-330.

Price, T.D. and Petersen, E.B., 1987. A Mesolithic Camp in Denmark. *Scientific American*, 256(3), pp. 112-121.

Stutz, L.N., 2003. *Embodied rituals & ritualized bodies : tracing ritual practices in late mesolithic burials*. Stockholm: Wallin & Dahlholm.

Strandvägen

Åberg, J., 2005. From the Hunter's Point of View. Animal Bones from the Motala site. In: G. Gruber, ed. 2005. *Identities in Transition. Mesolithic Strategies in the Swedish Province of Östergötland*. Linköping: Riksantikvarieämbetet, Arkeologiska undersökningar,Skrifter, 64. pp. 76-95.

Bergstrand, T., 2005. Leister fishing in Motala Ström during the Atlantic period: A typological study based on the finds from the Motala site, Östergötland. In: G. Gruber,

ed. 2005. *Identities in Transition. Mesolithic Strategies in the Swedish Province of Östergötland*. Linköping: Riksantikvarieämbetet, Arkeologiska undersökningar,Skrifter, 64. pp. 54-75.

Carlsson, T., 2004. *Arkeologisk slutundersökning: Mesolitikum och yngre järnålder på Strandvägen 1. Riksantikvarieämbetet UV Öst: Dokumentation av fältarbetsfasen 2004:2*. Linköping: Riksantikvarieämbetet.

Carlsson, T., 2007. Mesolitiska möten: Strandvägen, en Senmesolitisk Boplats vid Motala Ström. *Acta Archaeologica Lundensia*, 8(54).

Carlsson, T., 2008. *Where the River Bends: Under the Boughs of Trees: Strandvägen : a Late Mesolithic Settlement in Eastern Middle Sweden*. Stockholm: Riksantikvarieämbetet.

Carlsson, T., Gruber, G and Molin, F., 2005. Mesolithic in Östergötland . An introduction. In: G. Gruber, ed. 2005. *Identities in Transition. Mesolithic Strategies in the Swedish Province of Östergötland*. Linköping: Riksantikvarieämbetet, Arkeologiska undersökningar,Skrifter, 64. pp. 8-23.

Carlsson, T., Gruber, G., Molin, F. and Wikell, R., 2003. Between Quartz and Flint: Material Culture and Social interaction. In: L. Larsson, H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund, eds. 2003. *Mesolithic on the Move: Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*. Oxford: Oxbow Books. pp. 302-309.

Carlsson, T., Kaliff, A. and Larsson, M., 1999. Man and the Landscape in the Mesolithic: Aspects of Mental and Physical Settlement Organization. In: J. Boaz, ed. *The Mesolithic of Central Scandinavia*.Oslo: Universitetets Oldsaksamlings. Skrifter 22, pp. 47-72.

Carlsson, T., 2005. Home, Sweet Home. The spatial story of Mesolithic settlement organization in Östergötland. In: G. Gruber, ed. 2005. *Identities in Transition. Mesolithic Strategies in the Swedish Province of Östergötland*. Linköping: Riksantikvarieämbetet, Arkeologiska undersökningar,Skrifter, 64. pp. 36-53.

Tagerup

Ahlström, Torbjörn. 2003. Mesolithic human skeletal remains from Tågerup,Scania, Sweden. In: L. Larsson, H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund, eds. 2003. *Mesolithic on the Move: Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*. Oxford: Oxbow Books. pp. 478-484.

Andersson, M. et al, 2004. *Stone Age Scania*. Malmö: Elander Berlings. Tågerup a Middle and Late Neolithic Site. pp. 95-131.

Karsten, P. and Knarrström, B., 2001. Tågerup-Fifteen Hundred Years of Mesolithic Occupation in Western Scania, Sweden: A Preliminary View. *European Journal of Archaeology*, 4, p. 165.

Karsten, P. and Knarrström, B., 2003. *The Tagerup Excavations* (Skanska Spar : Arkeologi Langs Vastkustbanan). Svenska: Riksantikvarieambetets forlag.

Regnell, M., 2012. Plant subsistence and environment at the Mesolithic site Tågerup ,southern Sweden: new insights on the ‘‘Nut Age’’. *Vegetation History and Archaeobotany,* 21(1), pp. 1-16.

Sørensen, M. et al, 2013. The First Eastern Migrations of People and Knowledge into Scandinavia: Evidence from Studies of Mesolithic Technology, 9th-8th Millennium B. *Norwegian Archaeological Review*, 46(1), pp. 19-56.

Mosegarden

Madsen, T. and Jensen, H.J., 1982. Settlemet and land use in early Neolithic Denmark. *Analecta Prahistorica Leidensia* 15, pp. 63-86.

Madsen, T and Petersen, J.E., 1984. Tidligneolitiske anlaeg ved Mosegarden. Regionale og kronologiske forskelle I tidligneolithikum. *Kulm*, 1982-3, pp. 61-115.

Norsminde

Andersen, S.H. 1976. Et østjysk fjordsystems bebyggelse I stenalderen: Norsminde Fjord undersøgelsen. In: H. Thrane, eds. *Bebyggelsesarkaeologi Skrifter Fra Institut for historie og Samfundsvidenskab, 17*. Odense: Odense Universitet.

Andersen, S.H., 1989. Norsminde. A "Kokkenmodding" with Late Mesolithic and Early Neolithic occupation. *Journal of Danish Archaeology,* 8, pp. 13-40.

Andersen, S.H. and Johansen, E., 1987. Ertebølle Revisited. *Journal of Danish Archaeology,* 5, pp. 31-61.

Brouwer, M.E., 2009. Going against the grain?: trends observed in Mesolithic and Neolithic flint assemblages from Norsminde in Denmark. *Antiquity,* 83, p. 319.

Enghoff, I.B., 1989. Fishing from the stone age settlement of Norsminde. *Journal of Danish Archaeology*, 8, pp. 13-40.

Laurie, E.M., 2008. *An Investigation of the Common Cockle (Cerastoderma edule (L.)): Collection practices at the Kitchen Midden Sites of Norsminde and Krabbesholm, Denmark*. Oxford: Archaeopress, BAR, International Series 1834.

Bjørnsholm

Andersen, S.H., 1990. Pollen Spectra from two Early Neolithic Lugged Jars in the Long Barrow at Bjørnsholm, Denmark. *Journal of Danish Archaeology*, 9, pp. 56-63.

Andersen, S.H., 1991. Bjørnsholm, a Stratified Kokkenmodding on the Central Limfjord, North Jutland. *Journal of Danish Archaeology*, 10, pp. 59-96.

Andersen, S.H., and Johansen, E., 1990. An Early Neolithic Grave at Bjørnsholm, North Jutland. *Journal of Danish Archaeology,* 9, pp. 38-58.

Bratlund, B., 1991. The Bone Remains of Mammals and Birds from the Bjørnsholm Shell-Mound: A Preliminary Report. *Journal of Danish Archaeology*, 10, pp. 97-104.

Enghoff, I.B., 1991. Mesolithic Eel-Fishing at Bjørnsholm , Denmark, Spiced with Exotic Species. *Journal of Danish Archaeology,* 10, pp. 105-118.

Rasmussen, K.L., 1991. Radiocarbon Datings from the Bjørnsholm Site, North Jutland. *Journal of Danish Archaeology,* 10, pp. 93-96.

Grødbygard

Kempfner, K. et al, 1985. Settlement Sites with Middle Neolithic Houses at Grødbyard, Bornholm. .*Journal of Danish Archaeology,* 4(1), pp. 87-100.

Nielsen, F. O. and Nielsen, P.O., 1991. The Middle Neolithic Settlement at Grødbygard, Bornholm. In:K. Jennbert et al, eds *Regions and reflections in honour of Märta Strömberg*. Acta Archaeologica Lundensia Series in 8(20), pp 51-65.

Troldeberg

Winther, J., 1935. *Troldebjerg*. *En bymæssig Bebyggelse fra Danmarks yngre Stenalder. Deutsche Zusammenfassung*. Rudkøbing: Eget forlag.

Karlsfalt

Hjjelqvist, H., 1985. Economic plants from two stone age settlements in southernmost Scandinavia. In: L. Larsson, ed. *Karlsfalt: a settlement from the early and late funnel beaker culture in southern Scania, Sweden*. Acta Archaeologica, 54, pp. 3-63.

Larsson, L., 1985. Karlsfalt: a settlement from the early and late funnel beaker culture in southern Scania. *Acta Archaeologica,* 54, pp. 3-71.

Lindebjerg

Liverage, D., 1981. Neolithic monuments at Lindebjerg NW Zealand. Acta archaeological, 51, pp. 85-152.

Sarup

Andersen, N.H., 1988a. Sarup: Two Neolithic Enclosures in South-West Funen. *Journal of Danish Archaeology,* 7(1).

Andersen, N.H., 1988b. The Neolithic causewayed enclosures at Sarup on south-west Funen Denmark. In: C.P. Burgess, C. Topping, Mordant and M. Maddison, eds. 1988. *Enclosures and Defences in the Neolithic of Western Europe*. Oxford: BAR, International Series 403.

Andersen, N.H. 1997. *The Sarup Enclosures. The Funnel Beaker Culture of the Sarup site including two causewayed camps compared to the contemporary settlements in the area and other European enclosures*. Århus: Jutland Archaeological Society Publications 33(1).

Andersen, N.H. 1999a. *Saruppladsen. Tekst. Sarup vol 2*. Århus . Jutland Archaeological Society Publications, 33(3).

Andersen, N.H. 1999b. *Saruppladsen. Katalog. Sarup vol 3*. Århus. Jutland Archaeological Society Publications, 33(2).

Andersen, N.H. 2004. Sarup Causewayed enclosures placed in a Neolithic ritual landscape on Funen, *Denmark Journal of Nordic Archaeological Science,* 14, pp. 11–17.

Jeppesen, J., 1984 Functionbestemmelse af flintredskaber. Slidsporanalyse af skabere fra sarup. *Kulm*, 1982-3, pp. 31-60.

Jorgensen, G., 1977. Et Kornfund fra Sarup. *Kulm*, 1976, pp. 47-64.

Raetzel-Fabian, D., 1999. Monumentality and Communication - Neolithic Enclosures and Long Distance Tracks in West Central Europe. *Journal of Neolithic Archaeology*, 2002.

Tilley , C.Y., 2003. *An Ethnography of the Neolithic: Early Prehistoric Societies in Southern Scandinavia*. Cambridge: Cambridge University Press

Whittle, A., 1996. *Europe in the Neolithic: The Creation of New Worlds*. Cambridge: Cambridge University Press.

Whittle, A., 2008. *Problems in Neolithic Archaeology*. Cambridge: Cambridge University Press

Tustrup

Andersen, S.T., 2012. The Cultural Landscape of Megalithic Tombs in Denmark, Reconstructed by Soil Pollen Analysis, *Danish Journal of Archaeology*, 1(1), pp. 39-44.

Kjærum, P., 1955. A Neolithic Temple. *Kuml*, 7, pp. 7-35.

Kjærum, P., 1957. Storstensgrave ved Tustrup. *Kuml*, 9, pp. 9-23.

Kjærum, P., 1967. Mortuary Houses and Funeral Rites in Denmark. *Antiquity*, 41(163), pp. 190–196.

Ferslev

Bakker, J.A., 2009. *Studies in the Chronology and Geography of the Makers of Hunebeds and Tiefstich Pottery*. Leiden: Sidestone Press.

Kjærum, P., 1967. Mortuary Houses and Funeral Rites in Denmark. *Antiquity* 41(163), pp. 190–196.

Marseen, O., 1960. The Ferslev House. *Kuml* 1960, pp. 36-55.

Appendix 1 material correlates Codebook

Contents

Appendix 1 material correlates Codebook **559**

Recording and Categorising **560**

General information **561**

Subsistence practices **571**

General ritual/religious characteristics **586**

Mortuary practices **612**

Social complexity **696**

Sharing avoidance **740**

Community, ritual and monumental architecture **754**

Recording and Categorising

The Purpose of this document is to outline the recording and categorising strategy for the ethnographic (eHRAF) and archaeological databases central to this DPhil research project. In doing so, this document details the following three aspect of the recording and categorising strategy: (1) the specific aspects of each category that were examined in the eHRAF ethnographic and archaeological record; (2) the approach that was taken to identifying and extracting the data from the archaeological sources for the 111 site-phases used; and (3) the specific Outline of Cultural Material (OCM) code(s) that were used to extract and record the information relating to each of the categories from the eHRAF database. For the archaeology, the main focus was searching for the material culture that was indicative of particular practices. Where as in the eHRAF, ethnographic accounts I was looking for recorded references to the practices by an ethnographer(s). The archaeological data was collected from published material such as excavation reports, journal articles and books which could be accessed through Oxford and/or associated library resources. In relation to the eHRAF sample, a specific set of OCM codes were used to collect the data. The OCM codes are search codes relating to specific cultural information provided by the host of the eHRAF database. The information was recorded in terms of one qualitative category and 2 quantitative categories:

1. written descriptions
2. binary categories of absence or presence using (0 or 1)
3. likert scales to record the levels or intensities using (0 to 2) or (0 to 3)

Information for each eHRAF culture and archaeological site-phase was recorded on a Microsoft Access database in terms of seven categories:

8. General information

9. Subsistence information
10. General ritual/religious characteristics
11. Mortuary practices
12. Social complexity
13. Sharing avoidance
14. Ritual, community and monumental architecture

General information

General information about each eHRAF culture and archaeological site-phase was recorded on a Microsoft Access database. This information included the name of the culture, the geographic location of that culture and the estimated population size of the culture. For the eHRAF cultures, the OCM codes 105, 131, 132, 161 and cultural summary were be used for the purpose of recording these categories. The categories used to record general information were:

7. Name of eHRAF culture*
8. Name of archaeological site (site-phase)*
9. Geographic region
10. Geographic sub-region
11. Archaeological period*
12. Absolute dating*
13. Site phase cultural horizon*
14. Estimated area of settlement*
15. Period covered by ethnographic account(s)*
16. Time(s) of excavation of material(s) used*
17. Preservation conditions (description)*
18. Bone preservation conditions (description)*
19. Estimated average population

20. Degree of sedentism

* recorded only for archaeological site-phases

* recorded only for eHRAF cultures

1. Name of eHRAF culture*: Name given in the ethnographic account(s) provided by the eHRAF

2. Name of archaeological site (site-phase)*: Name given in the published literature usually connected to nearest town or topographical feature

3. Geographic region: This is the continent on which the site-phase or ethnographic culture are located

4. Geographic sub-region: This includes as much regions/local information as possible. For example, country, province, town etc.

5. Archaeological period*: Recorded in both Calibrated Years BP and Calibrated Years BC

6. Absolute dating*: Date given in published material following radiocarbon or AMS dating of each site-phase

7. Site phase cultural horizon*: Cultural horizon that the site-phase has been assigned to following dating and material culture evidence, e.g. Late Mesolithic

8. Estimated area of settlement*: The estimated the dated occupation/settlement area excavated, surveyed and reported upon in the literature/available sources (not just the areas of the excavation trenches). Given in meters squared (m^2) or hectares (ha). With 1 m^2 equal to 0.0001 hectares

9. Period covered by ethnographic account(s)*: The period covered by the ethnographic accounts given in the eHRAF database. Recorded as (1) period from X until Y in calendar years and (2) the number of years covered. For example, (1) 1810 to 1820 and (2) 10 years.

10. Time of excavation of material(s) used*: The period of (1) excavation and/or (2) different period of excavations in calendar years; e.g. (1) 1970 to 1988 and/or(2) 1970 to 1988, 1990 to 1992 and 2001 to 2006

11. Preservation conditions (description)*: Record the description of the site-phase given in the literature in terms of its composition: (1) the soil type ranging from sand to clay; (2) Inclusions in the soil e.g. Stones and charcoal: (3) the Colour of the soil; (4) the recorded acidity or basicity using ph. level.

12. Bone preservation conditions (description) *:

There are three aspects to recording the conditions of the recovered human bone. Record if the bone recovered reflects inhumation or cremation or both. Record the description of the human bone recovered given in the literature. For example, bone consistency can be described as brittle, hard, soft or metallic in consistency. Lastly, where given, the preservation of human bone is recorded in relation to the survival of original collagen in the recovered human bone, following the ranges given by Jans *et al.* (2002). Human bone is a heterogeneous composite material consisting of a hydroxyapatite, mineral phase and an organic phase. The organic phases accounts for 30% of bone composition. Of this 30%, 90% is composed of type 1 collagen. Thus, it is possible to use collagen as a standard method to examine the preservation of bone following recovery. Where it has been examined, the percentage of original collagen remaining is used to record the preservation of bone from a site-phase. The preservation of bone based on the percentage of original collagen remaining is recorded in terms of three categories.

d) poor <30% of original collagen remaining

e) moderate 30-60% of original collagen remaining

f) good > 60% of original collagen remaining

(Jans *et al.* 2002)

13. Estimated average population: (1, 2, 3)

(1 = population < 150 people, 2 = 150 to 500 and 3 = 500 to 5,000 people)

Focusing on the mathematical relationship between population size and site-phase area, two formulae based on estimated the dated occupation/settlement area excavated, surveyed and reported upon in the literature/ available sources, not just the areas of the excavation trenches are used: $P = 2.9379\ A^{.37}$ for the hunter-gatherer or Mesolithic and Epipalaeolithic site-phases and $P = 146\ \sqrt{A}$ for the agriculturalist or Neolithic site-phases. The assessment of population relates to the calculation of people at each site-phase using estimated area of the site-phase following surveying and excavation and reported in the literature. For this research, population was taken as the number of people at a given site-phase (using the formula) rather than any potential extended community which would have been difficult to determine over 111 site-phases. Therefore, the extent of the site-phase is what was considered as the community.

14. Degree of sedentism: (0, 1, 2) (0= no sedentism, 1= moderate sedentism/ Semi-sedentary, 2= fully sedentary communities

eHRAF: In the eHRAF database each culture is classified as mobile/nomadic, semi nomadic and settled/sedentary. For each eHRAF culture, the evidence for degree of sedentism is recorded form the available sources that identify and record the subsistence strategy, agricultural intensity, storage practices, settlement plan and mobility patterns for each culture.

Archaeology: In relation to the archaeological record a number of aspects were focused on; which can be categorised as: (1) group mobility pattern; (2) population density; the relationship between housing and mobility; (3) resource strategy; (4) food storage strategy; and (5) site-phase organisation. Criteria developed by:

(1) Examining various ethnographic record including eHRAF, Binford (1980; 1990); Kelly (1983; 1991; 1992); Raferty (1985);

(2) Examining the archaeological record of both regions; and

(3) Using criteria developed during a pilot study.

A number of the categories used to assess level of sedentism are dealt with in more detail in the additional sections. For the archaeological site-phases, the degree of sedentism is recorded form the available sources in relation to a set of material culture criteria relating to practice that are indicative of different levels of sedentism:

0 = Classification of no evidence of sedentism

The term fully mobile or nomadic relates to evidence of year-round residential mobility. This degree of sedentism is recorded form the available sources that identify and record any 3 of 23 material culture criteria relating to the no sedentism. The material culture evidence used to classify site-phases in this category was:

1. Group size less than 150 people
2. Evidence of hunting
3. Evidence of gathering
4. No evidence of domesticated plants
5. No evidence of domesticated plants
6. Group focused on a large number of resources; e.g. table isotope evidence indicates: (1) use of varied plant food sources; (2) indicates both terrestrial and marine diet elements
7. No evidence of long-term food storage strategy but can be evidence of short-term food storage, for example, in pits of storage of wild fruit, nut, seeds etc.
8. No large scale community food stores e.g. store rooms, granaries or silos

9. Located near a critical resource e.g. water source

10. Evidence of seasonal use of resources e.g. seasonal wild plants, summer fish caching, young animal bones indicting winter slaughtering

11. Evidence of processing of wild resources

12. Evidence of low occupation field camp via low amount of artifacts, single heath and lithic scatter

13. Evidence of occupation of natural shelters via low amount of artifacts, single heath and lithic scatter and no evidence of camp construction

14. No evidence of difficult to transport artifacts

15. No construction of permanent monuments

16. Dispersed not nucleated settlement pattern

17. Structures circular and semi-circular in plan

18. Generally locally sourced material used in construction rather than transported material

19. No evidence of foundations as construction on ground surface. Often only modification to ground surface maybe circular or semi-circular pots holes

20. Construction may include: stick and bush frame, thatch structure and, occasionally, some wattle and daub elements.

21. No use of mud or other types of bricks

22. In most examples roof and sides are the same material e.g. hide, locally sourced bark or vegetation

23. No dedicated burial area for repeated use

1 = Semi-sedentary groups

Semi-sedentary refers to a mobility situation in which relatively permanent house sites are maintained and returned to frequently, but where members of the group are seasonally mobile to procure resources. This degree of sedentism is recorded form the available sources that identify and record and record any 4 of 26 material

culture criteria relating to the degree of sedentism. The material culture evidence used to classify site-phases in this category was:

1. Group size not larger than 500
2. Evidence that some residence do occupy the site-phase on a year-round basis
3. Site-describe as early or proto-village
4. Evidence of garden cultivation with some evidence of domestication
5. Evidence of domesticated plants but not necessarily stables
6. evidence of domesticated animals such a sheep and goat but not necessarily cattle
7. Evidence of diet supplemented by hunting of wild species
8. Evidence of diet supplemented by gathering of wild species
9. Evidence of diet supplemented by seasonally available wild resources
10. Community focused on a smaller number of resources compared to mobile groups; e.g. particular crops

- Stable isotope evidence indicts use of particular food sources e.g. terrestrial protein source

11. Evidence of long-term food storage strategy
12. Domestic food stores e.g. store rooms, cists, granaries or grain bin
13. Evidence of processing of domesticated resources (plants)
14. Evidence of processing of domesticated resources (animals)
15. Evidence of seasonal use of resources e.g. seasonal wild plants, summer fish caching, young animal bones indicting winter slaughtering
16. Evidence of processing of wild resources
17. Evidence of permanent or semi-permanent occupation with via high amount of artifacts, heaths and lithic scatter
18. craft specialisation for example, stone tools, pottery and other artifacts

19. Structures both circular and rectangular in plan

20. Locally sourced material used in construction

21. Some evidence of foundations and modification of ground surface for construction

22. Construction may include: brush and stick frame, local vegetation, wattle and daub, use of mud or other types of bricks

23. Location, design and orientation are to a degree uniform across a site-phase

24. Not uniform burial practices

25. Not dedicated burial area

26. Presence of mouse (*mus musculus*) bones, indicative of sedentary groups

2 = fully sedentary groups

Fully sedentary refers to groups who maintain their residences in a permanent manner. This degree of sedentism is recorded form the available sources that identify and record of any 4 of 46 material culture criteria relating to the degree of sedentism. The material culture evidence used to classify the site-phases in this category was:

1. Group size greater than 150 people and can be into the 1000s

2. Description as a permanent settlement such as: farmstead, hamlet, village or urban centre

3. Dedicated areas of crop cultivations; larger than garden

4. Dedicated areas for domesticated animals; penning area(s)

5. Evidence of domesticated stables

6. evidence of domesticated animals—particularly, cattle

7. Community focused on a smaller number of resources; e.g. stable isotope evidence indicts use of particular food sources

8. Evidence of long-term domestic food storage strategy via pottery, store rooms, cists, granaries or grain bin and the drying, curing or smoking of protein source

9. Evidence of long-term community food stores via pottery, store rooms, cists, granaries or silos and the drying, curing or smoking of protein source

10. Evidence of processing of domesticated resources (plants)

11. Evidence of processing of domesticated resources (animals)

12. Evidence of secondary produce from domesticated animals e.g. milk use via study of residues in pottery

13. Evidence of long-term occupation with via high amount of artifacts, heaths and lithic scatter

14. Evidence of more complex, elaborate technology e.g water or wind technology

15. Large amount of artifacts due to:

- period of occupation of the site-phase
- reflects that all activates are carried out at the site-phase
- Accumulation of personal possessions

16. craft specialisation for example, stone tools, pottery and other artifacts

17. Evidence of site divisions that reflect craft specialisation for example, stone tools, pottery and other artifacts production areas

18. Evidence of difficult to transport artifacts; large and heavy

19. Construction of permanent monuments, ceremonial structures

20. Construction of community structures e.g. store rooms or meeting houses

21. Nucleated settlement pattern

22. Structures rectangular in plan

23. Structures rectangular in plan with augmentation(s)

24. Not always locally sourced transported material used in construction

25. Definite foundation trenches and modification of ground surface for construction

26. Landscape altered for domestic or monumental construction

27. Construction may include: wattle and daub, use of mud or other types of bricks

28. Roof and sides are the often different material e.g. thatched roof and wooden or mud brick walls

29. Location, design and orientation are mainly uniform across a site-phase

30. Evidence of social or political hierarchy reflected in larger domestic buildings and special burials (grave goods etc.)

31. Uniform burial practices

32. Dedicated burial area

33. Foci such as communal square or plaza

34. Long-term labour investment in domestic structures:

- Maintenance and Renovation e.g. plastering, repainting or reroofing

35. Long-term labour investment in communal structures:

- Large amount of people (team) with different skills require for construction
- time require for construction (not a quick construction)
- Maintenance and renovation e.g. plastering, repainting or reroofing

36. Presence of mouse (*mus musculus*) bones , indicative of sedentary groups

Subsistence practices

This section of the database was used to record the subsistence practices of each eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.2) were used. This section used categories of absence or presence (0 or 1) and Likert scales to identify and record the levels of crop intensity (0 to 2), animal domestication (0 to 2) and the storage strategy (0 to 3) for each culture. The categories used were:

1. Evidence of hunting
2. Evidence of gathering
3. Evidence of fishing
4. Evidence of animal husbandry
5. Evidence of animal domestication intensity
6. Evidence of cultivation/agriculture
7. Evidence of crop cultivation intensity
8. Evidence of settled forager activity
9. Evidence of nomadic pastoralism
10. Type of food storage strategy

Table 1.1: The eHRAF OCM codes for subsistence practices

OCM Code	Description
222	collecting
224	hunting and trapping
225	marine hunting
226	fishing
231	domesticated animals
233	pastoral activities
234	dairying
241	tillage
243	cereal agriculture
246	forage crops
251	preservation and storage of food
262	diet

1. Evidence of hunting: This category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of hunting (1 = present) is indicated by the recording of 1 of 11 criteria relating directly to hunting practices, in the eHRAF database. Reference to or description of

1. hunting as a main food source
2. hunting used to supplement food source
3. organisational aspects of hunting
4. yield from hunting
5. hunting expedition(s)
6. types of animals hunted
7. butchering or rendering of hunter animals

8. sharing or dividing out of hunting yield
9. storage of hunting yield
10. cooking of hunted meat
11. weapons used for hunting

Archaeology: For the archaeological site-phases evidence of hunting (1 = present) is recorded form the available sources that identify and record any 2 of 6 material culture criteria relating to hunting practices. Recording of:

1. the presence of the remains of non-domesticate animal at site phases
2. caches of non-domesticate animal remains
3. evidence on the bones of non-domesticate animal indicative of hunting e.g. perimortem trauma
4. Zooarchaeological evidence of butchery marks on the bones of non-domesticate animal
5. evidence of cooking of non-domesticated animals via spoil heap or hearths
6. weapons associated with hunting animals

2. Evidence of gathering: This category is recorded in terms of: 0 = absent, 1 = present. Gathering in this section relates to non-domesticated plants, vegetables, roots, leaves, cereals, legumes, pulses, nuts, seeds, herbs and fruits.

eHRAF: For each eHRAF culture, evidence of gathering (1 = present) is indicated by the 1 of 10 criteria relating directly to gathering practices, in the eHRAF database. Reference to or description of:

1. gathering as a main food source
2. gathering used to supplement food source
3. organisational aspects of gathering

4. yield from gathering

5. gathering expedition(s)

6. types of plants, vegetables, roots, leaves, cereals, nuts, seeds, herbs and fruits gathered

7. processing and cooking of gathered food source

8. sharing or dividing out of gathering yield

9. storage of gathered yield

10. tools and material used for gathering e.g. reaching or shaking sticks, coiled baskets, fibre bags or containers.

Archaeology: For the archaeological site-phases evidence of gathering (1 = present) is recorded form the available sources that identify and record any 2 of the material culture criteria relating to gathering practices. Recording of:

1. gathered non-domestic plants, vegetables, roots, leaves, cereals, nuts, legumes, pulses, seeds, herbs and fruits at a site-phase preserved via application of fire at a site-phase

2. gathered non-domesticates at a site-phase preserved via human coprolites

3. gathered non-domesticates at a site-phase preserved via waterlogged or other environment factors at a site-phase

4. gathered non-domesticates preserved in addition manners such as in pottery glaze

5. storage of gathered yield, for example in base camps pits, baskets or in pottery

6. storage of gathered yield in domestic and/or communal settings; e.g. in pottery or baskets in a small house or in a large granary or silo

7. cooking of gathered non-domesticates mainly via charcoal associated with hearths

8. tools and material used for gathering e.g. coiled baskets, fibre bags or wooden containers

3. Evidence of Fishing: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of fishing (1 = present) is indicated by the recording of 1 of 10 criteria relating directly to fishing practices, in the eHRAF database. Reference to or description of:

1. fishing as a main food source
2. fishing used to supplement food source
3. organisational aspects of fishing
4. yield from fishing
5. fishing expedition(s)
6. types of fish targeted or caught
7. processing and cooking of fish
8. sharing or dividing out of fishing yield
9. preservation and storage of fish
10. tools and material used for fishing e.g. rods, nets, fish traps or baskets.

Archaeology: For the archaeological site-phases evidence of fishing (1 = present) is recorded form the available sources that identify and record any 1 of the 5 material culture criteria relating to fishing. Recording of:

1. the presence of fish bones at site-phases
2. tools and material used for fishing e.g. fish traps
3. evidence of cooking of fish via spoil heap or hearths
4. evidence of the storage or preservation (drying, smoking, curing) of fish

5. Indication of marine sources in diet through measurement of the ratios of carbon (d13C) and nitrogen (d15N) stable isotopes in bone collagen.

4. Evidence of Animal husbandry: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF cultures, evidence of animal husbandry (1 = present) is indicated by the recording of 1 of 6 criteria relating directly to animal husbandry practices, in the eHRAF database. Reference to or description of:

1. animal husbandry as a food source via meat or animal produce
2. organisational/management aspects of animal husbandry—labour and land use
3. types of domesticated animal kept
4. processing of domesticated animals for meat and produce such as leather or dairy products
5. sharing or dividing out produce or meat as a result of animal husbandry
6. tools and material used in animal husbandry; for example, animal pens or food stored for domesticated animals.

Archaeology: For the archaeological site-phases evidence of animal husbandry (1 = present) is recorded form the available sources that identify and record 1 of 8 material culture criteria relating to animal husbandry practices. Recording of:

1. the presence of the remains of domesticated animal(s) at site phases—particularly, cattle, pig and sheep/goat
2. Zooarchaeological evidence of domestic animal ages, based on tooth eruption and wear indicative of an animal husbandry system

3. Zooarchaeological evidence of variation in livestock cull profiles relating to meat production and/or animals kept for secondary produce

4. The presence of a tanning bath (usually wood such as birch) associated with the remains of domesticated animal(s)

5. Butchery marks on the bones of domesticated animals

6. Evidence of cooking of domesticated animals via spoil heap or hearths

7. The analysis of carbon (d13C) and nitrogen (d15N) stable isotope composition in human bone collagen indicates domesticated herbivore protein in their daily diet

8. Ancient DNA indicates evidence on lactose tolerance connected with the consumption of produce from domesticated animals

5. Evidence of animal domestication intensity: this category is recorded in terms of a likert scale: 0, 1, 2 with 0 = no evidence of animal domestication, 1 = some domestication, including sheep, goats and pigs and 2 = full domestication including, cattle. This is based on the criteria provided in the evidence of animal husbandry section and the evidence of hunting section to determine:

0: If there is no animal domestication and the group are reliant of the hunting of wild animals

1: the identification/recording of domesticated animals such as sheep, goats and pigs that form a component of the protein intake

2: the identification/recording of the presence of domesticated animals especially cattle and no evidence of hunting

6. Evidence of cultivation/agriculture: this category is recorded in terms of: 0 = absent, 1= present.

eHRAF: For each eHRAF culture, evidence of cultivation (1 = present) is indicated by the recording of 1 of 8 criteria relating directly to cultivation practices, in the eHRAF database. Reference to or description of:

1. cultivated crops as a food source
2. land use for crop cultivation
3. organisational/management aspects of cultivation—labour and land use
4. types of domesticated crops (cereals, pulses, legumes etc.) planted and harvested;
5. processing (milling) of domesticated crops e.g. corn-driers, querns
6. processing of domesticated crops
7. storing or preservation out of yield from cultivation
8. sharing or dividing out of yield from crop cultivation; (9) tools and material used in crop cultivation

Archaeology: For the archaeological site-phases evidence of cultivation (1 = present) is recorded form the available sources that identify and recording of 2 of 8 of the material culture criteria relating to cultivating practices. Recording of:

1. domestication (e.g. cereals, pulses and legumes) at a site-phase preserved via application of fire at a site-phase; e.g. charred remains
2. domesticates at a site-phase preserved via human coprolites
3. domesticates at a site-phase preserved via waterlogged context or other environment factors
4. evidence of domesticates preserved in addition manners such as in pottery glaze
5. storage of domesticates, in domestic and/or communal settings e.g. storehouses, grain bin, granaries, pits or in pottery; domestic and/or communal settings

6. cooking of cultivated domesticates mainly via charcoal associated with hearths

7. processing (milling) of domesticates via querns

8. evidence of arable/cultivated land associated with site-phase

7. Evidence of crop cultivation intensity: this category is recorded in terms of a likert scale: 0, 1, 2 with 0 = no evidence of cultivation, 1 = cultivation of non-staples and 2 = intensive cultivation/agriculture with domesticated staples.

This is based on the criteria provided in the evidence of cultivation and the evidence of gathering sections with:

0: evidence of gathering with no evidence of plant domestication

1: cultivation of non-staples and evidence of some gathering of wild plants

2: cultivation of fully domesticated staples being: food that is consumed regularly and forms as a dominant portion of a diet in a given group. Staple foods supply a substantial portion of the energy requirements and nutrients. Fully domesticated plants imply that the plants have been genetically modified over time by humans for the selection of such traits as: loss of grain shattering, shorter maturity or the removal of bitter tasting compounds. For this study, I concentrated on food sources derived from cereals such as wheat, barley maize, rice and rye, as well as, tubers/root vegetables such as yams, taro and potatoes as the staple foods.

8. Evidence of settled forager activity: this category is recorded in terms of: 0 = absent, 1= present.

eHRAF: For each eHRAF cultures, evidence of settled foraging (1 = present) is indicated by the recording 1 of 11 criteria relating directly to foraging practices in

the context of a settled community, in the eHRAF database. Reference to or description of:

1. direct description of the group as settled foragers
2. foraging as a main food source
3. foraging used to supplement food source
4. organisational aspects of foraging
5. yield from foraging
6. foraging expedition(s)
7. types of foraged plants
8. processing and cooking of foraged plants
9. sharing or dividing out of foraged yield
10. storage of foraged yield
11. tools and material used for foraging e.g. reaching or shaking sticks, coiled baskets, fibre bags or containers.

Archaeology: For the archaeological site-phases evidence of foraging (1 = present) is recorded form the available sources that identify and record material culture criteria relating to foraging practices by a settled community. This is based on a two-tier analysis: (1) to establish if a community were settled and (2) if they practiced foraging. Thus, presence is recorded if we have a settled community that has any 2 of the additional criteria

(a) Evidence of a settled group via:

(1) Evidence of construction of permanent buildings and (2) Strontium and/or Oxygen isotopic analysis indicates that population were settled in one location

(b) Recording of foraging of non-domestic resources:

1. plants preserved via application of fire at a site-phase

2. foraging of non-domesticates at a site-phase preserved via human coprolites

3. foraging of non-domesticates at a site-phase preserved due to waterlogged or other environment factors at a site-phase

4. foraging of non-domesticates preserved in addition manners such as in pottery glaze

5. storage of foraging yield, for example in base camps pits or in pottery

6. storage of foraged yield in domestic and/or communal settings; e.g. in pottery, a small store- house or in a granary or silo

7. cooking of foraged non-domesticates mainly via charcoal associated with hearths

8. tools and material used for foraging e.g. coiled baskets, fibre bags or wooden containers

9. Evidence of nomadic pastoralism: this category is recorded in terms of: 0 = absent, 1 = present.

Nomadic pastoralism is a form of pastoralism where livestock are herded in order to find fresh pastures on which to graze. Dyson-Hudson (1980) and Khazanov (1994) present five characteristics of nomadic pastoralism:

1. Pastoralism is the predominant economic activity of the group

2. Maintaining herds of livestock all year round on a system of free-range grazing

3. Mobility within the boundaries of specific grazing territories

4. The participation in pastoral mobility of all or the majority of the population

5. Processing of livestock for subsistence

eHRAF: For each eHRAF culture, evidence of nomadic pastoralism (1 = present) is indicated by the recording any 1 of 11 criteria relating directly to livestock practices in the context of a mobile community, in the eHRAF database. Reference to or description of:

1. the group as nomadic pastoralists
2. moving grazing livestock a main food source
3. group moving for grazing livestock
4. locations for grazing livestock
5. organisational aspects of nomadic pastoralism (i.e. division of a labour for moving and/or maintaining herd)
6. yield from nomadic pastoralism
7. processing of grazing livestock
8. sharing or dividing out of grazing livestock yield
9. storage of yield from grazing livestock
10. tools and material used for nomadic pastoralism
11. settlements and structures associated with nomadic pastoralism.

Archaeology: For the archaeological site-phases evidence of nomadic pastoralism (1 = present) is recorded form the available sources that identify and record material culture criteria relating to grazing of domesticated livestock by a mobile group. This is based on a two-tier analysis: (1) to establish if a community were mobile and (2) if they had domesticated livestock. Thus, presence is recorded if we have a mobile group that has any of the additional criteria:

(a) Evidence of a mobile group outlines in the degree of sedentism section include:

(1) Evidence of construction of non-permanent buildings; (2) evidence of base camps and (3) Strontium and/or Oxygen isotopic analysis indicates that population were mobile

(b) Domesticated livestock recorded in terms of:

1. the presence of the remains of domesticated animal at the site-phase

2. zooarchaeological evidence of domestic animal ages, based on tooth eruption and wear indicative of managed system

3. Zooarchaeological evidence of variation in livestock cull profiles relating to meat production and/or animals kept for secondary produce in the context of a mobile group

4. zooarchaeological evidence of domestic animal ages, based on tooth eruption and wear indicative of nomadic pastoralism system

5. butchery marks on the bones of domesticated animals in the context of a mobile group

6. evidence of cooking of domesticated animals via spoil heap or hearths in the context of a mobile community

7. strontium and/or Oxygen isotopic analysis indicates that animals were grazing in different locations

8. ancient DNA indicates evidence of lactose tolerance connected with the consumption of produce from domesticated animals in the context of a mobile group.

10. Evidence and type of Food storage strategy: this category is recorded in terms of a likert scale: 0, 1, 2, 3; with 0 = no storage strategy, 1 = daily/weekly, 2 = monthly (less than 3 months), 3 = seasonal/yearly.

eHRAF: For each eHRAF culture, evidence of food storage strategy is scored in relation to the recording of criteria relating directly to food storage strategy, in the eHRAF database. Reference to or description of:

1. storage strategy employed by the culture
2. storage used to supplement food source in times of scarcity
3. storage method for food sources
4. organisational aspects of food storage

5. types of food sources stored

6. location of food storage

7. underground storage

8. domestic storerooms/houses

9. communal storerooms/houses

10. use of pottery or jars

11. evidence of freezing, drying, smoking, pickling, curing (salting), brining, burial, sealing and caching

12. processing of food source for storage (preservation methods)

13. sharing or dividing out of stored food (at particular times of year).

Archaeology: For the archaeological site-phases evidence of food storage or preservation relates to practices of preservation of food source via freezing, drying, smoking, pickling, curing (salting), brining, burial, sealing and caching. Storage and preservation of food were examined through the recorded evidence of any of the 11 material culture criteria relating to food storage practices. Recording of:

1. No evidence of food storage in pits, pottery/jars etc. is scored as 0

2. indication of wild fruits and berries such as pear pips in pits is scored as 1

3. preservation of food source by any of the above methods; indicting monthly or seasonal storage strategy depending of foodstuff:

- freezing, drying, smoking, pickling, curing (salting) of fish is scored as 2
- freezing, drying, smoking, pickling, curing (salting) of meat is scored as 3

4. food stored in hermetically sealed via lac (insect residue), clay or soil method (i.e. pottery); indicative of longer-term storage strategy is scored as 3

5. food stored in non-hermetically sealed method (i.e. pit); indicative of shorter-term storage strategy is scored as 2

6. recoding of food source such as nuts or fruits stored in pits but not hermetically sealed in site-phases associated with mobile hunter-gatherers (base-camps) is scored as 1

7. storage of food in a domestic setting; e.g. in pottery is scored as 2

8. storage of food in a domestic setting; e.g. in a domestic granary or grain bin; indicting long storage strategy is scored as 3

9. storage of food in a domestic setting; e.g. in a underground room or space is scored as 3

10. storage of food in a communal settings; e.g. in hermetically sealed pottery in a storage house or in a large granary or silo; indicting seasonal storage strategy is cored as 3

11. storage of food in a communal setting; e.g. in a underground room or space is scored as 3

12. evidence of moderate, garden cultivations is taken as an indication of a seasonal storage strategy is scored as 2

13. evidence of intensive agriculture is taken as an indication of a long-term storage strategy is scored as 3

General ritual/religious characteristics

This section of the database was used to record the general ritual activities of each eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.3) were used. For the most part, this section used categories of absence or presence (0 or 1) to identify and record the overall ritual characteristics of each culture and site-phase. However, to further asses the religious complexity of the eHRAF cultures ritual practice, the number of tiers of religious hierarchy was recorded (0, 1, 2, 3, >3); ranging for no religious practitioner in a community to an organised religious structure ranging from local practitioners to regional and pan-regional levels of hierarchy. Similarly, the level of standardisation was recorded using a Likert scales (0 to 2). In general, the presence of a more organised, homogenised, hierarchical and widespread set of religious practices and beliefs is associated with the doctrinal mode of religiosity. As the dysphoric arousal level and the ritual frequency of each eHRAF culture are already known, this section of the recording process was used to explore to what extent evidence of ritual standardisation and hierarchy can be used to comment on the imagistic or doctrinal nature of ritual/religious practices. Fifteen specific aspects of ritual/ religious characteristics are examined:

16. Evidence of ritual standardisation
17. Level of ritual standardisation
18. Evidence of ritual practitioner(s)
19. Levels of religious hierarchy
20. Evidence of the standardisation of mortuary practices
21. Evidence of ritual domestic space
22. Evidence of communal ritual buildings (not monuments)
23. Evidence of communal ritual monuments/monuments in the landscape

24. Evidence of large statues (and totems)

25. Evidence of anthropomorphic figurines

26. Evidence of zoomorphic figurines

27. Evidence of association between food and rituals*

28. Evidence of feasting

29. Evidence of an association between food and taboo(s) *

30. Evidence of in belief in sorcery/witchcraft/demons (malevolent spiritual forces)*

* recorded only for archaeological site-phases

* recorded only for eHRAF cultures

Table 1.2 the eHRAF OCM codes for ritual characteristics

OCM Code	Description
628	inter-community relations
764	burial practices
766	special burial practices and funerals
767	mortuary Practices
771	general character of religion
778	scared objects and spaces
780 (780-789)	religious practice
795	sects
796	organised ceremonial
869	transmission of beliefs

1. **Evidence of ritual standardisation**: this category is recorded in terms of: 0 = absent, 1 = present

eHRAF: For each eHRAF culture, evidence of ritual standardisation (1 = present) is indicated by the examination of 13 criteria relating directly to ritual/religious practices, in the eHRAF database: Reference to or description of:

1. the level of ritual standardisation in a community
2. hierarchical ritual/religious structure
3. dedicated ritual/religious practitioners
4. organisational aspects of ritual/religious practices
5. beliefs being practiced over a long period of time
6. prescribed ceremonial practices/actions
7. prescribed ceremonial practices/times
8. repetition/diffusion of ritual/religious symbols
9. prescribed set of mortuary practices
10. shared set of beliefs/practices
11. reinforcement of beliefs
12. standardisation of community ritual/religious places/buildings
13. standardisation of ritual/religious architecture

Archaeology: For the archaeological site-phases evidence of ritual standardisation (1 = present) is recorded form the available sources that identify and record of 2 of 15 material culture criteria relating to evidence of ritual standardisation. Recording of:

1. repetition/diffusion of anthropomorphic figurines across the site-phase associated with domestic structures, communal structures, monuments and graves

2. repetition/diffusion of zoomorphic figurines across the site-phase associated with domestic structures, communal structures, monuments and graves

3. repetition/diffusion of human bone relics (the use of particular bone i.e. skulls, long bones, hand and foot bones) across the site-phase associated with domestic structures, communal structures, monuments and graves

4. repetition/diffusion of animal bone relics (the use of particular bones i.e. skulls, and long bones or horns) across the site-phase associated with domestic structures, communal structures, monuments and graves

5. repeated instances of evidence of skull caching, painting or plastering across the site-phase

6. where reliable dating is present, it is established that that skull caching was repeated over a particular period of time

7. repetition of carved or painted symbols across the site-phase associated with domestic structures, communal structures and monuments

8. repetition of domestic ritual spaces across site-phase; identified by ritual artefacts such as figurines and bone relics and carved or painted symbols

9. caching of anthropomorphic figurines, zoomorphic figurines and bone relics in cists, storerooms and niches of building(s)

10. large scale public ceremonial places, identified by associated with presence or storage of carved or painted symbols, artefacts, bone relics or burials: a) communal ritual buildings, b) monuments, c) squares and plazas

11. repetition/standardisation of burial practices in terms of: age, gender, treatment of the body, interment-type, inhumation, completeness, articulation, use of cremation, secondary burial practices, location, orientation, personal adornment and presence/absence of grave goods. This section is used to determine the level of standardisation in burial practices (which is dealt with in a later section) it centres on the description in the literature of a particular practice e.g. the majority of the

dead being treated a certain way at a site-phase. Where percentages are given then greater than or equal to 60% is taken as the majority.

12. where reliable dating is present, it is established that burial practices were repeated over a period of time —strengthening a case for standardisation

13. specific location (cemetery) for burial containing human remains. This can be in a particular location in the landscape (flat cemetery), a communal building, a burial mound or monument

14. special burial treatment (outlined in mortuary practices section) for a limited/select number of individuals (< 30% if percentages are given) may indicate:

(a) a way of treating the corpse of certain individuals

(b) religious leader or practitioner.

15. similarity of painted or carved symbols, figurines, bone relics, architecture of communal ritual structures (monuments and buildings) and burial practices to other site-phases in the region. This is used to consider a shared belief or ritual practices across a number of sites which may be indicative of ritual standardisations

2. Level of ritual standardisation: this category is recorded in terms of a likert scale: 0, 1, 2 with 0 = no evidence of ritual standardisation, 1 = some degree ritual standardisation with variations of practices observed and 2 = consistent evidence of highly standardised, repeated practices.

eHRAF cultures: the same criteria used to examine the evidence of ritual standardisation are applied here to determine if practice/beliefs are practiced and replicated throughout the community network.

Archaeology: the same criteria used to examine the evidence of ritual standardisation are applied here to determine to what extent ritual/religious practices are replicated throughout the site-phase an, where possible, if these practices were replicate across and number of site-phases in a regions:

0 = no evidence of ritual standardisation across a site-phase

1 = some degree ritual standardisation with variations of practices observed: Similar type of practice and symbols at the site-phase level but not entirely uniform and greater variation on a regional level.

2 = evidence of highly standardised practices:

A. similar practices and symbols across a site-phase with little variations

B. repetition of architecture of communal ritual buildings and monuments

C. where dating available, evidence of practice and symbols over a long period of time e.g. all the MPPNB

D. evidence that similar practices and symbols shared by site-phases across a region with a high degree of replication

3. Evidence of ritual practitioner (s): this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, the evidence of ritual practitioner(s) is indicated by the examination of 8 criteria relating directly to the evidence of ritual practitioner(s), in the eHRAF database: Reference to or description of:

1. the level of ritual standardisation in a community
2. hierarchical ritual/religious structure
3. dedicated ritual/religious practitioners
4. organisational aspects of ritual/religious practices
5. prescribed ceremonial practices/actions
6. prescribed ceremonial practices/times
7. repetition/diffusion of ritual/religious symbols
8. reinforcement of beliefs via practitioners

Archaeology: For the archaeological site-phases the evidence of ritual practitioner(s) (1 = present) is recorded form the available sources that identify and record of 2 of 5 material culture criteria relating to evidence of ritual practitioner(s). Recording of:

1. evidence of moderate or high level of ritual standardisation (as scored in previous section)
2. large scale public ceremonial places such as communal ritual buildings and monuments
3. special burial treatment for a limited/select number of individuals (< 30% if percentages are given) may indicated a religious leader or practitioner. Special burial treatment (outlined later) centres on the description in the literature of a particular practice as relating to a minority of the dead. Where percentages are given, then less than or equal to 30% is taken as a minority. For example, dependant on the normal burial practices at a site-phase, special burial treatment includes: inclusion of grave goods, cremation, inhumation, high level of personal adornment (compared to other graves), different orientation of grave, location of grave in a communal ritual structure, a single individual primary or secondary burial where group burials dominate, evidence of secondary burial practices to (a) remove post cranial bones for relics and (b) skull caching, painting or plastering and evidence of secondary burial practices where the corpse is de-fleshed (excarnation) via naturally before being placed in the grave
4. the generation and storage of a surplus of food which would enable a class of ritual practitioners to be sustained while not actively engaging in a subsistence strategy
5. similarity in treatment of a minority of the dead at other site-phases in the region. This is used to consider a shared belief or ritual practices across a number of sites which may be indicative of ritual practitioners

4. **Levels of religious hierarchy**: this category is recorded in terms of a likert scale: (0, 1, 2, 3, >3) *

eHRAF: For each eHRAF culture, the levels of religious hierarchy are recorded using the likert scale with: 1 being a local ritual practitioner, 2 being a person or persons above the local ritual practitioner (regional or provincial level), 3 another level of a person or persons (supra-regional e.g. national level) and >3 being a level of religious hierarchy above the supra regional e.g. international. These are determined from the recording of any criteria relating directly to the levels of religious hierarchy, in the eHRAF database: Reference to or description of:

(1) the hierarchical ritual/religious structure

(2) dedicated ritual/religious practitioners

(3) the role of different ritual practitioners

(4) organisational aspects of ritual/religious practices

5. **Evidence of the standardisation of mortuary practices**: this category is recorded in terms of: 0 = absent, 1 = present. This relates to the replication of mortuary practises used in a culture where 1 = present:
Repeated use of mortuary practice throughout the culture and/or
Repeated use of mortuary practice throughout the culture (equal to or more than 60% if percentages are given) of individuals representing a particular group, e.g. adults, sub adults males, females

eHRAF: For each eHRAF culture, evidence of the standardisation of mortuary practices (1 = present) is indicated by the examination of 9 criteria relating directly to mortuary practices, in the eHRAF database: Reference to or description of:

1. the level the standardisation of mortuary practices in a community

2. organisational aspects of mortuary practices
3. rules regarding treatment of a corpse
4. prescribed set of mortuary practices
5. locations associated with mortuary practices
6. repetition/diffusion of mortuary practices
7. prescribed set of mortuary symbols
8. shared set of beliefs about death and afterlife
9. (standardisation of mortuary architecture (i.e. Grave markers and individual monuments)
10. social rules regarding attendance of mortuary practices

Archaeology: This section is used to examine the evidence for the standardisation of mortuary practices. The determination of a practice being regularly used it centres on the description in the literature of a particular practice e.g. the majority of the dead being treated a certain way at a site-phase. Where percentages are given, then greater than or equal to 60% is taken as the majority. For the archaeological site-phases evidence of the standardisation of mortuary practices (1 = present) is recorded form the available sources that identify and record of 2 of 14 material culture criteria relating to evidence of the standardisation of mortuary practices. Recording of:

1. Repetition/standardisation of burial practices in terms of treatment of the corpse. If the majority of individuals are given the same post-mortem treatment
2. Repetition/standardisation of burial practices in terms of: age and gender. If in most instances sub-adults, adult males and adult females respectively are given the same post-mortem treatment
3. Repetition/standardisation of burial practices in terms of interment-type, inhumation, cremation completeness, and articulation. If the majority of individuals

are given the same post-mortem treatment in terms of (a) interment-type; grave cut, urn, basket, monumental burial, domestic burial etc.; (b) cremation or inhumations; (c) articulated or disarticulated (d) flexed or extended and (e) single or comingled

4. Repetition/standardisation of burial practices in terms of secondary burial practices. Secondary burial practices involving:

(a) Reopening the grave after burial to retrieve artefacts or bones (post cranial and cranial). The former can be examine via the presence of staining due to the presence of a metal object which is no longer present and the latter can be indicated by absent bones particularly long bones and skull with no evidence of perimortem trauma

(b) Evidence of secondary burial practices where the corpse is de-fleshed (excarnation) naturally before being placed in the grave. This can be indicated by cut marks of bone or the absence of bone due to bones "rolling away" or being scavenged as happens when remain are placed in the open air to naturally de-flesh or all bones not collected properly

5. Repetition/standardisation of burial practices in terms of location and orientation

6. Repetition/standardisation of burial practices in terms of personal adornment: presence of beads etc. in burials

7. Repetition/standardisation of burial practices in terms of presence/absence of grave goods

8. Repetition/diffusion of human bone relics (the use of particular bone i.e. skulls, long bones, hand and foot bones) across the site-phase associated with domestic structures, communal structures, monuments and graves

9. Repeated instances of evidence of skull caching, painting or plastering across the site-phase

10. Where reliable dating is present, it is established that skull caching was repeated over a particular period of time

11. Repetition/diffusion of carved or painted symbols associated with burials

12. Large scale public ceremonial places associated with the presence of burials or the caching of cranial and post-cranial bone such as communal ritual buildings, monuments, squares and plazas

13. (13) Where reliable dating is present, it has been established that burial practices were repeated over a period of time—strengthening a case for standardisation

14. Similarity of burial practices to other site-phases in the region. This is used to consider a shared mortuary practices across a number of sites which may be indicative of standardisations

6. Evidence of ritual domestic space(s): this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of ritual domestic space (1 = present) is indicated by the examination of 8 criteria relating directly to the presence of ritual domestic space, in the eHRAF database: Reference to or description of:

1. ritual domestic space
2. location of ritual domestic spaces
3. construction of ritual domestic spaces
4. architecture associated with ritual domestic spaces
5. practices and ceremonies performed at ritual domestic spaces
6. rules regarding ritual domestic spaces
7. ritual aids and paraphernalia connected with ritual domestic spaces
8. practices and ceremonies attended at ritual domestic spaces

Archaeology: This section is for the recording of ritual domestic spaces at a site-phase. In general, this is identified in the archaeological record by the presence of area of domestic building(s) that are associated with ritual activity. For the archaeological site-phases the evidence of ritual domestic space (1 = present) is recorded form the available sources that identify and record of 2 of 9 material culture criteria. Recording of:

1. area of a domestic building(s) not associated with craft such as tool productions
2. area of a domestic building(s) not associated with food storage or processing
3. area of a domestic building(s) associated burial(s)
4. area of a domestic building(s) associated with skull caching, painting or plastering
5. area of a domestic building(s) associated with caching of anthropomorphic figurines
6. area of a domestic building(s) associated with caching of zoomorphic figurines
7. area of a domestic building(s) associated with human bone relics
8. area of a domestic building(s) associated with animal bone relics
9. area of a domestic building(s) associated with carved or painted symbols

7. Evidence of communal ritual buildings (not monuments): this category is used to record communal ritual buildings used for the purpose of housing ritual material, facilitating ritual/religious meetings and ritual/religious instruction—a contemporary example being a church or synagogue. The evidence is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of communal ritual structures (1 = present) is indicated by the examination of 8 criteria relating directly to the

presence of communal ritual structures, in the eHRAF database: Reference to or description of:

1. presence of dedicated communal ritual/religious building(s)
2. design of communal ritual/religious building(s)
3. construction of communal ritual/religious building(s)
4. use of communal ritual/religious building (s)
5. practices and ceremonies attended at communal ritual/religious building(s)
6. practices and ceremonies performed at communal ritual/religious building(s)
7. organisational aspects of ritual/religious practices
8. community ritual/religious architecture
9. standardisation of community ritual/religious architecture

Archaeology: This section is for the recording of ritual buildings that were used by the community. In general, this is identified in the archaeological record by the presence of large, supra-domestic buildings that are associated with ritual activity. Large in this case refers to buildings that are bigger that the typical domestic buildings at the site. For the archaeological site-phases the evidence of communal ritual structures (not monuments) (1 = present) is recorded form the available sources that identify and record of 2 of 11 material culture criteria. Recording of:

1. large supra-domestic buildings not associated with craft such as tool productions
2. large supra-domestic buildings not associated with food storage or processing
3. large supra-domestic buildings associated burial(s)
4. large supra-domestic buildings associated with special burial treatments
5. large supra-domestic buildings associated with skull caching, painting or plastering(s)

6. large supra-domestic buildings associated with caching of anthropomorphic figurines

7. large supra-domestic buildings associated with caching of zoomorphic figurines

8. large supra-domestic buildings associated with human bone relics

9. large supra-domestic buildings associated with animal bone relics

10. large supra-domestic buildings associated with carved or painted symbols

11. similar buildings at other site-phases in the region. This is used to consider a shared belief or ritual practices across a number of sites which may be indicative of ritual standardisations.

8. Evidence of communal ritual monuments/monuments in the landscape (including, barrows, henges megaliths): this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of monuments (1 = present) is indicated by the examination of 10 criteria relating directly to the presence of communal ritual monuments, in the eHRAF database: Reference to or description of:

1. presence of monuments
2. locations associated with monuments
3. construction of monuments
4. architecture of monuments
5. symbols associated with monuments
6. practices and ceremonies attended at monuments
7. practices and ceremonies performed at monuments
8. organisational aspects of ritual/religious practices at monuments
9. rules and sanctions regarding monuments

10. myths and beliefs regarding monuments

Archaeology: This section is for the recording of structures that were used for ritual purposes. This manly includes megaliths, henges, barrows and mounds that the archaeological evidence suggest were (1) the ritual focus of a community and/or (2) associated with ritual/religious practices of a community. In general, this is identified in the archaeological record by the presence of large, supra-domestic monuments that are associated with ritual activity. Large in this case refers to the fact that completion of such a structure would have required a large amount of investment in terms of time and labour. For the archaeological site-phases the evidence of monuments (1 = present) is recorded form the available sources that identify and record 1 of 11 of material culture criteria. Recording of:

1. presence of relatively complete monuments
2. presence of partially preserved monuments
3. presence of partially preserved (e.g. foundation remaining) monuments
4. monuments associated with burial(s)
5. monuments associated with special burial treatments (outline in mortuary practices section)
6. monuments associated with skull caching, painting or plastering
7. monuments associated with caching of anthropomorphic figurines
8. monuments associated with caching of zoomorphic figurines
9. monuments associated with human bone relics
10. monuments associated with animal bone relics
11. monuments associated with carved or painted symbols

9. Evidence of large statues (and totems): this category is recorded in terms of: 0 = absent, 1 = present. Large statues refers to (1) carved or cast figure with zoomorphic and/or anthropomorphic features; (2) that is larger than a bust (3) can be life-size or larger; (4) cannot be move by an individual; (5) made of stone, wood or metal. A totem refers to a large carved or painted representation of an object (as an animal or plant) that acts as a group emblem.

eHRAF: For each eHRAF culture, evidence of large statues (and totems) (1 = present) is indicated by the examination of 13 criteria relating directly to the presence of large statues, in the eHRAF database: Reference to or description of:

(1) Presence of large statute(s)

(2) Location associated with large statute(s)

(3) Person (real or mythical/religious) associated with large statute(s)

(4) Animal (real or mythical/religious) associated with large statute(s)

(5) Construction of large statute(s)

(6) A sculptor engaging in creating large statute(s)

(7) Symbols associated with large statute(s)

(8) Practices, ceremonies and dedications attended at large statute(s)

(9) Practices, ceremonies and dedications performed at large statute(s)

(10) Organisational aspects of creation and installation of large statute(s)

(11) Rules and sanctions associated with large statute(s)

(12) Myths and beliefs associated with large statute(s)

(13) Payment for large statute(s)

Archaeology: For the archaeological site-phases the evidence of large statues (and totems) (1 = present) is recorded form the available sources that identify and record any of the material culture criteria associated with the presence of large statue(s) (and totems) at site-phase indicated by preservation of

(1) Sections of large statue(s)

(2) Foundation evidence of large statue(s)

(3) Plinth of large statue(s)

10. Evidence of anthropomorphic figurines: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of anthropomorphic figurines (1 = present) is indicated by the examination of 12 criteria relating directly to the presence of anthropomorphic figurines, in the eHRAF database: Reference to or description of:

(1) presence of anthropomorphic figurines

(2) domestic use of anthropomorphic figurines

(3) non-domestic use of anthropomorphic figurines

(4) trading of anthropomorphic figurines

(5) person(s) (real or mythical/religious) associated with anthropomorphic figurines

(6) production of anthropomorphic figurines

(6) storage and caching of anthropomorphic figurines

(7) symbols associated with anthropomorphic figurines

(8) practices, ceremonies and dedications associated anthropomorphic figurines

(9) rules and sanctions associated with anthropomorphic figurines

(10) myths and beliefs associated with anthropomorphic figurines

(11) payment for anthropomorphic figurines

Archaeology: For the archaeological site-phases evidence of anthropomorphic figurines (1 = present) is recorded form the available sources that identify and record

1 of 10 material culture criteria:

1. presence anthropomorphic figurines at a site-phase
2. presence of anthropomorphic figurines in domestic building(s)
3. caching of anthropomorphic figurines in domestic building(s)
4. presence of anthropomorphic figurines in communal ritual building(s)
5. caching of anthropomorphic figurines in in communal ritual building(s)
6. presence of anthropomorphic figurines at communal ritual structure(s)
7. caching of anthropomorphic figurines at communal ritual structure(s)
8. presence of anthropomorphic figurines in burial(s)
9. caching of anthropomorphic figurines in in burial(s)
10. evidence of the production of anthropomorphic figurines via (1) unfinished examples or (2) stone debitage or preserved wooden shavings

11. Evidence of zoomorphic figurines: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of zoomorphic figurines (1 = present) is indicated by the examination of 11 criteria relating directly to the presence of anthropomorphic figurines, in the eHRAF database: Reference to or description of:

1. presence of zoomorphic figurines
2. domestic use of zoomorphic figurines
3. non-domestic use of zoomorphic figurines
4. trading of zoomorphic figurines
5. animal (real or mythical/religious) associated with zoomorphic figurines (6) production of zoomorphic figurines
6. storage and caching of zoomorphic figurines
7. symbols associated with zoomorphic figurines
8. practices, ceremonies and dedications associated zoomorphic figurines
9. rules and sanctions associated with zoomorphic figurines
10. myths and beliefs associated with zoomorphic figurines
11. payment for zoomorphic figurines

Archaeology: For the archaeological site-phases evidence of zoomorphic figurines (1 = present) is recorded form the available sources that identify and recording of 1 of 10 material culture criteria:

1. presence zoomorphic figurines at a site-phase
2. presence of zoomorphic figurines in domestic building(s)
3. caching of zoomorphic figurines in domestic building(s)
4. presence of zoomorphic figurines in communal ritual building(s)
5. caching of zoomorphic figurines in in communal ritual building(s)

6. presence of zoomorphic figurines at communal ritual structure(s)

7. caching of zoomorphic figurines at communal ritual structure(s)

8. presence of zoomorphic figurines in burial(s)

9. caching of zoomorphic figurines in in burial(s)

10. evidence of the production of zoomorphic figurines via (1) unfinished examples or (2) stone debitage or preserved wooden shavings.

12. Evidence of association between food and ritual: this category is recorded in terms of: 0 = absent, 1 = present. *

eHRAF: For each eHRAF culture, evidence of association between food with ritual (1 = present) is indicated by the examination of 14 criteria relating directly to the evidence of association between food and ritual, in the eHRAF database: Reference to or description of:

(1) use of food in rituals, ceremonies

(2) practices, ceremonies and dedications associated with food

(3) connections between food and the deceased/ancestors

(4) types of food collected for ritual(s)

(5) mythical/religious associations with food

(6) mythical/religious figures associated with food

(7) myths and beliefs surrounding the collection of food

(8) myths and beliefs surrounding the production of food

(9) myths and beliefs surrounding the preservation of food

(10) myths and beliefs surrounding the consumption of food

(11) ritual symbols associated with foods

(12) rules and sanctions associated with food

(13) periods of fasting as part of a ritual or ceremony

(14) description of ritual feasting (e.g. harvesting festival)

13. Evidence of feasting this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF culture, evidence of feasting (1 = present) is indicated by the examination of 20 criteria relating directly to the evidence of association between feasting with ritual, in the eHRAF database: Reference to or description of:

(1) description of feasting event(s)

(2) hosting feasting events

(3) attending feasts

(4) location of feasts

(5) occurrence/frequency of feasts

(6) reasons/motivations for feasts (e.g. harvesting festival)

(7) organisation of feasts

(8) rituals and ceremonies associated with feasts

(9) types of food gathered for feasts

(10) types of animals reared for feasts

(11) types of animals slaughtered/butchered for feasts

(12) types of animals hunted for feasts

(13) entertainment associated with feasts

(14) mythical/religious associations with feasting

(15) mythical/religious figures associated with feasting

(16) myths and beliefs surrounding the collection of food for feasting

(17) myths and beliefs surrounding the consumption of food at feasting

(18) ritual symbols associated with feastings

(19) rules and sanctions associated with feasting

(20) payment/reciprocal aspects of feasts

Archaeology: One of the problems with archaeological evidence of feasting is, even at well dated site-phases, it is difficult to determine if the record is indicating one large event or a number of smaller events. To examine the presence of feasting in the archaeological record of both regions, specific criteria were used:

(1) the previous criteria used by Dietrich *et al.* (2012); Munro and Grosman (2010); McGovern (2009); Dineley, (2004) and Dietler and Hayden (2001)

(2) the indicators of feasting that emerged as the best potential for examining the evidence o0f feasting during the pilot study.

For this research, the archaeological evidence of feasting (1 = present) is recorded form the available sources that identify and record of 3 of 20 material culture criteria:

(1) remains of large quantities of labour intensive animals

(2) remains of large quantities of labour intensive plants

(3) remains of large quantities of wild animals

(4) remains of large quantities of domesticated animals

(5) remains of large quantities of both wild and domesticated animals

(6) evidence of butchery or processing of animals via cut marks

(7) evidence of butchery or processing of animals at the site via cut marks on bone and stone tool evidence

(8) evidence of all anatomical regions of the animals accounted for

(9) evidence of butchery not at the site (no stone tool evidence) and the selective transport of particular anatomical regions of animals

(10) disposal of large amounts of articular joints

(11) large amount of long bones with evidence of spiral and longitudinal breaks associated with marrow extraction

(12) large amount of bones with evidence of blackening, warping and fragmentation associated with cooking

(13) large amounts of hearths and roasting pits in close proximity e.g. in a row

(14) large of hearth and/or roasting pit

(15) Large bone dumps

(16) unusually large quantities of material e.g. pottery

(17) unusually large vessels

(18) special temporary structure(s) indicated by post-holes etc.

(19) use of special locations usually not habitation sites e.g. monuments, tombs and henges

(20) large food storage facilities e.g. pits, granaries and silos

(21) evidence of record keeping e.g. tally sticks and counting tokens

(22) evidence of special substances such as alcohol narcotics or hallucinogens indicated via (1) material evidence of productions (e.g. Dineley 2004) and/or (2) organic residue on pottery (McGovern 2009).

14. Evidence of an association between food and taboo(s): this category is recorded in terms of: 0 = absent, 1 = present. *

eHRAF: This section was used to record and examine any social or religious custom prohibiting or restricting a particular practice in relation to types of food including: the growing, harvesting, collection, hunting, processing or consumption of particular food is indicated by the examination of 20 criteria relating directly to the evidence of an association between food and taboo(s), in the eHRAF database: Reference to or description of:

(1) description of taboos associated with food(s)

(2) rules and sanctions associated with food

(3) the enforcement of rules and sanctions associated with food taboo(s)

(4) the carrying out of sanctions associated with food taboo(s)

(5) ritual/religious practitioners associated with food taboo(s)

(6) the taking part in sanctions associated with food taboo(s)

(7) the witnessing of sanctions associated with food taboo(s)

(8) mythical/religious associations with food

(9) practices and ceremonies associated with food

(10) connections between food and the deceased/ancestors

(11) connections between food and the malevolent forces (curses and evil spirits)

(12) connections between food and group fortune/future

(13) connections between food taboo (s) and the fortune/future of the individual

(14) mythical/religious figures associated with food taboo(s)

(15) taboo(s) surrounding the collection of food

(16) taboo(s) surrounding the production of food

(17) taboo(s) surrounding the preservation of food

(18) taboo(s) surrounding the consumption of food

(19) symbols associated with food taboo(s)

(20) social/spiritual cleansing and reintegration into group after sanction(s) associated with food taboo.

15. Evidence of in belief in sorcery/witchcraft/demons (malevolent spiritual forces): this category is recorded in terms of: 0 = absent, 1 = present. *

eHRAF: For each eHRAF culture, evidence of malevolent spiritual forces: (1 = present). It is indicated by the examination of 23 criteria relating directly to the evidence of evidence of malevolent spiritual forces, in the eHRAF database: Reference to or description of:

1. description of malevolent spiritual forces
2. rules and sanctions associated with malevolent spiritual forces
3. secret practice connected with malevolent spiritual forces
4. secret groups connected with malevolent spiritual forces
5. the invocation of malevolent spiritual forces (e.g. voodoo and black magic)
6. the enforcement of rules and sanctions associated with malevolent spiritual forces

7. the carrying out of sanctions associated with evidence of malevolent spiritual forces

8. the taking part in sanctions associated with evidence of malevolent spiritual forces

9. the witnessing of sanctions associated with evidence of malevolent spiritual forces

10. mythical/religious associations with malevolent spiritual forces

11. practices, ceremonies and incantations associated with evidence of malevolent spiritual forces

12. preventative appeasement of associated with evidence of malevolent spiritual forces

13. connections between malevolent spiritual forces and the deceased/ancestors

14. connections between evidence of malevolent spiritual forces and group fortune/future

15. connections between evidence of malevolent spiritual forces and the fortune/future of the individual

16. mythical/religious figures associated with of malevolent spiritual forces

17. myths and beliefs surrounding malevolent spiritual forces

18. symbols associated with evidence of malevolent spiritual forces

19. social/spiritual cleansing and reintegration into group associated with malevolent spiritual forces

20. appeasement of malevolent spiritual forces via ceremonies and ritual practice

21. appeasement of malevolent spiritual forces via actions such as animals slaughtered/butchered

22. types of animals slaughtered/butchered for appeasement of malevolent spiritual forces

23. types of food used for appeasement of malevolent spiritual forces

Mortuary practices

This section of the database was used to record the mortuary practices of each eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.3) were used. This section used categories of absence or presence (0 or 1) to identify and record the mortuary practices of each culture and site-phase. A practice was deemed typical based on the description in the literature of e.g. the majority of the dead being treated a certain way at a site-phase. Where percentages are given, then greater than or equal to 60% is taken as the majority. On the other hand, special burial treatment (outlined later) centres on the description in the literature of a particular practice as relating to the minority of the dead. Where percentages are given, then less than or equal to < 30% is taken as a minority.

The material correlates categories used to record the mortuary practices of each culture and site-phase were:

1. Evidence of the standardisation of mortuary practices
2. Evidence of cemetery burial (evidence of cemeteries)
3. Evidence of non-cemetery interment
4. Evidence of intramural interment
5. Evidence of extramural interment
6. Evidence of interment in ritual building(s) (not monuments)
7. Evidence of monumental burial/interment
8. Evidence of interment in domestic building(s)
9. Evidence of single individual burial/interment

10. Evidence of group burial/interment

11. Evidence of flexed burials

12. Evidence of extended burials

13. Evidence of inhumation

14. Evidence of cremation

15. Evidence of secondary burial or interment practice

16. Evidence of grave disturbance

17. Evidence of grave goods

18. Evidence of skulls manipulation/modification (associated with mortuary practices) Including:

- evidence of skulls caching: (0 /1)
- evidence of plastered skulls: (0 /1)
- evidence of painting skulls: (0 /1)
- evidence of post-mortem decapitation: (0 /1)

19. Evidence of burial associated with animals

20. Evidence of special burial treatment

Table 1:3 the eHRAF OCM codes for mortuary practice

OCM Code	**Description**
761	life and death
764	burial practices
766	special burial practices and funerals
767	mortuary practices
769	cult of the dead
771	general character of religion
778	scared objects and spaces
788	ritual
796	organised ceremonial

1. **Evidence of the standardisation of mortuary practices**: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General ritual/religious characteristics* section.

2. **Evidence of cemetery burial**: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term cemetery refers to an area or locations set aside for the burying of multiple human remains (more than 5, if possible); it includes communal burial areas such as cemeteries, graveyards, communal buildings, burial mounds, barrows and monuments. Cemeteries are generally located close to but not necessarily within settlement(s). In the ethnographic record cemeteries, generally, have a systematic layout that is associated with (1) ancestral/familial grave spaces and (2) the performance of community funerary rituals. A cemetery is taken to be an area where repeated interments have taken place, usually, over a period of time. It can contain single individual burial and group burials.

eHRAF: For each eHRAF culture, evidence of a cemetery (1 = present) comes for the recording of 29 criteria in the eHRAF database: Reference to or description of:

1. the use of a communal burial area(s) (cemetery or cemeteries) by a group/community
2. the requesting for interment in a cemetery
3. specific location (cemetery) for burial containing human remains. This can be in a particular location in the landscape, a communal building, a burial mound or monument
4. the use of a communal burial area(s) for most individuals as a standard treatment
5. the use of a communal burial area(s) for certain individuals as a non-standard treatment

6. age differences associated with the use of a communal burial area(s)

7. sex differences associated with the use of a communal burial area(s)

8. preparation of a corpse or corpses for cemetery burial

9. burial practices at a cemetery

(a) primary burial practices at a cemetery

(b) secondary burial practices at a cemetery

10. practices, rituals, ceremonies and dedications associated with the dead in cemeteries

11. practices, rituals, ceremonies and dedications associated with cemetery grounds

12. connections between cemeteries and the deceased/ancestors

13. preforming practices, rituals, ceremonies and dedications associated in cemeteries

14. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications in cemeteries

15. dedicated member(s) of the community associated with rituals, ceremonies and dedications in cemeteries

16. dedicated kin member(s) associated with rituals, ceremonies and dedications in cemeteries

17. attending practices, rituals, ceremonies and dedications associated in cemeteries

18. participating in practices, rituals, ceremonies and dedications associated in cemeteries

19. mythical/religious associations with cemeteries

20. mythical/religious figures associated with cemeteries

21. design and/or layout of cemeteries

22. architecture associated with cemeteries

23. ritual symbols associated with cemeteries
24. statues and/or grave markers used at cemeteries
25. rules and sanctions associated with cemeteries
26. visiting and re- visiting cemeteries
27. maintenance of graves at cemeteries
28. (maintenance of cemeteries
29. payment for burial in a cemetery

Archaeology: This section is used to determine the use of cemeteries as part of the burial/interment practices at a site. Cemetery is taken as a particular location where multiple interments have occurred. It includes flat cemeteries, burial mounds, barrows and megalithic cemeteries. Where percentages are given or can be calculated, then greater than or equal to 60% is taken as the majority. On the other hand, where percentages are not given, we have to rely on the excavators' description of practices as standard, typical, uniform, afforded to the majority of individuals etc.

For the archaeological site-phases evidence of cemeteries (1 = present) is recorded form the available sources that identify and record 3 of 19 material culture criteria via the recording of:

1. specific location for burial/interment containing multiple human remains. This can be in a particular location in:

1. the settlement
2. the surrounding landscape (hilltop, plateaux etc.)
3. communal building(s)
4. burial mound (s), barrow(s)
5. monument(s)/tombs e.g. megaliths

2. sectioned-off specific location for burial/interment containing human remains physical barriers include walls, ditches or palisades:

- in the settlement the settlement
- in the surrounding landscape

3. where reliable dating is present, it is established that a particular location was used for burial/interment repeated over a period of time

4. the use of a particular location (a communal burial area(s)) for most individuals (standard treatment)

5. repetition/standardisation of burial practice in a particular burial/interment location

6. repetition/standardisation of location of burials/interments associated with a particular burial/interment location

7. repetition/standardisation of orientation of burials/interments associated with a particular burial/interment location

8. repetition/standardisation of interment type associated with a particular burial/interment location:

- grave cuts in the ground,
- cists,
- urns
- barrow(s),
- burial mound(s)
- interment in a monument/tomb e.g. megalithic tomb(s)

9. repetition/standardisation of burial/interment of the body associated with a particular location:

- Flexed inhumation
- Extended inhumation
- Articulated

- Disarticulated
- Single inhumation burial/interment
- Group inhumation burial/interment
- Level of completeness of inhumation
- Single Cremation
- Comingled cremation
- Level of completeness of cremations

10. Repetition/standardisation of practices associated with age at a particular burial/interment location. E.g. the majority of sub-adults receive beads as grave goods

11. repetition/standardisation of practices associated with biological sex at a particular burial/interment location E.g. the majority of adult females receive weapons as grave goods

12. Repetition/standardisation of grave goods associated with a particular burial/interment location. Including:

- beads
- weapons
- pottery
- utilitarian object
- carved stones
- human bone relics
- animal bone

13. Repetition/standardisation of bodily adornment associated with a particular burial/interment location.

14. repetition/standardisation of primary burial practice in a particular location (similar to points 8 and 9)

15. Repetition/standardisation of secondary burial practice in a particular location. Including:

- re-opening the grave to retrieve bone (e.g. long bone, skull) missing bone but no evidence of perimortem trauma
- re-opening the grave to retrieve artifact (staining due to artefacts no longer present)

16. repetition/diffusion/standardisation of design associated with a particular burial/interment location

17. repetition/diffusion/standardisation architecture associated with a particular burial/interment location

18. repetition/diffusion/standardisation ritual symbols associated with a particular burial/interment location

19. repetition/diffusion/standardisation grave markers used at a particular burial/interment location

3. Evidence of non-cemetery interment: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term non-cemetery refers to an area or locations not specifically set aside for the burying of human remains. It includes the evidence of single interment or group interment in a grave cut, cist, urn, monument, barrow, henge, tomb, as well as, intramural and extramural interment that appears not be associated with a communal burial/interment location.

eHRAF: For each eHRAF culture, evidence of a non-cemetery interment (1 = present) comes for the recording of 31 criteria in the eHRAF database: Reference to or description of:

1. the use of a non-cemetery interment area(s) for burial
2. the requesting for non-cemetery interment

3. the use of non-cemetery interment for most individuals as a standard treatment

4. the use of non-cemetery interment for certain individuals as a non-standard treatment

5. age differences associated with the use of non-cemetery interment

6. sex differences associated with the use of non-cemetery interment

7. specific location for non-non-cemetery interments

8. recording of isolated graves inside the group territory with one individual

9. recording of isolated graves outside the group territory with one individual

10. recording of isolated graves inside the group territory with more than one individual

11. recording of isolated graves outside the group territory with more than one individual

12. disposal of a body for group members that die away from the group territory

13. preparation of a corpse or corpses for non-cemetery interment

14. interment practices at a non-cemetery locations

15. primary burial practices at a non-cemetery locations

16. secondary burial practices at a non-cemetery locations

17. practices, rituals, ceremonies and dedications associated with the dead in non-cemetery locations

18. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications in non-cemetery locations

19. dedicated member(s) of the community associated with rituals, ceremonies and dedications in non-cemetery locations

20. dedicated kin member(s) associated with rituals, ceremonies and dedications in non-cemetery locations

21. connections between non-cemetery locations and the deceased/ancestors

22. preforming practices, rituals, ceremonies and dedications associated with the dead in non-cemetery locations

23. attending practices, rituals, ceremonies and dedications associated with the dead in non-cemetery locations

24. participating in practices, rituals, ceremonies and dedications associated with the dead in non-cemetery locations

25. mythical/religious associations with the dead in non-cemetery locations

26. mythical/religious figures associated with the dead in non-cemetery locations

27. ritual symbols associated with the dead in non-cemetery locations

28. grave markers used at for interments at non-cemetery locations

29. rules and sanctions associated with the dead in non-cemetery locations

30. visiting and re-visiting the dead in non-cemetery locations

31. maintenance of "graves" at non-cemetery locations

Archaeology: For the archaeological site-phases evidence of non-cemetery burial/interment (1 = present) is recorded form the available sources that identify and record of 3 of 22material culture criteria. The recording of:

1. No evidence of a specific location for burial/interment at a particular location inside the settlement:

2. No evidence of a specific location for burial/interment at a particular location outside but connected with the settlement:

3. No evidence of a sectioned-off specific location for burial/interment containing human remains; physical barriers include walls, ditches or palisades:

- in the settlement the settlement
- in the surrounding landscape

4. Little or no standardisation/repetition of burial/interment practices at a particular location

5. Burial/interment that is not at a recorded communal burial/interment at a site

6. Recording of isolated or deviant burial/interments

7. isolated burial/interments inside the settlement

8. Contemporary isolated burial/interments outside the settlement. This case can be strengthened if we have dating, ancient DNA or isotope evidence that indicates a connection between the burial and the settlement

9. isolated burial/interments in a communal building

10. isolated burial/interments in a communal ritual building

11. isolated burial/interments between building

12. isolated burial/interments in a barrow, henge, mound or megalith

13. burial/interments in a domestic building

14. No evidence of repetition/standardisation of orientation of burials associated with a particular burial/interment location

15. No evidence of repetition/standardisation of interment type associated with a particular burial/interment location:

16. No evidence of repetition/standardisation of burial/interment of the body associated with a particular location:

17. No evidence of repetition/standardisation of practices associated with age at a particular burial/interment location. E.g. the majority of sub-adults receive beads as grave goods

18. No evidence of repetition/standardisation of practices associated with sex at a particular burial/interment location E.g. the majority of adult females receive weapons as grave goods

19. No evidence of repetition/standardisation of grave goods associated with a particular burial/interment location. Including:

20. No evidence of repetition/standardisation of bodily adornment associated with a particular burial/interment location.

21. No evidence of repetition/diffusion/standardisation of design associated with a particular burial/interment location

22. No evidence of repetition/diffusion/standardisation grave markers used at a particular burial/interment location

4. Evidence of intramural interment: this category is recorded in terms of: 0 = absent, 1 = present. In this study, the term intramural interment refers to the placing of human remains within the walls, foundations or floor of a building(s). It may reflect a one-off or repeated interment practice at that location.

It includes the evidence of:

- single complete individual intramural interment (inhumation)
- single incomplete individual intramural interment (inhumation)
- group complete intramural interment (inhumation)
- group incomplete intramural interment (inhumation)
- comingled intramural interment (inhumation)
- Single cremation intramural interment
- Comingled cremation intramural interment
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a building(s)

Note for this study:

a. complete = all bones present or anatomical regions accounted for if soft tissue is well-preserved or present (e.g. via Mummification)

b. incomplete = not all bones present or anatomical regions not accounted for if soft tissue is present

eHRAF: For each eHRAF culture, evidence of intramural interment (1 = present) comes for the examination of 31 criteria in the eHRAF database: Reference to or description of:

1. the use of intramural interment:
2. the requesting for intramural interment:
3. the use of intramural interment for most individuals as a standard treatment
4. the use of intramural interment for certain individuals as a non-standard treatment
5. age differences associated with the use of intramural interment
6. sex differences associated with the use of intramural interment
7. the occasions when intramural interment occurs
8. the reasons for the use of intramural interment
9. the individual(s) afforded intramural interment
10. the frequency of intramural interment
11. specific location for intramural interments
12. recording of isolated graves within the walls, floor or foundation of a building(s) with one individual
13. recording of isolated graves within the walls, floor or foundation of a building(s) with more than one individual
14. recording of bone caching within the walls, floor or foundation of a building(s)
15. preparation of a corpse or corpses for intramural interment
16. practices at intramural interment locations

(a) primary interment practices within the walls, floor or foundation of a building(s)

(b) secondary interment practices within the walls, floor or foundation of a building(s)

17. practices, rituals, ceremonies and dedications associated with in intramural interment

18. connections between intramural interment locations and the deceased/ancestors

19. preforming practices, rituals, ceremonies and dedications associated with the dead in intramural interment locations

20. attending practices, rituals, ceremonies and dedications associated with the dead in intramural interment locations

21. participating in practices, rituals, ceremonies and dedications associated with the dead in intramural interment locations

22. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with in intramural interment

23. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with in intramural interment

24. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with in intramural interment

25. mythical/religious associations with the dead in intramural interment locations

26. mythical/religious figures associated with the dead in intramural interment locations

27. ritual symbols associated with the dead in intramural interment locations

28. grave markers used at for interments at intramural interment locations

29. rules and sanctions associated with the dead in intramural interment locations

30. visiting and re- visiting the dead in intramural interment locations

31. maintenance of intramural interment locations

Archaeology: For the archaeological site-phases, the use of intramural burial/interment (1 = present) relates to the identification of any burials/interments inside the walls, floors or foundations of buildings. Intramural burial/interment can occur in a pit, grave cut, cist or urn. Intramural burial/interment is recorded form the available sources that identify and record 1 of 33 material culture criteria:

1. single complete individual intramural burial/interment within the walls, foundations or floor of communal building(s)
2. single complete individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)
3. single complete individual intramural burial/interment within the walls, foundations or floor of domestic building(s)
4. single incomplete individual burial/interment within the walls, foundations or floor of communal building(s)
5. single incomplete individual burial/interment within the walls, foundations or floor of communal ritual building(s)
6. single incomplete individual burial/interment within the walls, foundations or floor of domestic building(s)
7. single cremated individual intramural burial/interment within the walls, foundations or floor of communal building(s)
8. single cremated individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)
9. single cremated individual intramural burial/interment within the walls, foundations or floor of domestic building(s)
10. group complete intramural burial/interment the within walls, foundations or floor of domestic building(s)

11. group complete intramural burial/interment the within walls, foundations or floor of communal ritual building(s)

12. group complete intramural burial/interment the within walls, foundations or floor of communal building(s)

13. group incomplete intramural burial/interment within the walls, foundations or floor of communal building(s)

14. group incomplete intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

15. group incomplete intramural burial/interment within the walls, foundations or floor of domestic building(s)

16. comingled intramural burial/interment within the walls, foundations or floor of communal building(s)

17. comingled intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

18. comingled intramural burial/interment within the walls, foundations or floor of domestic building(s)

19. comingled cremation intramural burial/interment within the walls, foundations or floor of communal building(s)

20. Comingled cremation individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

21. comingled cremation individual intramural burial/interment within the walls, foundations or floor of domestic building(s)

22. single complete individual intramural burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

23. single incomplete individual burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

24. group complete intramural burial/interment the within walls, foundations or floor of isolated building(s) inside the settlement

25. group incomplete intramural burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

26. comingled intramural burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

27. single cremation intramural burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

28. comingled cremation intramural burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

29. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal building(s)

30. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal ritual building(s)

31. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a domestic building(s)

32. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of isolated building(s) inside the settlement

33. evidence practices associated with interment in building(s)

- primary interment practices within the walls, floor or foundation of building(s)
- secondary interment practices within the walls, floor or foundation of building(s)

5. **Evidence of extramural interment**: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term extramural interment refers to the placing of human remains immediately outside the walls of a building or in the space between buildings in a settlement. It may reflect a one-off or repeated interment practice at that location.

It includes the evidence of:

- single complete individual extramural interment (inhumation)
- single incomplete individual extramural interment (inhumation)
- group complete extramural interment (inhumation)
- group incomplete extramural interment(inhumation)
- comingled extramural interment (inhumation)
- single cremation intramural interment
- comingled cremation intramural interment
- the caching of particular bones e.g. long bones or skulls outside the walls of or between buildings

eHRAF: For each eHRAF culture, evidence of extramural interment (1 = present) comes for the examination of 31 criteria in the eHRAF database: Reference to or description of:

1. the use of extramural interment
2. the requesting for extramural interment
3. the use of extramural interment for most individuals as a standard treatment
4. the use of extramural interment for certain individuals as a non-standard treatment
5. age differences associated with the use of extramural interment

6. sex differences associated with the use of extramural interment

7. the occasions when extramural interment occurs

8. the reasons for the use of extramural interment

9. the individual(s) afforded extramural interment

10. the frequency of extramural interment

11. specific location(s) for extramural interments; outside the walls of or between buildings

12. recording of isolated graves outside the walls of or between buildings with one individual

13. recording of isolated graves outside the walls of or between buildings with more than one individual

14. recording of bone caching outside the walls of or between buildings

15. preparation of a corpse or corpses for extramural interment

16. practices at extramural interment locations

(a) primary interment practices outside the walls of or between buildings

(b) secondary interment practices outside the walls of or between buildings

17. practices, rituals, ceremonies and dedications associated with the dead in extramural interment locations

18. connections between extramural interment locations and the deceased/ancestors

19. preforming practices, rituals, ceremonies and dedications associated with extramural interment locations

20. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with in extramural interment

21. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with in extramural interment

22. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with in extramural interment

23. attending practices, rituals, ceremonies and dedications associated with extramural interment locations

24. participating in practices, rituals, ceremonies and dedications associated with extramural interment locations

25. mythical/religious associations with the dead in extramural interment locations

26. mythical/religious figures associated with the dead in extramural interment locations

27. ritual symbols associated with the dead in extramural interment locations

28. grave markers used at interments at extramural interment locations

29. rules and sanctions associated with the dead in extramural interment locations

30. visiting and re- visiting the dead in extramural interment locations

31. maintenance of extramural interment locations

Archaeology: For the archaeological site-phases evidence of extramural burial/interment (1 = present) relates to the identification of burials/interments outside or between the walls of buildings; in this cases between refers to the space between two building. Extramural burial/interment can occur in a pit, grave cut, cist or urn. It is recorded form the available sources that identify and record 1 of 34 material culture criteria. The recording of:

1. single complete individual extramural burial/interment outside or between the walls of communal building(s)

2. single complete individual extramural burial/interment outside or between the walls of communal ritual building(s)

3. single complete individual extramural burial/interment outside or between the walls of domestic building(s)

4. single incomplete individual burial/interment outside or between the walls of communal building(s)

5. single incomplete individual burial/interment outside or between the walls of communal ritual building(s)

6. single incomplete individual burial/interment outside or between the walls of domestic building(s)

7. group complete extramural burial/interment the outside or between walls of domestic building(s)

8. group complete extramural burial/interment the outside or between walls of communal ritual building(s)

9. group complete extramural burial/interment the outside or between walls of communal building(s)

10. group incomplete extramural burial/interment outside or between the walls of communal building(s)

11. group incomplete extramural burial/interment outside or between the walls of communal ritual building(s)

12. group incomplete extramural burial/interment outside or between the walls of domestic building(s)

13. comingled extramural burial/interment outside or between the walls of communal building(s)

14. comingled extramural burial/interment outside or between the walls of communal ritual building(s)

15. comingled extramural burial/interment outside or between the walls of domestic building(s)

16. Single cremation intramural burial/interment outside or between the walls of communal building(s)

17. Single cremation intramural burial/interment outside or between the walls of communal ritual building(s)

18. Single cremation intramural burial/interment outside or between the walls of domestic building(s)

19. comingled cremation intramural burial/interment outside or between the walls of communal building(s)

20. comingled cremation intramural burial/interment outside or between the walls of communal ritual building(s)

21. comingled cremation intramural burial/interment outside or between the walls of domestic building(s)

22. single complete individual extramural burial/interment outside or between the walls of isolated building(s) inside the settlement

23. single incomplete individual burial/interment outside or between the walls of isolated building(s) inside the settlement

24. group complete extramural burial/interment outside the walls of isolated building(s) inside the settlement

25. group incomplete extramural burial/interment outside the walls of isolated building(s) inside the settlement

26. comingled extramural burial/interment outside the walls of isolated building(s) inside the settlement

27. single cremation extramural burial/interment outside the walls of isolated building(s) inside the settlement

28. comingled cremation extramural burial/interment outside the walls of isolated building(s) inside the settlement

29. the caching of particular bones e.g. long bones or skulls outside or between the walls of a communal building(s)

30. the caching of particular bones e.g. long bones or skulls outside or between the walls of a communal ritual building(s)

31. the caching of particular bones e.g. long bones or skulls outside or between the walls of a domestic building(s)

32. the caching of particular bones e.g. long bones or skulls outside the walls of isolated building(s) inside the settlement

34. evidence practices associated with extramural interment

- primary interment practices outside the walls of building(s)
- secondary interment practices outside the walls of building(s)

6. Evidence of interment in ritual building(s) (not monuments): this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF and archaeology, the evidence for the purpose of recording a ritual building(s) (not monuments) are outlined in the *General ritual/religious characteristics* section. But in in this study, this is taken as a building that is used for the purpose of housing ritual material, facilitating ritual/religious meetings and ritual/religious instruction.

In this study the term interment in ritual building(s) refers to the placing of human remains within the walls, foundations or floor of buildings of dedicated ritual buildings; buildings used for religious instruction and ceremonies. It may reflect a one-off or repeated interment practice in ritual buildings. It includes the evidence of:

- single complete individual interment in ritual building(s) (inhumation)
- single incomplete individual interment in ritual building(s) (inhumation)
- group complete interment in ritual building(s) (inhumation)

- group incomplete interment in ritual building(s) (inhumation)
- comingled interment in ritual building(s) (inhumation)
- Single cremation interment in ritual building(s)
- comingled cremation interment in ritual building(s)
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of ritual building(s)

eHRAF: For each eHRAF culture, evidence of interment in ritual building(s) (1 = present) comes for the examination of 30 criteria in the eHRAF database: Reference to or description of:

1. the use of interment in ritual building(s)
2. a request for interment in a ritual building
3. the use of interment in ritual building(s) for most individuals as a standard treatment
4. the use of interment in ritual building(s) for certain individuals as a non-standard treatment
5. age differences associated with the use of interment in ritual building(s)
6. sex differences associated with the use of interment in ritual building(s)
7. the occasions when interment in ritual building(s) occurs
8. the reasons for the use of interment in ritual building(s)
9. the individual(s) afforded interment in ritual building(s)
10. the frequency of interment in ritual building(s)s
11. recording of interments within the walls, floor or foundation of ritual building(s) with one individual
12. recording of interments within the walls, floor or foundation of ritual building(s) with more than one individual

13. recording of bone caching within the walls, floor or foundation of ritual building(s)

14. preparation of a corpse or corpses for interment in ritual building(s)

15. practices associated with interment in ritual building(s)

(a) primary interment practices within the walls, floor or foundation of ritual building(s)

(b) secondary interment practices within the walls, floor or foundation of ritual building(s)

16. practices, rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

17. connections between interment in ritual building(s) and the deceased/ancestors

18. preforming practices, rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

19. attending practices, rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

20. participating in practices, rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

21. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

22. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

23. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with the dead interred in ritual building(s)

24. mythical/religious associations with the dead interred in ritual building(s)

25. mythical/religious figures associated with the dead interred in ritual building(s)

26. ritual symbols associated with the dead interred in ritual building(s)

27. grave markers used at/ for interments ritual building(s)

28. rules and sanctions associated with the dead interred in ritual building(s)

29. visiting and re- visiting the dead interred in ritual building(s)

30. maintenance of interments in ritual building(s)

Archaeology: For the archaeological site-phases evidence of burial/interment in ritual building(s) refers to the interment of human remains in pits, grave cut, cist, tombs or urn in ritual buildings. The evidence (1 = present) is recorded form the available sources that identify and record 1 of 10 material culture criteria. The recording of:

1. single complete individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

2. single incomplete individual burial/interment within the walls, foundations or floor of communal ritual building(s)

3. single cremated individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

4. group complete intramural burial/interment the within walls, foundations or floor of communal ritual building(s)

5. group incomplete intramural burial/interment within the walls, foundations or floor of communal building(s)

6. group incomplete intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

7. comingled intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

8. comingled cremation individual intramural burial/interment within the walls, foundations or floor of communal ritual building(s)

9. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal ritual building(s)

10. evidence practices associated with interment in ritual building(s)

- primary interment practices within the walls, floor or foundation of ritual building(s)
- secondary interment practices within the walls, floor or foundation of ritual building(s)

7. Evidence of monumental burial/interment: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term monumental interment refers to the placing of human remains within man-made structures; including megalithic monuments, henges, tombs, burial mounds and barrows; used for religious ceremonies. It may reflect a one-off or repeated interment practice in these strictures.

It includes the evidence of:

- single complete individual interment in monument(s) (inhumation)
- single incomplete individual interment in monument(s) (inhumation)
- group complete interment in monument(s) (inhumation)
- group incomplete interment in monument(s) (inhumation)
- comingled interment in monument(s) (inhumation)
- single cremation interment in monument(s)
- comingled cremation interment in monument(s)
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation monument(s)

eHRAF: For each eHRAF culture, evidence of interment in monument(s) (1 = present) comes for the examination of 28 criteria in the eHRAF database: Reference to or description of:

1. the use of monument(s) for interment of human remains
2. a request for interment in a monument
3. the use of interment in monument(s) for most individuals as a standard treatment
4. the use of interment in monument(s) for certain individuals as a non-standard treatment
5. age differences associated with the use of interment in monument(s)
6. sex differences associated with the use of interment in monument(s)
7. the occasions when interment in monument(s) occurs
8. the reasons for the use of interment in monument(s)
9. the individual(s) afforded interment in monument(s)
10. the frequency of interment in monument(s)
11. recording of interments within monument(s) containing one individual
12. recording of interments graves within monument(s) containing more than one individual
13. recording of bone caching within monument(s)
14. preparation of a corpse or corpses for interment in monument(s)
15. practices associated with interment in monument(s)

(a) primary interment practices associated with monument(s)

(b) secondary interment practices associated with monument(s)

16. practices, rituals, ceremonies and dedications associated with the dead interred in monument(s)

17. connections between interment in monument(s) and the deceased/ancestors

18. performance of practices, rituals, ceremonies and dedications associated with the dead interred in monument(s)

19. attending practices, rituals, ceremonies and dedications associated with the dead interred in monument(s)

20. participating in practices, rituals, ceremonies and dedications associated with the dead interred in monument(s)

21. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with the dead interred in monument(s)

22. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with the dead interred in monument(s)

23. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with the dead interred in monument(s)

24. mythical/religious associations with the dead interred in monument(s)

25. mythical/religious figures associated with the dead interred in monument(s)

26. ritual symbols associated with the dead interred in monument(s)

27. rules and sanctions associated with the dead interred in monument(s)

28. visiting and re- visiting the dead interred in monument(s)

Archaeology: For the archaeological site-phases evidence of burial/interment in monuments (1 = present) is recorded form the available sources that identify and record of 1 of 9 material culture criteria. The recording of:

1. single complete individual intramural burial/interment within monuments

2. single incomplete individual burial/interment within monuments

3. single cremated individual burial/interment within monuments

4. group complete burial/interment the within monuments

5. group incomplete burial/interment within monuments

6. comingled intramural burial/interment within monuments

7. comingled cremation burial/interment within monuments

8. evidence practices associated with interment in monuments

- primary interment practices within monuments
- secondary interment practices within monuments

9. the caching of particular bones e.g. long bones or skulls within monuments

8. Evidence of interment in domestic building(s): this category is recorded in terms of: 0 = absent, 1 = present. It refers to the interment of human remains in pits, grave cut, cist, tombs or urn in domestic buildings.

It includes the evidence of:

- single complete individual interment in domestic building(s) (inhumation)
- single incomplete individual interment in domestic building(s) (inhumation)
- group complete interment in domestic building(s) (inhumation)
- group incomplete interment in domestic building(s) (inhumation)
- comingled interment in domestic building(s) (inhumation)
- single cremation interment in domestic building(s)
- comingled cremation interment in domestic building(s)
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of ritual building(s)

eHRAF: For each eHRAF culture, evidence of interment in domestic building(s) (1 = present) comes for the examination of 30 criteria in the eHRAF database: Reference to or description of:

1. the use of interment in domestic context(s)

2. a request for interment in a domestic

3. the use of interment in domestic context(s) for most individuals as a standard treatment

4. the use of interment in domestic context(s) for certain individuals as a non-standard treatment

5. age differences associated with the use of interment in domestic context(s)

6. sex differences associated with the use of interment in domestic context(s)

7. the occasions when interment in domestic building(s) occurs

8. the reasons for the use of interment in domestic building(s)

9. the individual(s) afforded interment in domestic building(s)

10. the frequency of interment in domestic building(s)s

11. recording of interments within the walls, floor or foundation of domestic building(s) with one individual

12. recording of interments within the walls, floor or foundation of domestic building(s) with more than one individual

13. recording of bone caching within the walls, floor or foundation of domestic building(s)

14. preparation of a corpse or corpses for interment in domestic building(s)

15. practices associated with interment in domestic building(s)

(a) primary interment practices within the walls, floor or foundation of domestic building(s)

(b) secondary interment practices within the walls, floor or foundation of domestic building(s)

16. practices, ceremonies and dedications associated with the dead interred in domestic building(s)

17. connections between interment in domestic building(s) and the deceased/ancestors

18. preforming practices, domestics, ceremonies and dedications associated with the dead interred in domestic building(s)

19. attending practices, domestics, ceremonies and dedications associated with the dead interred in domestic building(s)

20. participating in practices, domestics, ceremonies and dedications associated with the dead interred in domestic building(s)

21. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with the dead interred in domestic building(s)

22. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with the dead interred in domestic building(s)

23. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with the dead interred in domestic building(s)

24. mythical/religious associations with the dead interred in domestic building(s)

25. mythical/religious figures associated with the dead interred in domestic building(s)

26. domestic symbols associated with the dead interred in domestic building(s)

27. grave markers used at/ for interments domestic building(s)

28. rules and sanctions associated with the dead interred in domestic building(s)

29. visiting and re- visiting the dead interred in domestic building(s)

30. maintenance of interments in domestic building(s)

Archaeology: For the archaeological site-phases evidence of burial/interment in domestic building (s) (1 = present) is recorded form the available sources that identify and record 1 9 of material culture criteria. The recording of:

1. single complete individual burial/interment within the walls, foundations or floor of domestic building(s)

2. single incomplete individual burial/interment within the walls, foundations or floor of domestic building(s)

3. single cremated individual intramural burial/interment within the walls, foundations or floor of domestic building(s)

4. group complete intramural burial/interment the within walls, foundations or floor of domestic building(s)

5. group incomplete intramural burial/interment within the walls, foundations or floor of domestic building(s)

6. comingled intramural burial/interment within the walls, foundations or floor of domestic building(s)

7. comingled cremation individual burial interment within the walls, foundations or floor of domestic building(s)

8. evidence practices associated with interment in domestic building(s)

- primary interment practices within the walls, floor or foundation of domestic building(s)
- secondary interment practices within the walls, floor or foundation of domestic building(s)

9. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a domestic building(s)

9. Evidence of single individual burial or interment: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term single individual interment refers to the placing of the remains of one individual in a grave cut, monument, walls, foundations or floor of a domestic or communal ritual structure(s). It may reflect a one-off or repeated single individual interment practice. The location of burial(s)/interment(s) containing the remains of one individual can be:

- within the settlement
- a dedicated location for burial within the settlement without barriers

- a sectioned-off specific location for burial/interment with physical barriers include walls, ditches or palisades:
- domestic building(s)
- communal building(s)
- communal ritual building(s)
- burial mound (s), barrow(s)
- grave cuts in the ground,
- cists,
- pits
- monument(s)/tombs e.g. megaliths
- the surrounding landscape (hilltop, plateaux etc.)

It includes the evidence of:

- single complete individual interment (inhumation)
- single incomplete individual interment (inhumation)
- Single cremation interment (in an urn or not)
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a building(s) representing one individual

eHRAF: For each eHRAF culture, evidence of single individual interment (1 = present) comes for the examination of 29 criteria in the eHRAF database: Reference to or description of:

1. the use of single individual interment:
2. a request for single individual interment
3. the use of single individual interment for most individuals as a standard treatment
4. the use of single individual interment for certain individuals as a non-standard treatment

5. age differences associated with the use of single individual interment

6. sex differences associated with the use of single individual interment

7. the occasions when single individual interment occurs

8. the reasons for the use of single individual interment

9. the individual(s) afforded single individual interment

10. the frequency of single individual interment

11. locations used for single individual interment

12. recording of single individual interments in in cemeteries, non-cemetery locations, monuments and buildings

13. recording of the caching of bones of different anatomical regions (e.g. skull long, bones etc.) reflecting one individual in cemeteries, non-cemetery locations, monuments and buildings

14. preparation of a corpse for single individual interment

15. practices associated with single individual interment

(a) primary single individual interment practices in in cemeteries, non-cemetery locations, monuments and buildings

(b) secondary single individual interment practices in in cemeteries, non-cemetery locations, monuments and buildings

16. practices, rituals, ceremonies and dedications associated with the dead

17. preforming practices, rituals, ceremonies and dedications associated with the interment of one individual

18. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with the interment of one individual

19. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with the interment of one individual

20. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with the interment of one individual

21. attending practices, rituals, ceremonies and dedications associated with the interment of one individual

22. participating in practices, rituals, ceremonies and dedications associated with the interment of one individual

23. mythical/religious associations with the interment of a corpse

24. mythical/religious figures associated with the interment of a corpse

25. ritual symbols associated with the interment of a corpse

26. grave markers used at/ for single individual interments

27. rules and sanctions associated with the interment of individuals

28. visiting and re- visiting the location of the interment of a particular individual

29. maintenance of single individual interments

Archaeology: For the archaeological site-phases evidence of single individual burial/interment (1 = present) relates to the information from recorded form the available sources that identify and record of 1 of 24 material culture criteria. The recording of:

1. it is recorded that the majority of interments are single- individual interments

2. the sources state that single individual interment is afforded to the majority or represents the standard or dominant practice at a site phase

3. single complete individual burial/interment within the walls, foundations or floor of communal building(s) (Flexed or Extended inhumation)

4. single complete individual burial/interment within the walls, foundations or floor of communal ritual building(s) (Flexed or Extended inhumation)

5. single complete individual burial/interment within the walls, foundations or floor of domestic building(s) (Flexed or Extended inhumation)

6. single incomplete individual burial/interment within the walls, foundations or floor of communal building(s) (Flexed or Extended inhumation)

7. single incomplete individual burial/interment within the walls, foundations or floor of communal ritual building(s) (Flexed or Extended inhumation)

8. single incomplete individual burial/interment within the walls, foundations or floor of domestic building(s) (Flexed or Extended inhumation)

9. single cremated individual burial/interment within the walls, foundations or floor of communal building(s)

10. single cremated individual burial/interment within the walls, foundations or floor of communal ritual building(s)

11. single cremated individual burial/interment within the walls, foundations or floor of domestic building(s)

12. single complete individual burial/interment within the walls, foundations or floor of isolated building(s) (Flexed or Extended inhumation) inside the settlement

13. single incomplete individual burial/interment within the walls, foundations or floor of isolated building(s) (Flexed or Extended inhumation) inside the settlement

14. single cremation burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

15. comingled cremation burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

16. single complete individual intramural burial/interment within monument(s)

17. single incomplete individual burial/interment within communal structure(s) barrow, henge, mound, monument

18. single cremated individual burial/interment within communal structure(s) barrow, henge, mound, monument

19. Single cremation within communal structure(s) barrow, henge, mound, monument

20. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal building(s) representing one individual

21. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal ritual building(s) representing one individual

22. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a domestic building(s) representing one individual

23. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of isolated building(s) inside the settlement representing one individual

24. the caching of particular bones e.g. long bones or skulls representing one individual, within communal structure(s) barrow, henge, mound, monument representing one individual

10. Evidence of group burial/interment: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term group interment refers to the placing of the remains of more than one individual in a grave cut, monument, walls, foundations or floor of domestic or communal building(s). It may reflect a one-off or repeated interment practice by a group: (1) as it may reflect a one off scenarios such as simultaneous death via child birth, disease, famine or conflict and (2) group familial burials over a period of time.

This can be located in:

- within the settlement
- a dedicated location for burial within the settlement without barriers

- a sectioned-off specific location for burial/interment with physical barriers include walls, ditches or palisades:
- domestic building(s)
- communal building(s)
- communal ritual building(s)
- burial mound (s), barrow(s)
- grave cuts in the ground,
- cists,
- pits
- monument(s)/tombs e.g. megaliths
- the surrounding landscape (hilltop, plateaux etc.)

It includes the evidence of:

- complete group (inhumation)
- incomplete group interment (inhumation)
- group cremation interment (in an urn or not)
- the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a building(s) representing more than one individual.

eHRAF: For each eHRAF culture, evidence of group interment (1 = present) comes for the examination of 39 criteria in the eHRAF database: Reference to or description of:

1. the use of group interment
2. a request for group interment
3. the use of group interment for most individuals as a standard treatment
4. the use of group interment for certain individuals as a non-standard treatment
5. age differences associated with the use of group interment

6. sex differences associated with the use of group interment

7. the occasions when group interment occurs

8. the reasons for the use of group interment

9. the groups afforded group interment

10. the frequency of group interment

11. locations used for group interment

12. group interments in cemeteries, non-cemetery locations, monuments and buildings

13. mass graves in cemeteries, non-cemetery locations, monuments and buildings

14. familial grave in cemeteries or non-cemetery locations

15. use of group burials in times of disease

16. use of group burials in times of famine

17. use of group burials in times of conflict

18. familial interment

19. familial plot in cemetery

20. child and parent or guardian interments

21. interment of siblings together

22. group interment e.g. warrior band

23. the caching of bones (e.g. skull, long bones etc.) reflecting more than one individual in cemeteries, non-cemetery locations, monuments and buildings

24. preparation of a corpse or corpses for group interment

25. practices associated with group interment

(a) primary group interment practices in cemeteries or non-cemetery locations, monuments and buildings

(b) secondary group interment practices in in cemeteries or non-cemetery locations, monuments and buildings

26. practices, rituals, ceremonies and dedications associated with interment of more than one individual in a mass or familial grave

27. preforming practices, rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

28. attending practices, rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

29. participating in practices, rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

30. dedicated ritual practitioner(s) associated with rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

31. dedicated member(s) of the community associated with rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

32. dedicated kin member(s) associated with rituals, ceremonies and dedications associated with the interment of more than one individual in a mass or familial grave

33. mythical/religious associations with the interment of a corpse or corpses in relation to group burials

34. mythical/religious figures associated with the interment of a corpse or corpses in relation to group burials

35. ritual symbols associated with the interment of a corpse or corpses in relation to group burials

36. grave markers used at/ for group interments

37. rules and sanctions associated with the interment of groups

38. visiting and re-visiting the location of group interments

39. maintenance of group interments

Archaeology: For the archaeological site-phases evidence of group burial/interment (1 = present) relates to the information from recorded form the available sources that identify and record of 1 of 23 material culture criteria. The recording of:

1. it is recorded that the majority of interments are group interments
2. the sources state that group interment is afforded to the majority or represents the standard or dominant practice at a site phase
3. group complete burial/interment within the walls, foundations or floor of communal building(s) (Flexed or Extended inhumation)
4. group complete burial/interment within the walls, foundations or floor of communal ritual building(s) (Flexed or Extended inhumation)
5. group complete burial/interment within the walls, foundations or floor of domestic building(s) (Flexed or Extended inhumation)
6. group incomplete burial/interment within the walls, foundations or floor of communal building(s) (Flexed or Extended inhumation)
7. group incomplete burial/interment within the walls, foundations or floor of communal ritual building(s) (Flexed or Extended inhumation)
8. group incomplete burial/interment within the walls, foundations or floor of domestic building(s) (Flexed or Extended inhumation)
9. group cremated burial/interment within the walls, foundations or floor of communal building(s)
10. group cremated burial/interment within the walls, foundations or floor of communal ritual building(s)
11. group cremated burial/interment within the walls, foundations or floor of domestic building(s)
12. group complete burial/interment within the walls, foundations or floor of isolated building(s) (Flexed or Extended inhumation) inside the settlement

13. group incomplete burial/interment within the walls, foundations or floor of isolated building(s) (Flexed or Extended inhumation) inside the settlement

14. group cremation burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement—each in an urn

15. comingled cremation burial/interment within the walls, foundations or floor of isolated building(s) inside the settlement

16. group complete burial/interment within communal structure(s) barrow, henge, mound, monument

17. group incomplete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

18. comingled burial/interment within communal structure(s) barrow, henge, mound, monument

19. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal building(s) representing more than one individual

20. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a communal ritual building(s) representing more than one individual

21. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a domestic building(s) representing more than one individual

22. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of isolated building(s) inside the settlement representing more than one individual

23. the caching of particular bones e.g. long bones or skulls within communal structure(s) barrow, henge, mound, monument, representing more than one individual

11. Evidence of flexed burials: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term flexed burial/interment refers to the interment of human remains of one or more than one individual in a grave cut, monument or floor of domestic or communal structure(s) in a flexed position—in which the body is interred in a foetal or crouched position with the legs folded up to the chest.

In this study the term flexed interment refers to the placing of the remains of one or more individual in a flexed position in a grave cut, monument, foundations or floor of a domestic or communal structure(s). It may reflect a one-off or repeated single interment event. The burial/interment containing the flexed remains of one or more individuals can be located in:

- the settlement
- a dedicated location for burial within the settlement without barriers
- a sectioned-off specific location for burial/interment with physical barriers include ditches or palisades:
- domestic building(s)
- communal building(s)
- communal ritual building(s)
- burial mound (s), barrow(s)
- grave cuts in the ground,
- cists
- pits
- monument(s)/tombs e.g. megaliths
- the surrounding landscape (hilltop, plateaux etc.)

It includes the evidence of:

- single complete flexed individual (inhumation)
- single incomplete individual interment (inhumation)

- group complete flexed interment
- group incomplete flexed interment

Note for this study:

a. complete = all bones present or anatomical regions accounted for if soft tissue is well-preserved or present (e.g. via Mummification)

b. incomplete = not all bones present or anatomical regions not accounted for if soft tissue is present

eHRAF: For each eHRAF culture, evidence of flexed burial/interment (1 = present) comes for the examination of 28 criteria in the eHRAF database: Reference to or description of:

1. a flexed burial/interment
2. the use of flexed burial/interment for most individuals as a standard treatment
3. the use of flexed burial/interment for certain individuals as a non-standard treatment
4. age differences associated with the use of flexed burial/interment
5. sex differences associated with the use of flexed burial/interment
6. the occasions when flexed burial/interment is used
7. the reasons for the use of flexed burial/interment
8. the individual(s) afforded flexed burial/interment
9. the group(s) afforded flexed burial/interment
10. the frequency of flexed burial/interment
11. locations used for flexed burial/interment
12. horizontal flexed burial/interments
13. upright flexed burial/interments; where the corpse is placed in the ground

14. upright flexed burial/interments; where the corpse is a container (e.g. basket) and then placed in the ground

15. flexed burial/interments in cemeteries, non-cemetery locations, monuments and buildings

16. preparation of a corpse or corpses for flexed burial/interment

17. practices associated with flexed burial/interment

(a) primary flexed burial/interment practices in in cemeteries, non-cemetery locations, monuments and buildings

(b) secondary flexed burial/interment practices in in cemeteries, non-cemetery locations, monuments and buildings

18. practices, rituals, ceremonies and dedications associated with the dead in which flexed burial is used

19. preforming practices, rituals, ceremonies and dedications associated with the interment of more than one individual or the interment of one individual in a mass or familial grave

20. participating in practices, rituals, ceremonies and dedications associated with the interment of one or more individuals in a flexed position

21. mythical/religious associations with the interment of a corpse or corpses in flexed position

22. mythical/religious figures associated with the interment of a corpse or corpses in relation to flexed burial/interment

23. ritual symbols associated with flexed burials

24. grave markers associated with flexed burial/interments

25. rules associated with flexed burial/interments

26. sanctions associated with flexed burial/interments

27. visiting and re-visiting the location of flexed burial/interments

28. maintenance of flexed burial/interments

Archaeology: For the archaeological site-phases evidence of flexed burial/interment (1 = present) relates to the information from recorded form the available sources that identify and record of 1 of 12 material culture criteria. The recording of:

1. horizontal flexed burial/interments
2. upright flexed burial/interments; where the corpse is placed in the ground
3. upright flexed burial/interments; where the corpse is a container (e.g. basket) and then placed in the ground

in any of the following contexts:

1. It is recorded that the majority of interments are flexed interments
2. The sources state that flexed interment is afforded to the majority or represents the standard or dominant practice at a site phase
3. group or single flexed, complete burial/interment within the foundations or floor of communal building(s)
4. group or single flexed, complete burial/interment within the foundations or floor of communal ritual building(s)
5. group or single flexed, complete burial/interment within the foundations or floor of domestic building(s)
6. group or single flexed, incomplete burial/interment within the foundations or floor of communal building(s)
7. group or single flexed, incomplete burial/interment within the foundations or floor of communal ritual building(s)
8. group or single flexed, incomplete burial/interment within the foundations or floor of domestic building(s)
9. group or single flexed, complete intramural burial/interment within the foundations or floor of isolated building(s) inside the settlement

10. group or single flexed, incomplete burial/interment within the foundations or floor of isolated building(s) inside the settlement

11. group or single flexed, complete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

12. group or single flexed, incomplete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

12. Evidence of extended burials: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term extended burial/interment refers to the interment of human remains of one or more than one individual in a grave cut, monument or floor of domestic or communal structure(s) in a extended position—in which the body is positioned flat with arms and legs straight, or with the arms folded upon the chest. Extended burials may be supine or prone. It may reflect a one-off or repeated interment event. The location of burial/interment containing the extended remains of one or more individuals can be in:

- the settlement
- a dedicated location for burial within the settlement without barriers
- a sectioned-off specific location for burial/interment with physical barriers include ditches or palisades:
- domestic building(s)
- communal building(s)
- communal ritual building(s)
- burial mound (s), barrow(s)
- grave cuts in the ground,
- cists,
- pits

- monument(s)/tombs e.g. megaliths
- the surrounding landscape (hilltop, plateaux etc.)

It includes the evidence of:

- single complete, extended interment (inhumation)
- single incomplete, extended interment (inhumation)
- group complete, extended complete interment (inhumation)
- group incomplete, extended interment (inhumation)

eHRAF: For each eHRAF culture, evidence of extended burial/interment (1 = present) comes for the examination of 25 criteria in the eHRAF database: Reference to or description of:

1. an extended burial/interment
2. the use of extended burial/interment for most individuals as a standard treatment)
3. the use of extended burial/interment for certain individuals as a non-standard treatment
4. age differences associated with the use of extended burial/interment
5. sex differences associated with the use of extended burial/interment
6. the occasions when extended burial/interment is used
7. the reasons for the use of extended burial/interment
8. the individual(s) afforded extended burial/interment
9. the group(s) afforded extended burial/interment
10. the frequency of extended burial/interment
11. locations used for extended burial/interment
12. extended burial/interments in cemeteries, non-cemetery locations, monuments and buildings
13. preparation of a corpse or corpses for extended burial/interment

14. practices associated with extended burial/interment

(a) primary extended burial/interment practices in in cemeteries, non-cemetery locations, monuments and buildings

(b) secondary extended burial/interment practices in in cemeteries, non-cemetery locations, monuments and buildings

15. performing practices, rituals, ceremonies and dedications associated nin which extended burial is used

16. attending practices, rituals, ceremonies and dedications associated with the interment of one or more individuals in an extended position

17. participating in practices, rituals, ceremonies and dedications associated with the interment of one or more individuals in an extended position

18. (mythical/religious associations with the interment of a corpse or corpses in extended position

19. mythical/religious figures associated with the interment of a corpse or corpses in relation to extended burial/interment

20. ritual symbols associated with the interment of a corpse or corpses in relation to group burials

21. grave markers associated with extended burial/interments

22. rules associated with extended burial/interments

23. sanctions associated with extended burial/interments

24. visiting and re-visiting the location of extended burial/interments

25. maintenance of extended burial/interments

Archaeology: For the archaeological site-phases evidence of extended burial/interment (1 = present) relates to the information from recorded form the available sources that identify and record of 1 of 12 material culture criteria:

1. It is recorded that the majority of interments are extended interments

2. The sources state that extended interment is afforded to the majority or represents the standard or dominant practice at a site phase

3. group or single extended, complete burial/interment within the foundations or floor of communal building(s)

4. group or single extended, complete intramural burial/interment within the foundations or floor of communal ritual building(s)

5. group or single extended, complete intramural burial/interment within the foundations or floor of domestic building(s)

6. group or single extended, incomplete burial/interment within the foundations or floor of communal building(s)

7. group or single extended, incomplete burial/interment within the foundations or floor of communal ritual building(s)

8. group or single extended, incomplete burial/interment within the foundations or floor of domestic building(s)

9. group or single extended, complete intramural burial/interment within the foundations or floor of isolated building(s) inside the settlement

10. group or single extended, incomplete burial/interment within the foundations or floor of isolated building(s) inside the settlement

11. group or single extended, complete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

12. group or single extended, incomplete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

13. Evidence of inhumation: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term inhumation burial/interment refers to burying the dead with either the soft tissue present or as part of a secondary burial practice involving

burial of de-fleshed naturally (excarnation) bone. It may reflect a one-off or repeated interment practice in the group. The location of inhumation burial/interment containing the remains of one or more individuals can be in:

- the settlement
- a dedicated location for burial within the settlement without barriers
- a sectioned-off specific location for burial/interment with physical barriers include walls, ditches or palisades:
- domestic building(s)
- communal building(s)
- communal ritual building(s)
- burial mound (s), barrow(s)
- grave cuts in the ground,
- cists,
- pits
- monument(s)/tombs e.g. megaliths
- the surrounding landscape (hilltop, plateaux etc.)

It includes the evidence of:

- single complete individual (flexed or extended inhumation)
- single incomplete individual interment (flexed or extended inhumation)
- group complete individual (flexed or extended inhumation)
- group incomplete individual interment (flexed or extended inhumation)

eHRAF: For each eHRAF culture, evidence of inhumation (1 = present) comes for the examination of 26 criteria in the eHRAF database: Reference to or description of:

1. an inhumation interment
2. a request for an inhumation interment
3. the use of inhumation for most individuals as a standard treatment

4. the use of inhumation for certain individuals as a non-standard treatment

5. age differences associated with the use of inhumation

6. sex differences associated with the use of inhumation

7. the occasions when inhumation is used

8. the reasons for the use of inhumation

9. the individual(s) afforded inhumation

10. the group(s) afforded inhumation

11. the frequency of inhumation

12. location(s) used for inhumation

13. inhumations in cemeteries or non-cemetery locations

14. preparation of a corpse or corpses for inhumation

15. practices associated with inhumation

(a) primary inhumation practices in in cemeteries or non-cemetery locations

(b) secondary inhumation practices in in cemeteries or non-cemetery locations

16. performing practices, rituals, ceremonies and dedications associated with inhumation(s)

17. attending practices, rituals, ceremonies and dedications associated with inhumation(s)

18. participating in practices, rituals, ceremonies and dedications associated with inhumation(s)

19. mythical/religious associations with inhumation(s)

20. mythical/religious figures associated with inhumation(s)

21. ritual symbols associated with inhumation(s)

22. grave markers associated with inhumation(s)

23. rules associated with inhumation(s)

24. sanctions associated with inhumation(s)

25. visiting and re-visiting the location of inhumation(s)

26. maintenance of the location(s) of inhumation(s)

Archaeology: For the archaeological site-phases evidence of inhumation burial/interment (1 = present) relates to the information from recorded form the available sources that identify and record of 2 of 15 material culture criteria. The recording of:

1. It is recorded that the majority of interments are single- inhumations
2. The sources state that inhumation interment. is afforded to the majority or represents the standard or dominant practice at a site phase
3. bone with no evidence of charring or fissuring, warping or fragmentation characteristic of cremation (cremation is dealt with in next section)
4. evidence of soft tissue still preserved (e.g. via Mummification)
5. evidence of soft tissue present at the time of indicated by the identification of preserved evidence such as:

- Evidence of bacterial bio-erosion related to the bacteria of the gastrointestinal tract
- Preserved Larvae of, for example, the *Calliphoridae* (blowfly) and *Sacrophagidae* (fleshfly)
- Evidence of presence of beetles such as *dermestid* via beetle larvae

6. group or single extended or flexed inhumation, complete burial/interment within the foundations or floor of communal building(s)
7. group or single extended or flexed inhumation, incomplete burial/interment within the foundations or floor of communal ritual building(s)
8. group or single extended or flexed inhumation, complete burial/interment within the foundations or floor of domestic building(s)
9. group or single extended or flexed inhumation, incomplete burial/interment within the foundations or floor of communal building(s)

10. group or single extended or flexed inhumation, complete burial/interment within the foundations or floor of communal ritual building(s)

11. group or single extended or flexed inhumation, incomplete burial/interment within the foundations or floor of domestic building(s)

12. group or single extended or flexed inhumation, complete intramural burial/interment within the foundations or floor of isolated building(s) inside the settlement

13. group or single extended or flexed inhumation, incomplete burial/interment within the foundations or floor of isolated building(s) inside the settlement

14. group or single extended or flexed inhumation, complete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

15. group or single extended or flexed inhumation, incomplete intramural burial/interment within communal structure(s) barrow, henge, mound, monument

14. Evidence of cremation: this category is recorded in terms of: 0 = absent, 1 = present.

In this study the term cremation refers to the evidence for cremation and or cremation burial(s):

1. Cremation: the use of burning as a method of disposing of a corpse. Cremation of a human body requires temperatures ranging between 800 to 1200 degrees Celsius. The cremation of human remains involves placing the remains on a cremation pyre (elevated or not), chamber or furnace to reduce the remains to its basic chemical compounds resulting in mineral fragments retaining the appearance of dry bone.

2. Cremation burial/interment: the burial/interment of cremated remains

eHRAF: For each eHRAF culture, evidence of cremation and or cremation burial (1 = present) comes for the examination of 40 criteria in the eHRAF database: Reference to or description of:

1. cremation and or cremation interment/burial
2. a request for an cremation
3. Use of a pyre
4. collection of materials for a pyre
5. construction of a pyre
6. location of pyre
7. lighting of a pyre
8. management/supervision of a pyre
9. extinguishing of a pyre
10. the use of cremation and or cremation burial for most individuals as a standard treatment
11. the use of cremation and or cremation burial for certain individuals as a non-standard treatment
12. age differences associated with the use of cremation and or cremation burial
13. sex differences associated with the use of cremation and or cremation burial
14. the occasions when cremation and or cremation burial is used
15. the reasons for the use of cremation and or cremation burial
16. the individual(s) afforded cremation and or cremation burial
17. the group(s) afforded cremation and or cremation burial
18. the frequency of cremation and or cremation burial
19. location(s) used for cremation and or cremation burial
20. cremation and or cremation burial(s) in cemeteries or non-cemetery locations
21. preparation of a corpse or corpses for cremation and or cremation burial

22. transportation of corpse to the pyre

23. placing a corpse on a pyre

24. position of corpse on a pyre

25. length of time of cremation

26. raking the pyre

27. collecting of remains during the cremation process

28. collecting of cremated remains

29. transportation of cremated remains

30. storage of cremated remains

31. interment of cremated remains

32. practices associated with cremation and or cremation burial

(a) primary cremation burial practices in in cemeteries or non-cemetery locations

(b) secondary cremation burial practices in in cemeteries or non-cemetery locations

33. performing practices, rituals, ceremonies and dedications associated with cremation and or cremation burial(s)

34. attending practices, rituals, ceremonies and dedications associated with cremation and or cremation burial(s)

35. participating in practices, rituals, ceremonies and dedications associated with cremation and or cremation burial(s)

36. mythical/religious associations with cremation and or cremation burial(s)

37. mythical/religious figures associated with cremation and or cremation burial(s)

38. ritual symbols associated with cremation and or cremation burial(s)

39. grave markers associated with cremation burial(s)

40. rules associated with cremation and or cremation burial(s)

41. sanctions associated with cremation and or cremation burial(s)

42. visiting and re-visiting the location of cremation and or cremation burial(s)

43. maintenance of the location(s) of cremation and or cremation burial(s)

Archaeology: this section outlines the evidence that is used to indicated/record the use of: (1) cremation as a way of processing corpse or corpses and (2) the interment of cremated remains.

(1) cremation as a way of processing corpse(s)

The cremation process and conditions affect the bones in a number of ways. For instance, exposure to the heat of a pyre changes the colour, shape, size and weight of bone. The colour of bone fragments affected by high temperatures is a function of oxygen availability, duration and temperature. Complete burning will result in complete oxidation of the organic component of bone, leaving the mineral portion remaining. At about 900^0C the organic content of bone is destroyed, leaving only the inorganic matrix which, at that temperature, is rendered brittle and assumes a metallic consistency rather like that of fine bone china. On cooling, the inorganic matrix appears white. Importantly, it is this white colour that offers the most reliable clue as to the temperature reached at the hottest part of the pyre.

Evidence of cremation can be determined from the identification of 2 of 10 criteria:

1. The explicit noting by the excavators as cremation being in use at the site.
2. The recording of a pyre location at the site
3. Presence of Pyre Debris:

- If Pyre debris has been noted to have been deposited in the backfill of cremation burials

4. The colour of the bone

Holden et al. (1995) provide us with a summary of the association between specific colours and their associate bone colours:

- Brown/Orange = Unburnt
- Black = Charred (c.300°C)

- Blue/Grey = Incompletely Oxidised (c.600°C)
- White = Completely Oxidised (>600°C)

5. Bone consistency:

- brittle bone with a metallic consistency indicates cremation

6. The degree of Warping

- degree of warping is related to the presence of soft tissue at the time of exposure to the cremation pyre. Bone burned with flesh still present will contain considerable warping, transverse fractures (recurrently in a curvilinear pattern) and more irregular longitudinal splitting.

7. Evidence of shrinkage and Dehydration:

- Shrinkage of bone during the cremation process due to dehydration can amount to a 25-30% decrease in cross-section width and accordingly approximately a 5% decrease in bone length. Evidence of dehydration presents itself on the bone fragments in the form of fissuring or transverse, concentric and parabolic cracking—particularly, when soft tissue was still present on the bone. On Spongy bone shrinkage initiates at 700ºC, augments at 800ºC and no further shrinkage occurs at higher temperatures. In addition, it is asserted that shrinkage, correlates with both temperature and the duration of heat exposure.

8. Evidence of secondary Crushing following cremation:

- A substantial percentage of bone fragments less that 5mm (<5mm) with indication via colouring etc. of cremation can be considered as probable evidence that following the cremation process, bone were mechanically pulverised in order to get them into a burial container or to transport them.

9. Evidence of transportation of Remain

- If transportation had taken place we should observe the absence of a majority of hand and feet bones—which are unlikely to be collected.

10. Presence of Pyre/Grave Goods

- For example, metal items leave a trace of their presence in the form of staining on the bone, especially those manufactured from copper alloys. Dunlop (1978) reports that copper produces a pink colour in cremated bones, copper alloys and iron a green colour and zinc a yellow colour.

(2) Interment of cremated remains

The evidence of the interment of cremated remains can be determined form the recording of 1 of 13 criteria:

1. it is recorded that the majority of interments are cremation interments
2. the sources state that cremation interment is afforded to the majority or represents the standard or dominant practice at a site phase
3. group or single cremation intramural burial/interment within the foundations or floor of communal building(s) (with or without an urn)
4. group or single cremation intramural burial/interment within the foundations or floor of communal ritual building(s) (with or without an urn)
5. group or single cremation intramural burial/interment within the foundations or floor of domestic building(s) (with or without an urn)
6. group or single cremation burial/interment within the foundations or floor of communal building(s) (with or without an urn)
7. group or single cremation burial/interment within the foundations or floor of communal ritual building(s) (with or without an urn)
8. group or single cremation burial/interment within the foundations or floor of domestic building(s) (with or without an urn)
9. group or single cremation intramural burial/interment within the foundations or floor of isolated building(s), inside the settlement (with or without an urn)
10. group or single cremation burial/interment within the foundations or floor of isolated building(s), inside the settlement (with or without an urn)

11. group or single cremation intramural burial/interment within communal structure(s) barrow, henge, mound, monument (with or without an urn)

12. group or single cremation intramural burial/interment within communal

13. structure(s) barrow, henge, mound, monument (with or without an urn)

15. Evidence of secondary burial or interment practice: this category is recorded in terms of: 0 = absent, 1 = present.

In this study, secondary burial treatment refers to the use of two-part interment practices. This can relate to: (a) reopening of an interment, for example, to remove bones for relics, caching, painting or plastering; (b) reopening or an internment to re-inter the remains in a different location; and (3) the corpse is de-fleshed naturally before being placed in the grave—in this instance the corpse in often placed on a platform of some description for excarnation (de-fleshing). It does not refer to cremation which is dealt with in a separate section.

eHRAF: For each eHRAF culture, evidence of secondary burial treatment (1 = present) comes for the examination of 40 criteria in the eHRAF database: Reference to or description of:

1. secondary burial practices
2. request for secondary burial treatment
3. re-opening of graves
4. re-interment of individuals
5. bone caching
6. bone relics
7. use of an excarnation/de-fleshing platform
8. construction of a excarnation/de-fleshing platform
9. location of excarnation/de-fleshing platform
10. management/supervision of a de-fleshing platform

11. the use of secondary burial practices for most individuals as a standard treatment

12. the use of secondary burial practices for certain individuals as a non-standard treatment

13. age differences associated with the use of secondary burial practices

14. sex differences associated with the use of secondary burial practices

15. the occasions when secondary burial practices is used

16. the reasons for the use of secondary burial practices

17. the individual(s) afforded secondary burial practices

18. the group(s) afforded secondary burial practices

19. the frequency of secondary burial practices

20. location(s) used for secondary burial practices; initial interment or second interment

21. preparation of a corpse or corpses for secondary burial practices; preparing for excarnation/de-fleshing or re-burial

22. transportation of corpse to the de-fleshing platform

23. placing a corpse on a de-fleshing platform

24. position of a corpse on a de-fleshing platform

25. collecting of remains following the excarnation/de-fleshing process

26. transportation of remains as part of a secondary burial practices

27. storage of remains as part of a secondary burial practices

28. final interment of remains as part of a secondary burial practices

29. practices associated with secondary burial treatment

(a) primary burial practices in cemeteries or non-cemetery locations

(b) secondary burial practices in cemeteries or non-cemetery locations

30. performing practices, rituals, ceremonies and dedications associated with secondary burial treatment(s); initial interment or second interment

31. attending practices, rituals, ceremonies and dedications associated with secondary burial treatment(s); initial interment or second interment

32. participating in practices, rituals, ceremonies and dedications associated with secondary burial treatment(s); initial interment or second interment

33. mythical/religious associations with secondary burial treatment(s)

34. mythical/religious figures associated with secondary burial practices

35. ritual symbols associated with secondary burial practices

36. grave markers associated with secondary burial(s); initial interment or second interment location

37. rules associated with secondary burial practices

38. sanctions associated with secondary burial practices

39. visiting and re-visiting the location of secondary burial practices; initial interment or second interment

40. maintenance of the location(s) of secondary burial practices; initial interment or second interment location

Archaeology: evidence of secondary burial practices (1 = present) comes for the recording of 2 of 9 criteria at site-phase:

1. Evidence of post-mortem removal of human bone as part of a secondary practice(s) involving:

(a) reopening the grave after burial to retrieve individual bone, collection of bones or skull(s) for relics, caching modification or interment in another location. It can be examine via by absent bones particularly long bones and skull with no evidence of perimortem trauma in the removal of such bones.

(b) evidence of excarnation as part of a secondary burial practices where the corpse is de-fleshed naturally before being placed in the grave.

(C) evidence of secondary burial practices where the bones have been placed in a second interment

Both (b) and (c) are difficult but can potentially be indicated by:

I. absence of particular bones; often hand and foot bone which may not have been collected for reinternment following natural excarnation/de-fleshing (no evidence of cut marks)

II. in a situation where soft tissue is, generally, preserved due to the biochemical conditions of the site but we have interments with no evidence of soft tissue

III. Where analysis demonstrates that the interment was not associated with the presence of soft tissue. evidence of soft tissue present at the time of burial indicated by the identification of preserved evidence such as:

- Evidence of bacterial bio-erosion related to the bacteria of the gastrointestinal tract
- Preserved Larvae of, for example, the *Calliphoridae* (blowfly) and *Sacrophagidae* (fleshfly)
- Evidence of the presence of beetles such as *dermestid* beetle via larvae

2. Evidence of separate burial of individual bones or skull

3. Evidence of bone or skull caching:

4. the caching of bones or skull(s) within the walls, floor or foundation of a building(s)

5. the caching of bones or skull(s) in any location on the site

6. the caching of bones or skull(s) in the surrounding landscape of the site; where evidence indicates (1) dating: contemporary with the site and/or (2) ancient DNA or isotope evidence indicates a connection between to the population of the site

7. Evidence of plastered skulls:

8. Evidence of painting bone or skulls:

9. Any of the above any type of

- single complete individual interment (inhumation)
- single incomplete individual interment (inhumation)
- group complete interment (inhumation)
- group incomplete interment (inhumation)
- comingled interment (inhumation)

16. Evidence of grave disturbance: this category is recorded in terms of: 0 = absent, 1 = present. In this study, grave disturbance refers to the reopening of an interment to: (1) remove bones for relics, caching, painting or plastering; (2) remove grave goods/artefacts; (3) to re-inter in a different location and (4) re-opening of interment to place grave goods/artefacts or additional human or animal bone; this does not include such multiple interments such as familial burial in which a member of the family is later buried in the same plot. It refers to the deliberate re-opening to include items as part of either a standard or special burial practice.

eHRAF: For each eHRAF culture, evidence of grave disturbance (1 = present) comes for the examination of 31 criteria in the eHRAF database: Reference to or description of:

1. grave disturbance
2. re-opening of graves
3. re-interment of individuals
4. bone caching
5. bone relics

6. the practice of grave disturbance for most individuals as a standard treatment

7. the practice of grave disturbance for certain individuals as a non-standard treatment

8. age differences associated with grave disturbance

9. sex differences associated with grave disturbance

10. the occasions when grave disturbance happens

11. the reasons for grave disturbance

12. the individual(s) whose graves are subject to disturbance

13. the group(s) whose graves are subject to disturbance

14. the frequency of grave disturbance

15. preparation of a corpse or corpses for re-burial following grave disturbance

16. transportation of corpse for re-burial following grave disturbance

17. collecting of remains for re-burial following grave disturbance

18. storage of remains as part of a secondary burial practices

19. final interment of remains as part of a secondary burial practices

20. practices associated with grave disturbance

21. grave disturbance in cemeteries or non-cemetery locations

22. performing practices, rituals, ceremonies and dedications associated with grave disturbance(s)

23. attending practices, rituals, ceremonies and dedications associated with grave disturbance(s)

24. participating in practices, rituals, ceremonies and dedications associated with grave disturbance(s)

25. mythical/religious associations with grave disturbance(s)

26. mythical/religious figures associated with grave disturbance(s)

27. ritual symbols associated with grave disturbance(s)

28. grave markers associated with secondary burial(s)

29. rules associated with grave disturbance(s)

30. sanctions associated with grave disturbance(s)

31. visiting and re-visiting the location of grave disturbance(s)

Archaeology: The evidence of grave disturbance is recorded using the criteria outlined in the *secondary burial practices section* (no. 15). In this study, grave disturbance refers to the reopening of an interment to:

(1) remove bones for relics, caching, painting or plastering; indicated by absent bones particularly long bones and skull

(2) remove grave goods/artefacts—indicated via the occurrence of staining due to the presence of a metal object which is no longer present

(3) to re-inter in a different location: indicated by the presence of a grave cut where grave goods or other artefacts are present, chemical analysis indicates organic matter (e.g. stomach/intestinal parasites) associated with human burial but all aspects of the skeleton are absent

Note the re-opening of interment to place grave goods/artefacts or additional human or animal bone was not recorded as it is difficult to ascertain in the archaeological record but it mat potential be examined where dating for the individual(s) interred gives an earlier date then the date(s) received for the artefact or bone are different; this may show some continued knowledge of ancestral burial but could also represent later intrusions not connected with the initial interment.

18. Evidence of grave goods: this category is recorded in terms of: 0 = absent, 1 = present. A grave good refers to any artefact deliberately places in or accompanying an interment. It can be: (1) manufactured items such as beads, pottery, weapons, carved stone and implements associated with a vocation/profession etc. in an interment and (2) natural items such as unaltered shells, fossils, as well as, animal

bones or additional human bones (particular bones or areas of the anatomy) etc. in an interment. The presence of grave goods can be related to a number of factors including, rank, social status vocation/profession, sex and age.

eHRAF: For each eHRAF culture, evidence of grave goods (1 = present) comes for the examination of 44 criteria in the eHRAF database: Reference to or description of:

1. placing grave goods in an interment
2. the requesting of grave goods in an interment
3. the use of grave goods for most individuals as a non-standard treatment
4. the use of grave goods for certain individuals as a non-standard treatment
5. age differences associated with grave goods
6. sex differences associated with grave goods
7. types of grave goods
8. the placing of items in an interment
9. the designing of grave goods
10. making of grave goods
11. storage of grave goods
12. caching of grave goods
13. preparation of grave goods for interment
14. the placing of manufactured items such as beads, pottery, weapons, implements associated with a vocation/profession etc. in an interment
15. the placing of natural items such as shells, animal bones or additional human bones etc. in an interment
16. the placing of personal items in an interment
17. the placing of items associated with a belief system in an interment
18. the occasions when grave goods are used
19. the reasons for placing grave goods in an interment
20. the individual(s) whose graves receive grave goods

21. the group(s) whose graves are receive grave goods

22. the frequency of placing grave goods in an interment

23. preparation of a corpse or corpses for burial using grave goods

24. preparation of a corpse or corpses for re-burial using grave goods

25. collecting of grave goods

26. transportation of grave goods for interment

27. final interment of grave goods as part of a primary burial practices

28. final interment of grave goods as part of a secondary burial practices

29. practices associated with grave goods

30. locations associated with grave goods: cemeteries and non-cemetery locations

31. grave disturbance in cemeteries or non-cemetery locations associated with the placing grave goods

32. grave disturbance in cemeteries or non-cemetery locations associated with the retrieving of grave goods

33. performing practices, rituals, ceremonies and dedications associated with grave goods

34. dedicated ritual practitioner(s) associated with the placing of grave goods

35. dedicated member(s) of the community associated with the placing of grave goods

36. dedicated kin member(s) associated with the placing of grave goods

37. attending practices, rituals, ceremonies and dedications associated with grave goods

38. participating in practices, rituals, ceremonies and dedications associated with grave goods

39. mythical/religious associations with grave goods

40. mythical/religious figures associated with grave goods

41. ritual symbols associated with grave goods

42. grave markers associated with secondary burial

43. rules associated with grave goods

44. sanctions associated with grave goods

Archaeology: In this study, a grave good refers to the artefacts that are present at the time of excavation. It related to (1) any manufactured item such as beads, pottery, weapons, carved stone and implements associated with a vocation/profession etc. in an interment and (2) natural items such as shells, fossils, animal bones or additional human bones (particular bones or areas of the anatomy) etc. in an interment. As it is hard to determine the intentional placing of natural items such as shells or fossils, these were only deemed as grave goods if their presence was recorded as associated with intentional caching of number of examples via the positioning and arrangement of shells and/or fossils in an interment.

Grave goods present was recorded if (1) any manufactured item such as beads, pottery, weapons, carved stone and implements associated with a vocation/profession etc. in an interment and (2) natural items (as described) were interred with:

1. that the majority of interments have grave goods

2. The sources state that the inclusion of grave goods is present at the majority of interments or represents the standard or dominant practice at a site phase

3. single complete individual interment (inhumation)

4. single incomplete individual interment (inhumation)

5. group complete interment (inhumation)

6. group incomplete interment (inhumation)

7. comingled interment (inhumation)

8. single cremation interment

9. group cremation interment where each cremation is in an urn

10. comingled cremation interment

11. the caching of particular bones e.g. long bones or skulls within the walls, floor or foundation of a building(s)

19. Evidence of skulls manipulation/modification (associated with mortuary practices): this category is recorded in terms of: 0 = absent, 1 = present refers to recording of any deliberately modification or removal of the skull of the deceased, which is not indicative of interpersonal violence, e.g.:

1. Evidence of post-mortem removal of the skull

2. Evidence of separate skull(s) interment

3. Evidence of skull caching

4. Evidence of plastered skulls

5. Evidence of painted skulls

Skull manipulation can be related to a number of factors including, rank, social status vocation/profession, sex and age.

eHRAF: For each eHRAF culture, skull manipulation (1 = present) comes for the examination of 48 criteria in the eHRAF database: Reference to or description of:

1. the use of skull manipulation/modification

2. the requesting of skull manipulation

3. the use of skull manipulation for most individuals as a standard treatment

4. the use of skull manipulation for certain individuals as a non-standard treatment

5. age differences associated with skull manipulation

6. sex differences associated with skull manipulation

7. removal of a skull from a corpse

8. types of skull manipulation/modification including skull painting and plastering

9. the placing of individual skulls in an interment

10. tools for skull removal

11. storage of tools for skull removal

12. tools for skull manipulation including skull painting and plastering

13. storage of tools for skull manipulation including skull painting and plastering

14. storage of manipulated skulls

15. caching of skulls

16. caching of manipulated skulls

17. preparation of skulls for manipulation

18. preparation of manipulated skulls for interment

19. the placing of manipulated skulls in an interment

20. the occasions when skull manipulation are used

21. the reasons for placing manipulated skulls in an interment

22. the individual(s) who receive skull manipulation

23. the group(s) who receive skull manipulation

24. the frequency of skull manipulation

25. the frequency of placing manipulated skulls in an interment

26. preparation of a corpse or corpses for burial associated with skull manipulation

27. preparation of a corpse or corpses for re-burial associated with skull manipulation

28. collecting of manipulated skulls

29. transportation of manipulated skulls for interment

30. final interment of manipulated skulls as part of a primary burial practices

31. final interment of manipulated skulls as part of a secondary burial practices

32. practices associated with skull manipulation

33. Locations associated with skull manipulation: domestic, ritual buildings, communal buildings and workshops

34. Locations associated with interment of manipulated skulls: cemeteries and non-cemetery locations

35. grave disturbance in non-cemetery locations associated with the retrieving of skulls for manipulation

36. grave disturbance in cemeteries locations associated with the placing manipulated skulls

37. performing practices, rituals, ceremonies and dedications associated with skull manipulation

38. dedicated ritual practitioner(s) associated with skull manipulation

39. dedicated member(s) of the community associated with skull manipulation

40. dedicated kin member(s) associated with skull manipulation

41. attending practices, rituals, ceremonies and dedications associated with skull manipulation

42. participating in practices, rituals, ceremonies and dedications associated with skull manipulation

43. mythical/religious associations with skull manipulation

44. mythical/religious figures associated with skull manipulation

45. ritual symbols associated with skull manipulation

46. grave markers associated with secondary burial practices for the purpose of skull manipulation

47. rules associated with skull manipulation

48. sanctions associated with skull manipulation

Archaeology: Archaeological evidence of skull manipulation refers post-mortem removal and manipulation of the skull(s). It is recorded if any 1 of 5 criteria are present:

1. Evidence of post-mortem removal of the skull(s) as part of a secondary practice(s)involving:

(a) re-opening the grave after burial to retrieve skull(s) for relics, caching modification or interment in another location. It can be examined via by absent skull bones with no evidence of perimortem trauma in the removal of such bones—e.g. no marks on the cervical vertebrae, mastoid processes or mandible.

(b) evidence of secondary burial practices where the corpse is de-fleshed naturally (excarnation) before being placed in the grave without the skull.

(C) evidence of secondary burial practices where the bones have been placed in a second interment without the skull

Both (b)and (c) can potentially be indicated by:

I. absence of particular bones; often hand and foot bone which may not have been collected for reinternment following natural excarnation/de-fleshing (no evidence of cut marks)

II. Where soft tissue is, generally, preserved due to the biochemical conditions of the site but we have interments with no evidence of soft tissue

III. Where analysis demonstrates that the interment was not associated with the presence of soft tissue. evidence of soft tissue present at the time of burial indicated by the identification of preserved evidence such as:

- Evidence of bacterial bio-erosion related to the bacteria of the gastrointestinal tract

- Preserved Larvae of, for example, the *Calliphoridae* (blowfly) and *Sacrophagidae* (fleshfly)
- Evidence of the presence beetles such as *dermestid* via beetle larvae

2. Evidence of separate skull burial

3. Evidence of skulls caching:

- the caching of skull(s) within the walls, floor or foundation of a building(s)
- the caching of skull(s) in any location on the site
- the caching of skull(s) in the surrounding landscape of the site; where evidence indicates (1) contemporary with the site (2) or dating, ancient DNA or isotope evidence indicates a connection between to the population of the site

4. Evidence of plastered skulls:

5. Evidence of painting skulls:

Any of the above any type of

- single complete individual interment (inhumation)
- single incomplete individual interment (inhumation)
- group complete interment (inhumation)
- group incomplete interment (inhumation)
- comingled interment (inhumation)

20. Evidence of burial associated with animals: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: For each eHRAF cultures, burial associated with animals refers to (1) the inclusion of any part of animal anatomy e.g. bone, tooth, horns, tusk, antler or hide in an interment and (2) the slaughtering of animals as part of a mortuary ritual. This category refers specifically to (1) hunted large wild game (2) wild or domesticated sheep, goat, pigs or cattle. For each eHRAF cultures, evidence of burial associated

with animals (1 = present) comes for the examination of 50 criteria in the eHRAF database: Reference to or description of:

1. placing animal bone(s) in an interment
2. the requesting of animal bone(s) to be placed in an interment
3. the use of animal bone(s) for most individuals as a standard treatment
4. the use of animal bone(s) for certain individuals as a non-standard treatment
5. age differences associated with the placing of animal bone(s) in an interment
6. sex differences associated with the placing of animal bone(s) in an interment
7. types of animal bone(s) e.g. long bone or skull placed in an interment
8. the placing of animal bone(s) in an interment
9. storage of animal bone(s) before placing in an interment
10. caching of animal bone(s)) before placing in an interment
11. preparation of animal bone(s) for interment
12. the placing of items associated with a belief system in an interment
13. the occasions when animal bone(s) before placed in an interment
14. the reasons for placing animal bone(s) in an interment
15. the individual(s) whose graves receive animal bone(s)
16. the group(s) whose graves are receive animal bone(s)
17. the frequency of placing animal bone(s) in an interment
18. collecting of animal bone(s) for interment
19. transportation of animal bone(s) for interment
20. final interment of animal bone(s) as part of a primary burial practices
21. final interment of animal bone(s) as part of a secondary burial practices
22. practices associated with animal bone(s)
23. locations associated with animal bone(s)n in interments: cemeteries and non-cemetery locations

24. grave disturbance in cemeteries or non-cemetery locations associated with the placing animal bone(s)

25. grave disturbance in cemeteries or non-cemetery locations associated with the retrieving of animal bone(s)

26. performing practices, rituals, ceremonies and dedications associated with animal bone(s) in mortuary contexts

27. dedicated ritual practitioner(s) associated with the placing of animal bone(s) in mortuary contexts

28. dedicated member(s) of the community associated with the placing of animal bone(s) in mortuary contexts

29. dedicated kin member(s) associated with the placing of animal bone(s) in interments

30. attending practices, rituals, ceremonies and dedications associated with animal bone(s) in mortuary contexts

31. participating in practices, rituals, ceremonies and dedications associated with animal bone(s) in mortuary contexts

32. mythical/religious associations with animal bone(s) in mortuary contexts

33. mythical/religious figures associated with animal bone(s) in mortuary contexts

34. ritual symbols associated with animal bone(s) in mortuary contexts

35. grave markers associated with animal bone(s) in mortuary contexts

36. rules associated with animal bone(s) in mortuary contexts

37. sanctions associated with animal bone(s) in mortuary contexts

38. organisation of slaughtering of animals for mortuary practices

39. rituals and ceremonies associated with slaughtering of animals for mortuary practices;

40. wild animals slaughtering/butchered for mortuary practices

41. domesticated animals slaughtering/butchered for mortuary practices

42. types of animals reared for slaughtering/butchered for mortuary practices

43. types of animals hunted for slaughtering in to context of mortuary practices

44. entertainment associated with the slaughtering of animals for mortuary practices

45. mythical/religious associations with the slaughtering of animals for mortuary practices

46. mythical/religious figures associated with the slaughtering of animals for mortuary practices

47. ritual symbols associated with the slaughtering of animals for mortuary practices

48. rules and sanctions associated with the slaughtering of animals for mortuary practices

49. rules and sanctions associated with the consumption of animals for mortuary practices

50. payment/reciprocal aspects of slaughtering of animals for mortuary practices

Archaeology: Burial associated with animals (1 = present) was recorded in relation to evidence of the inclusion of any part of animal anatomy e.g. bone, tooth, horns, tusk antler or hide (where the biochemical conditions all for the preservation of hide) of (1) hunted large wild game (2) wild or domesticated sheep, goat, pigs or cattle which were interred:

1. It is recorded that the majority of interments have animal bones etc. inclusions

2. The sources state that the inclusion of animal bones etc. are present at the majority of interments or represents the standard or dominant practice at a site phase associate

The inclusion of animal bones with any type of:

3. single complete individual interment (inhumation)
4. single incomplete individual interment (inhumation)
5. group complete interment (inhumation)
6. group incomplete interment (inhumation)
7. comingled interment (inhumation)
8. single cremation interment
9. group cremation interment using urns for each cremation
10. comingled cremation interment
11. the caching of particular animal bones/horns/tooth associated with human remains within the walls, floor or foundation of any building(s).

17. Evidence of special burial treatment

This category is recorded in terms of: 0 = absent, 1 = present. In this study special burial treatment refers to the evidence that a certain practices were reserved for a minority of individuals; a limited/select number of individuals (< 30% of all interments, if provided) or where the excavator states that the treatment was only afforded to a minority of examples. Special burial treatment can relate to a number of factors including, rank, social status vocation/profession, sex and age. This can relate to the:

- Different location of an interment e.g. tomb, plaza, ritual building or monument
- Different orientation of an interment
- Special processing of the body e.g. cremation versus interment
- Position of the body; flexed versus extended
- Single individual interments where group burial is used

- Ornamentation of the burial e.g. personal adornment of the corpse via, e.g., beads or dress
- The inclusion of grave goods where normally there are none present. For example, figurines, beads, weapons, metal or pottery
- Burials associated with animal bone , tusk, antler or hide
- The inclusion of different grave goods compared to other burials
- Different grave furnishing compared to other graves
- Secondary burial practices associated with corpse; practices before or after final interment
- Grave disturbance
- Removal of bone for circulation or relics e.g. long bones or skull plastering/painting
- Specific grave markers associated with special burial treatments
- Specific symbols associated with special burial treatments

eHRAF: For each eHRAF culture, evidence of special burial treatment (1 = present) comes for the examination of 32 criteria in the eHRAF database: Reference to or description of:

1. the use of special burial treatment
2. request for special burial treatment
3. the use of special burial treatment for certain individuals as a non-standard treatment
4. age differences associated with the use of special burial treatment
5. sex differences associated with the use of special burial treatment
6. status differences associated with the use of special burial treatment
7. the occasions when special burial treatment is used
8. the reasons for the use of special burial treatment

9. the individual(s) afforded special burial treatment

10. the group(s) afforded special burial treatment

11. the frequency of special burial treatment

12. location(s) used for special burial treatment

13. orientation of special graves

14. preparation of a corpse or corpses for special burial treatment

15. practices associated with special burial treatment

(a) primary cremation burial practices in in cemeteries or non-cemetery locations

(b) secondary cremation burial practices in in cemeteries or non-cemetery locations

16. grave good associated with special burial treatment(s)

17. ostentatious grave goods

18. Bodily adornment associate with special burial treatment(s)

19. grave furnishing associate with special burial treatment(s)

20. ostentatious graves

21. ostentatious funerals

22. performing practices, rituals, ceremonies and dedications associated with special burial treatment(s)

23. attending practices, rituals, ceremonies and dedications associated with special burial treatment(s)

24. participating in practices, rituals, ceremonies and dedications associated with special burial treatment(s)

25. mythical/religious associations with special burial treatment(s)

26. mythical/religious figures associated with special burial treatment(s)

27. ritual symbols associated with special burial treatment(s)

28. grave markers associated with special burial treatment(s)

29. rules associated with special burial treatment(s)

30. sanctions associated with special burial treatment(s)

31. visiting and re-visiting the location of special burial treatment(s)

32. maintenance of the location(s) of special burial treatment(s)

Archaeology: In the archaeological samples, special burial treatment was recorded when (1) a particular burial practices was recorder as afforded to a select number of individuals identified. However, this is still difficult as a number of the categories could also lead to the identification of deviant burials. For the most part, it is suggested to focus on (1) enhancements to the typical burial practices e.g. bodily adornment, grave goods and (2) Investment in terms of time and labour associated with interments e.g. in communal ritual structures such a megalithic monuments. The recording of special burial treatment relates to the recording of 2 of 18 criteria:

1. Different location of an interment:

- Inside the settlement
- Outside the settlement
- Monument
- Tomb
- Individual grave cut(s)
- Extramural: plaza, square or in-between buildings
- Intramural: Communal building, Communal ritual building, domestic building or isolated building

2. Different type interment

- Monument
- Tomb
- Individual grave cut(s)
- Cist
- Pit

3. Different position of the body

- Flexed
- Extended
- Prone
- Supine

4. Different orientation of an interment

5. Special processing of the body e.g. cremation versus inhumation

6. Ornamentation of the burial via personal adornment of the corpse via, e.g. beads or dress

7. The inclusion of grave goods e.g. figurines, bead , weapons, metal or pottery

8. A group interment with weapons

9. The inclusion of different types grave goods compared to other interments—particularly if evidence indicates exotic/imported good

10. grave furnishing

11. Different grave furnishing compared to other graves

12. Secondary burial practices associated with corpse; practices before or after final interment. involving:

(a) Reopening the grave after burial to retrieve artefacts or bones (post cranial and cranial). The former can be examine via the presence of staining due to the presence of a metal object which is no longer present and the latter can be indicated by absent bones particularly long bones and skull with no evidence of perimortem trauma.

(b) evidence of secondary burial practices where the corpse is de-fleshed naturally before being placed in the grave. This can be indicated by cut marks of bone or the absence of bone due to bones “rolling away” or being scavenged as happens when remain are placed in the open air to naturally de-flesh or all bones not collected properly

13. Evidence of skull caching

14. Evidence of skull painting

15. Evidence of skull painting

16. Interments associated with food via the inclusion:

- of animal bone (domestic and/or wild)
- gathered plant food (wild)
- domestic plant food
- Liquid or resin food (such as honey) indicated by chemical analysis of pottery
- Alcohol, narcotics hallucinogens indicated by archaeobotanical analysis or chemical analysis of pottery

17. Interments with the inclusion of animal bone (domestic and/or wild) as a grave good-decorated or undecorated

18. Specific grave markers associated with particular interments

Social complexity

This section of the database was used to record the evidence of social complexity associated with each eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.4) were used. This section used categories of absence or presence (0 or 1) to record the evidence of social complexity. In addition, levels of community hierarchy and ritual hierarchy were recorded using a Likert scale (0, 1, 2, 3, >3). A total of 17 categories were used to examine the level of social complexity:

1. Evidence of social inequality
2. Degree of sedentism
3. Subsistence strategy variables
4. levels of community hierarchy*
5. Evidence of resource monopolisation
6. Evidence of permanent settlement
7. Evidence of settled forager activity
8. Evidence of nomadic pastoralism
9. Evidence of temporary settlement
10. Evidence of large(r) domestic dwellings
11. Evidence of feasting
12. Evidence of craft specialisation
13. Evidence of pottery
14. Evidence of exchange networks
15. Storage of cultural knowledge
16. levels of religious hierarchy*
17. Evidence of interpersonal violence
18. Evidence of single individual burial

19. Evidence of grave goods

20. Evidence of special burial treatment

21. Evidence of cemeteries

* recorded only for archaeological site-phases

* recorded only for eHRAF cultures

Table 1:4 the eHRAF OCM codes for social complexity/inequality

OCM Code	Description
341	architecture
342	dwellings
346	religious and educational structures
362	housing
560	social stratification
622	community heads
628	inter-community relations
682	offenses against life
683	offenses against the person
631	territorial hierarchy
681	sanctions
764	burial practices
766	special burial practices and funerals
767	mortuary practices
769	cult of the dead

1. Evidence of social inequality: this category is recorded in terms of: 0 = absent, 1 = present.

The evidence of social inequality was assessed by examining:

1. direct mention of social inequality in the written sources (eHRAF)
2. positions of rank in the community (eHRAF)
3. the burial practices; focusing on special burial treatment, single-individual burials, special treatment of the body and the inclusion of burial goods afforded to a minority of the group
4. domestic architecture; to examine if domestic architectural (size and design) differences related to social inequality
5. resource monopolization

The presence of these criteria (outlined below) was used to examine and establish if there is evidence of social equality in each eHRAF cultures or the archaeological site-phase. The identification of any one of these criteria in the eHRAF cultures or the archaeological site-phases is used to record social inequality as present.

2. Degree of sedentism: (0, 1, 2) (0= no sedentism, 1= moderate sedentism/ Semi-sedentary, 2= fully sedentary communities

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General* section above

3. Subsistence strategy:

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *subsistence* section above for:

- **Evidence of hunting**: This category is recorded in terms of: 0 = absent, 1 = present
- **Evidence of gathering**: This category is recorded in terms of: 0 = absent, 1 = present

- **Evidence of animal domestication**: This category is recorded in terms of: 0 = absent, 1 = present
- **Evidence of crop cultivation/agriculture**: This category is recorded in terms of: 0 = absent, 1 = present
- **Evidence of animal domestication intensity**: this category is recorded in terms of a likert scale: 0, 1, 2 with 0 = no evidence of animal domestication, 1 = some domestication, including sheep, goats and pigs and 2 = full domestication including, cattle.
- **crop cultivation intensity**: this category is recorded in terms of a likert scale: 0, 1, 2 with 0 = no evidence of cultivation, 1 = cultivation of non-staples and 2 = intensive cultivation/agriculture with domesticated staples.
- **Evidence and type of Food storage strategy**: this category is recorded in terms of a likert scale: 0, 1, 2, 3; with 0 = no storage strategy, 1 = daily, 2 = monthly, 3 = seasonal/year.

4. levels of community hierarchy: the levels of community hierarchy and ritual hierarchy were recorded using a Likert scale: 0, 1, 2, 3, >3 *

The number of tiers of community hierarchy: is recorded to assess how hierarchically structure each eHRAF culture was (is). It is generally asserted that the greater the number of tiers of community hierarchy the more complex the society—particularly, when the hierarchical structure extends beyond the initial community. The use of the term structures refers to aspects such as a form of legal system and or members of a community or society who enforce certain codes (e.g. ruling council of a police force). For the purpose of this research, scoring for societal tiers of hierarchy was as follows:

0: relates to hierarch/management via household head only

1: relates to a low level of hierarch/management (household and community leaders)

2: reflects a medium level of hierarch/management (household, community and regional leaders and structures)

>3: represent a high level of hierarchy/management (household, community, regional and state leaders and structures)

eHRAF: these are determined from the recording of any criteria relating directly to the levels of community hierarchy, in the eHRAF database:

Reference to or description of:

1. dedicated household leaders
2. dedicated kin leaders
3. dedicated tribal leaders
4. the hierarchical community structure
5. dedicated community leaders
6. community organisation
7. community officials
8. community meetings (council)
9. the hierarchical regional structure
10. dedicated regional leaders
11. regional organisation
12. regional officials
13. regional meetings (council or parliament)
14. the hierarchical supra-regional structure
15. dedicated supra-regional leaders
16. supra-regional organisation

17. supra-regional officials
18. supra-regional meetings (council or parliament)
19. manner of election to roles (community, regional or supra-regional)
20. manner of appointment to roles (community, regional or supra-regional)
21. lineage/inherited roles (i.e. community role via father to son)
22. making/deciding on rules and regulations
23. levels of representation (community, regional or supra-regional)
24. imposing rules and regulations
25. legal system
26. enforcement of rules and regulations
27. levels of sanctions (community, regional or supra-regional)
28. retribution (community, regional or supra-regional)
29. Punishment (community, regional or supra-regional).

5. Evidence of resource monopolisation: this category is recorded in terms of: 0 = absent, 1 = present.

Evidence of resource monopolisation relates to the control of food, territory or vital resources by an individual, a kin group, or select members of a group. This is exemplified by land or resource ownership and controlling the storage and distribution of resources. The presence of resource monopolisation can inform us about the (1) hierarchical organisation of the group; (2) the control and distribution system in a group; (3) the groups' economic system and (4) social inequality

eHRAF: For each eHRAF culture, evidence of resource monopolization occurring in the group comes for the examination of 33 criteria in the eHRAF database: Reference to or description of:

1. Resource monopolization occurring in the group

2. Unequal sharing of resources

3. Organised food storage:

- In a particular larger domestic setting
- In a particular secular communal building where the storage as distribution is controlled by group agents or an organisation
- In a particular religious communal building where the storage as distribution is controlled by religious leader(s)

4. Ownership of a substantial amount land ownership by:

- an individual,
- a kin group,
- select members of a group

5. Ownership of a high percentage of the domesticated animals by:

- an individual,
- a kin group,
- select members of a group

6. Control of a river or lake for fishing by:

- an individual,
- a kin group,
- select members of a group

7. Control of an important natural resource such as a water spring by:

- an individual,
- a kin group,
- select members of a group

8. Control of hunting territory by:

- an individual,
- a kin group,
- select members of a group

9. Control of a gathering territory by:

- an individual,
- a kin group,
- select members of a group

10. Competition for resources

11. Bidding for resources

12. Payment for resources

13. The paying of rent for land

14. Renting or sub-letting land

- Renting or sub-letting land for domestic purposes (dwelling renting)
- Renting or sub-letting land for commercial purposes (workshop etc.)
- Renting or sub-letting land for storage purposes
- Renting or sub-letting storage facilities
- Renting or sub-letting land for crops
- Renting or sub-letting land for animal husbandry
- In-group conflict over the control of resources

15. Inheritance of ownership of resources

16. Organised distribution of land

17. Organised distribution of resources

18. The sectioning-off/protection of resources via fences (wire wooded etc..), walls or trenches

19. Animal penning in a certain location

20. Private property

21. Land disputes

22. Disputes related to the control of resources

23. Conflict between individuals over the control of resources

24. In-group conflict over the control of resources

25. Between-group conflict over the control of resources

26. Rules related to the control of resources

27. Sanctions related to the control of resources

28. Taxes and tariffs related to the control of resources

29. Accounting system related to the control of resources

30. Laws related to the control of resources

31. Judgements related to the control of resources

32. Settling disputes related to the control of resources

33. Payment for resources

Archaeology: Evidence of resource monopolisation relates to the control of food or territory by a member or members of a group at each site-phase. Although resource monopolization could relate to a number of natural resources or produced items, it was decided to focus on land and food. Thus, this section is used to examine and record the control of food resources via "ownership" and storage connected with what appear to be larger domestic dwellings (larger domestic dwellings category outlines in no 8 of this section) to inform us about resource monopolisation.

For the archaeological site-phases evidence of resource monopolisation (1 = present) is recorded form the available sources that identify and record of one of the ownership and the storage criteria:

Ownership

1. The dividing up of the cultivated land via systems of walls, fences, palisades or ditched associated with the settlement

2. Evidence of animal penning associated with the settlement

3. Walls used to section of area of cultivation associated with a dwelling(s)

4. Fences/palisades used to section of area of cultivation associated with a building(s)

5. Ditches used to section of area of cultivation associated with a dwelling(s)

6. Animal penning via associated with a domestic building(s)

7. Walls used to section of area of cultivation associated with a domestic dwelling(s)

8. Fences/palisades used to section of area of cultivation associated with a domestic building(s)

9. Ditches used to section of area of cultivation associated with a domestic dwelling(s)

10. Animal penning via associated with a domestic building(s)

Food storage

1. The domestic storage of a surplus amount of food. Surplus indicating more food that would be required for the estimated habitants of such a dwelling

2. smoking, curing or drying of a large amount of meat or fish associated with domestic dwelling(s)

3. storage of excess food in a domestic setting via:

- pottery
- hermetically sealed pottery
- granary,
- grain bin
- silo
- additional storage house

4. Larger domestic dwelling(s) associated with surplus food storage via large amount of stored or charred seeds or grains in niches, pottery, baskets or grain bins (processed and unprocessed)

5. larger domestic dwelling(s) associated with the storage of animal remains via large amount of stored or charred animal bones with indication of butchering

6. Secure storage area for surplus food; located in the inner section of house or under the floor

7. Larger domestic dwelling(s) associated with cooking food storage via large amount of charred seeds

8. Larger domestic dwelling(s) associated with the cooking of animal remains via large charred animal bones with indication of butchering

9. Evidence of feasting associated with a domestic dwelling(s)

6. Evidence of permanent settlement: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: In the eHRAF database each culture is classified as evidence of permanent settlement come from (1) the description of groups as settled and/or sedentary; (2) the description of permanent structures for domestic, ritual and community purposes; (3) the description of groups as engaging in intensive agriculture including domesticated croups or animals; and (4) the description of groups as engaging in a long-term food storage strategy at one location involving storehouses and silos. Therefore, evidence of permanent settlement is recorded form the available sources that identify and record the subsistence strategy, agricultural intensity, storage practices, settlement plan and mobility patterns for each culture.

Archaeology: for the archaeological site-phases, the evidence of permanent settlement is recorded form the available sources in relation to the identification/recording of 4 of 37 material culture criteria:

1. No occupation of natural shelters via low amount of artifacts, single heath and lithic scatter and no evidence of camp construction

2. Evidence of permanent occupation with via high amount of artifacts, heaths and lithic scatter

3. Dedicated areas of crop cultivations; larger than garden

4. Dedicated areas for domesticated animals; penning area(s)

5. Evidence of domesticated stables e.g. wheat or corn

6. evidence of domesticated animals—particularly, cattle

7. Community focused on a smaller number of resources; e.g particular crops

8. Evidence of long-term food storage strategy via pottery, store rooms, cists, granaries or silos

9. Evidence of long-term domestic food storage strategy via pottery, store rooms, cists, granaries or grain bin and the drying, curing or smoking of protein source

10. Evidence of long-term community food stores via pottery, store rooms, cists, granaries or silos and the drying, curing or smoking of protein source

11. Evidence of processing of domesticated resources (plants)

12. Evidence of secondary produce from domesticated animals e.g. milk use via study of residues in pottery

13. Evidence of processing of domesticated resources (animals)

14. Evidence of long-term occupation with via high amount of artifacts, heaths and lithic scatter

15. Evidence of processing of domesticated resources (plants and animals)

16. Evidence of more complex, elaborate technology e.g. water or wind technology

17. Large amount of artifacts due to:

- period of occupation of site
- reflects that all activates are carried out at site
- Accumulation of personal possessions

18. Craft specialisation for example, stone tools, pottery and other artifacts

19. Evidence of site divisions that reflect craft specialisation for example, stone tools, pottery and other artifacts

20. Evidence of difficult to transport artifacts; large and heavy

21. Construction of permanent monuments, ceremonial structures

22. Construction of community structures e.g. store rooms or meeting houses

23. Nucleated settlement pattern

24. Structures rectangular in plan

25. Structures rectangular in plan allowing for or with augmentation

26. Locally sourced transported material used in construction

27. Definite foundations and modification of ground surface for construction

28. Landscape altered for domestic or monumental construction of

29. Construction may include: wattle and daub, use of mud or other types of bricks

30. Roof and sides are often different material e.g. thatched roof and wooden or mud brick walls

31. Evidence of social or political hierarchy reflected in larger domestic buildings and special burials (grave goods etc.)

32. Uniform burial practices

33. Dedicated burial area

34. Foci such as square or plaza

35. Long-term labour investment in domestic structures:

- Maintenance and Renovation e.g. plastering, repainting or reroofing

36. Long-term labour investment in communal structures:

- Large amount of people (team; some with different skills) require for construction
- Large amount of time require for construction
- Maintenance and renovation e.g. plastering, repainting or reroofing

37. Presence of mouse (*mus musculus*) bones, indicative of sedentary groups

7. Evidence of temporary settlement: this category is recorded in terms of: 0 = absent, 1 = present.

eHRAF: In the eHRAF database each culture is classified as representing temporary settlement from (1) the description of groups as mobile, semi-mobile or nomadic; (2) the description of temporary structures for domestic, ritual and community purposes; (3) the description of groups as engaging in mobile hunting-gathering as primary food source or nomadic pastoralists; and (4) the description of groups as engaging in a more short-term food storage strategy involving consuming relatively soon after hunting, gathering or slaughtering mobile livestock. Therefore, evidence of temporary settlement is recorded form the available sources that identify and record the subsistence strategy, storage practices, settlement plan and mobility patterns for each culture.

Archaeology: for the archaeological site-phases, the evidence of temporary settlement is recorded form the available sources in relation to the identification/recording of 4 of 34 material culture criteria

1. Evidence of diet supplemented by hunting
2. Evidence of diet supplemented by gathering
3. Group focused on a large number of resources; e.g. particular crops

• Stable isotope evidence indicates use of varied plant food sources or indicates both terrestrial and marine diet elements

4. Evidence of garden cultivation
5. Evidence of domesticated plants but not necessarily stables
6. Evidence of domesticated animals such a sheep and goat but not cattle
7. Evidence of diet supplemented by seasonally available wild resources

8. Evidence of processing of wild resources

9. Evidence of seasonal use of resources e.g. seasonal wild plants, summer fish caching, young animal bones indicting winter slaughtering.

10. No large scale community food stores e.g. store rooms, granaries or silos

11. Settlement located near a critical resource e.g. water source

12. No dedicated areas of crop cultivations; larger than garden

13. No dedicated areas for domesticated animals; penning area(s)

14. No evidence of domesticated stables e.g. wheat or corn

15. No evidence of domesticated animals—particularly, cattle

16. No evidence of long-term domestic food storage strategy via pottery, store rooms, cists, granaries or grain bin and the drying, curing or smoking of protein source

17. No evidence of long-term community food stores via pottery, store rooms, cists, granaries or silos and the drying, curing or smoking of protein source

18. No evidence of more complex, elaborate technology e.g. water or wind technology

19. Evidence of low occupation field camp via low amount of artifacts, single heath and lithic scatter

20. Evidence of occupation of natural shelters via low amount of artifacts, single heath and lithic scatter and no evidence of camp construction

21. Structures mainly circular and semi-circular in plan

22. Generally locally sourced material used in construction rather than transported material

23. Little evidence of foundation and modification of ground surface; often only modification to ground surface maybe circular or semi-circular pots holes

24. Construction may include: brush and stick frame, local vegetation, and, occasionally, some wattle and daub elements.

25. No use of mud or other types of bricks

26. some craft specialisation for example, stone tools, pottery and other artifacts

27. No evidence of site divisions that reflect craft specialisation for example, stone tools, pottery and other artifacts

28. No evidence of difficult to transport artifacts; large and heavy

29. No construction of permanent monuments, ceremonial structures

30. No nucleated settlement pattern

31. No alteration of the landscape for domestic, community or monumental construction

32. No evidence of social or political hierarchy reflected in larger domestic buildings and special burials (grave goods etc.)

33. No long-term labour investment in domestic structures:

- Maintenance and Renovation e.g. plastering, repainting or reroofing

34. No long -term labour investment in communal structures:

- Large amount of people (team) require for construction
- Large amount of time require for construction
- Maintenance and renovation e.g. plastering, repainting or reroofing
- No dedicated burial area

8. Evidence of settled forager activity

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *Subsistence practices s*ection above

9. Evidence of nomadic pastoralism

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *Subsistence practices s*ection above

10. Evidence of large(r) domestic dwellings: this category is recorded in terms of: 0 = absent, 1 = present.

This category is used to record evidence of large(r) domestic dwelling(s) in the eHRAF dataset and at each archaeological site-phase. The presence of large(r) domestic dwelling(s) is associated with (1) hierarchical organisation of the group; (2) social inequality; (3) resource monopolization via storage and/or control of distribution. These dwelling(s) can range from slightly larger huts for a group elder or opulently decorated domestic dwelling(s) for regional leader.

eHRAF: For each eHRAF culture, evidence of large(r) domestic dwelling(s) is indicated by the examination of 35 criteria relating directly to the presence of communal buildings, in the eHRAF database: Reference to or description of:

1. presence of large(r) domestic dwelling(s)
2. design of large(r) domestic dwelling(s)(structural)
3. large foundation work involving heavy manipulation of ground surface
4. architecture of large(r) domestic dwelling(s) (structural)
5. construction of large(r) domestic dwelling(s)
6. Labour in terms of time for construction
7. Labour in terms of the number of people for construction
8. Labour in terms of the different craft specialists
9. interior design of large(r) domestic dwelling(s)(ostentations)
10. interior architecture of large(r) domestic dwelling(s) (ostentations)
11. decoration of large(r) domestic dwelling(s) (ostentations)
12. comparative size of large(r) domestic dwelling(s)
13. courtyard of large(r) domestic dwelling(s)
14. Garden of large(r) domestic dwelling(s)
15. walls of large(r) domestic dwelling(s)
16. gates of large(r) domestic dwelling(s)

17. the ownership of large(r) domestic dwelling(s)
18. the location of large(r) domestic dwelling(s)
19. water source for large(r) domestic dwelling(s)
20. sanitation for large(r) domestic dwelling(s)
21. position of fire place or hearth in large(r) domestic dwelling(s)
22. organisation of events at large(r) domestic dwelling(s)
23. events attended at large(r) domestic dwelling(s)
24. the convening of secular gatherings at large(r) domestic dwelling(s)
25. secular gatherings attended at large(r) domestic dwelling(s)
26. the convening of ceremonial gatherings at large(r) domestic dwelling(s)
27. ceremonial gatherings attended at large(r) domestic dwelling(s)
28. storage of materials at large(r) domestic dwelling(s)
29. processing of food at large(r) domestic dwelling(s)
30. partaking in the processing of food at large(r) domestic dwelling(s)
31. supervision of the processing of food at large(r) domestic dwelling(s)
32. storage of food at large(r) domestic dwelling(s)
33. partaking in the storage of food at large(r) domestic dwelling(s)
34. supervision of the storage of food at large(r) domestic dwelling(s)
35. position of the storage of food area in large(r) domestic dwelling(s)

Archaeology: Although this is difficult to determine in archaeological contexts. This category was employed as a possible way to examine social inequality in the archaeological record.

This section is for the recording of buildings that are larger than the typical domestic building at a site-phase but are considered to be domestic due to (1) non-ritual associations; (2) not large enough for community building; and (3) not considered a production workshop for pottery, tools etc. In general, these are identified in the archaeological record by the presence of:

- large domestic buildings that are considered well-crafted structures
- large domestic buildings with a high number of decorative artefacts such as decorated pottery or figurines
- large domestic buildings with evidence of the domestic storage of a surplus amount of food, domestic
- large domestic buildings with evidence of courtyards and segregation via walls or fences were examined

Large in this case refers to buildings that are bigger that the typical domestic buildings at the site. For the archaeological site-phases the evidence of communal structures (1 = present) is recorded form the available sources that identify and record of 3 of 27 material culture criteria. Recording of:

1. presence of large(r) domestic dwelling(s) compared to other domestic buildings by area (m2)
2. large(r) domestic dwelling(s) requiring substantial labour investment in terms of time for construction
3. large(r) domestic dwelling(s) requiring substantial labour investment in terms of the number of people for construction
4. large foundation work involving heavy manipulation of ground surface
5. use of mud-brick or stone for wall construction
6. evidence of high quality craft work; stone or wood work
7. evidence of different craft specialists to construct large(r) domestic dwelling(s)
8. interior design of large(r) domestic dwelling(s)(ostentations)
9. interior architecture of large(r) domestic dwelling(s) (ostentations)
10. decoration of large(r) domestic dwelling(s) (ostentations)
11. courtyard of large(r) domestic dwelling(s)
12. garden of large(r) domestic dwelling(s)

13. distinctive divisional feature compared to other buildings

- Walls
- Court yard

14. Different material used for roof and sides

15. large(r) domestic dwelling(s) associated with the presence of high craft goods such as pottery or basket, figurines

16. large(r) domestic dwelling(s) associated with decorative pottery

17. large(r) domestic dwelling(s) associated with decorative wall installations (e.g. carvings or painted features)

18. large(r) domestic dwelling(s) associated with decorative anthropomorphic figurines

19. large(r) domestic dwelling(s) associated with decorative zoomorphic figurines

20. large(r) domestic dwelling(s) associated with surplus food storage via large amount of stored or charred seeds or grains in niches, pottery, baskets or grain bins (process and unprocessed)

21. large(r) domestic dwelling(s) associated with the storage of animal remains via large amount of stored or charred animal bones with indication of butchering

22. Secure storage area for food; located in the inner section of house or under the floor

23. large(r) domestic dwelling(s) associated with cooking food storage via large amount of charred seeds and inner hearth

24. large(r) domestic dwelling(s) associated with the cooking of animal remains via large charred animal bones with indication of butchering and inner hearth

25. large(r) domestic dwelling(s) not associated burial(s)

26. evidence of luxury items such as pottery or figurines from another region

27. similar buildings at other site-phases in the region. This is used to consider a shared belief or ritual practices across a number of sites which may be indicative of ritual standardisations.

11. Evidence of feasting: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General ritual/religious characteristics* section abov

12. Evidence of craft specialisation: this category is recorded in terms of: 0 = absent, 1 = present. This category related to the recording of different crafts/trades. This includes:

1. artisan crafts such as bead, pottery, leather, basket production and woodworking
2. weapon production
3. larger projects involving a number of crafts e.g. boat building and construction

eHRAF: For each eHRAF culture, evidence of craft specialisation in the group comes for the examination of 33 criteria in the eHRAF database: Reference to or description of:

1. a workshop or workshops
2. description of different trades
3. trade guilds and organisations
4. training/practicing and apprenticeships
5. duties of apprentice
6. duration of training
7. training/educational facilities
8. Organised production of pottery, weapons, and baskets etc.:

- In a particular non-domestic setting (area in the group territory)
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

9. Storage of raw/basic material such as clay or stone, reeds, minerals, ores, etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

10. Storage of large amount of unfinished of pottery, figurines, glass, beads, weapons, metal ingots tool blanks and baskets etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

11. storage of large amount of finished pottery, figurines, glass, beads, weapons, and baskets etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

12. Displaying of finished pottery, figurines, glass, beads, weapons and baskets etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building

- In a particular religious communal building

13. distribution of pottery, figurines, glass, beads,, weapons, and baskets etc.:

- from a particular non-domestic setting
- from a particular domestic setting
- from a particular secular building where the storage and distribution is controlled by group agents or an organisation
- from a particular religious communal building where the storage as distribution is controlled by religious leader(s)

14. Evidence of a furnace or heat source for production
15. Description of smelting for metal production
16. Description of a pottery wheel
17. description of a drying kiln
18. Descriptions of wood turning
19. Sale of pottery, weapons, and baskets etc.
20. Exchange of pottery, weapons, and baskets etc.
21. Uses of pottery, weapons, and baskets etc.
22. Requirement for pottery, weapons, and baskets etc.
23. Area of a domestic building(s) associated with craft such as tool productions
24. Spoil heap or dumping area associated with craft such as tool productions
25. pottery, weapons, and baskets at market
26. Bidding for pottery, weapons, and baskets etc.
27. Exchange for pottery, weapons, and baskets etc.
28. Payment for pottery, weapons, and baskets etc.
29. Fishing requiring specific types of boats
30. Domestic construction projects involving different crafts/trades
31. Communal construction projects involving different crafts/trades
32. Regional construction projects involving different crafts/trades

33. Payment of craft specialist

Archaeology: For the archaeological site-phases evidence of craft specialization (1 = present) is recorded form the available sources that identify and record of 2 of 12 material culture criteria relating to evidence of craft specialization:

1. Storage of raw/basic material such as clay or stone, reeds, minerals etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

2. Storage/caching of large amount of unfinished of pottery, figurines, glass, beads, weapons, tool blanks and baskets etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

3. Storage/caching of large amount of finished pottery, figurines, glass, beads, weapons and baskets etc.

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

4. Area of a settlement associated with craft such as tool productions via, for example, scattering of stone blanks or debitage

5. Area of a building(s) associated with craft such as tool productions via, for example, scattering of stone blanks or debitage

6. Stone or bone scrapers for hides/skin

7. Bone awls and bone and antler needles and awls and points for hides/skin

8. Spoil heap or dumping area associated with craft such as tool productions

9. Discovery of boats indicating boat carpentry

10. Domestic construction projects involving different crafts/trades: For example different material for sides and roof e.g. stonemasonry and carpentry

11. Specialised architectural features

12. Communal construction projects involving different crafts/trades (as above)

13. Evidence of pottery :

This category is recorded in terms of: 0 = absent, 1 = present.

Pottery was included in the social complexity category as pottery:

1. it is a defining feature of the Neolithic transition enabling us to track the trajectory of the Neolithic transition

2. indicates a technical innovation that is directly associated with the Neolithic transition

3. it indicates the development of an organised storage system be it food or other aspects of material.

4. the presence of pottery enables us to examine aspects of craft specialization, food storage strategy, private food storage, resource monopolization (social inequality), exchange networks and possible storage of cultural knowledge.

The presence of pottery at a site can be as a result of production by the group or exchange with groups that have pottery technology.

eHRAF: For each eHRAF culture, evidence of pottery in the group comes for the examination of 36 criteria in the eHRAF database: Reference to or description of:

1. Pottery workshop or workshops

2. Trade guilds and organisations associated with pottery production

3. Training/practicing and apprenticeships associated with pottery production

4. Duties of apprentice associated with pottery production

5. Duration of training associated with pottery production

6. Training/educational facilities associated with pottery production

7. Organised production of pottery

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

8. Storage of raw material (clay):

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

9. Storage of large amount of unfinished of pottery:

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

10. Storage of large amount of pottery:

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

11. Displaying of pottery:

- In a particular non-domestic setting
- In a particular domestic setting

- In a particular secular building
- In a particular religious communal building

12. Distribution of pottery:

- From a particular non-domestic setting
- From a particular domestic setting
- From a particular secular building where the storage and distribution is controlled by group agents or an organisation
- From a particular religious communal building where the storage as distribution is controlled by religious leader(s)

13. Evidence heat source for production of pottery
14. Description of a pottery wheel
15. Description of drying kiln
16. Different pottery designs; pot shape and size
17. Sealed pottery
18. Unsealed pottery
19. Different designs on the pottery
20. descriptions of glazing
21. Spoil heap or dumping area associated with pottery production
22. Sale of pottery
23. Exchange of pottery between individuals
24. Items exchanged for pottery between individuals
25. Exchange of pottery between groups
26. Items exchanged for pottery between groups
27. Exchange of pottery technology between individuals
28. Exchange of pottery technology between groups
29. Uses of pottery for storage of food
30. Storage of liquid in pottery e.g. water or wine

31. Uses of pottery for storage of non-food items
32. Request for pottery
33. Commissioning of pottery
34. Patronage of pottery production
35. Bidding for pottery
36. Pottery at markets
37. Payment for pottery
38. Domestic use of pottery
39. Secular use of pottery
40. Ritual/religious use of pottery
41. Burial ceremonies involving pottery

Archaeology: For the archaeological site-phases evidence of pottery (1 = present) relates to

1. Evidence of pottery at a site-phase
2. Evidence of the production of pottery
3. Evidence of the use of pottery for storage og food and non-food resources
4. Evidence of the use of pottery in ritual/religious practices

The presence of pottery is recorded form the available sources that identify and record of 2 of 19 material culture criteria:

1. Evidence of pottery at a site-phase
2. The presence of raw material (clay):

- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building

3. The presence of unfinished of pottery:

- At the site-phase
- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building
- Associated with the interment of human remains

4. The presence of finished pottery:

- At the site-phase
- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building
- Associated with the interment of human remains

5. The presence of broken of pottery:

- At the site-phase
- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building
- Associated with the interment of human remains

6. The use of pottery for food storage—indicated by preservation (e.g. hermetically sealed pottery charred remains or residues:

- At the site-phase
- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building

- In a particular religious communal building
- Associated with the interment of human remains

7. The use of pottery for non-food storage:

- At the site-phase
- In a particular non-domestic setting
- In a particular domestic setting
- In a particular secular building
- In a particular religious communal building
- Associated with the interment of human remains

8. spoil heap or dumping area associated with pottery production
9. Evidence of exchange of pottery between groups via stylistic differences

14. Evidence of exchange networks: this category is recorded in terms of: 0 = absent, 1 = present. This section is used to examine the level of connectedness between the group being recorded and other groups through the exchange of information, technology and material among groups, or institutions. This section focuses on the exchange (transmission and receiving) of:

- Information (secular and religious)
- Technology
- Resources
- Raw materials
- Commodities
- weapons
- Gifts

eHRAF: For each eHRAF culture, evidence in the group comes for the examination of 30 criteria in the eHRAF database: Reference to or description of:

1. Exchange networks described in the sources
2. Reliance/inter-dependence between groups via exchange
3. Geographic distribution of exchanged items
4. Regional influence of a particular group
5. Exchange of:

- knowledge
- technology
- resources
- raw materials
- commodities
- weapons
- food
- gifts

6. Selling of:

- knowledge
- technology
- resources
- raw materials
- commodities
- weapons
- food
- gifts

7. Transport of:

- technology
- resources
- raw materials
- commodities

- weapons
- food
- gifts

8. Delivery of:

- technology
- resources
- raw materials
- commodities
- weapons
- food
- gifts

9. Receiving/buying:

- knowledge
- technology
- resources
- raw materials
- commodities
- weapons
- food
- gifts

10. Distribution/dissemination of exchanged (new):

- knowledge
- technology
- resources
- raw materials
- commodities

- weapons
- food
- gifts

11. Formal instruction on new technology or knowledge
12. Informal instruction on new technology or knowledge
13. Arranged exchange between groups
14. Payment for exchange
15. Reciprocal exchange
16. Alliance exchanges; for the purpose of defence/conflict
17. Control of exchange
18. Exchange taxes and tariffs
19. Accounting systems and/or records associated with exchange
20. Rules and regulations of exchange
21. Enforcement of rules and regulations of exchange
22. Formal contracts associated with exchange
23. Social contracts associated with exchange
24. Arbitration associated with exchange
25. Returning of exchanged items
26. Markets associated with exchange
27. Exchange routes
28. People associated with exchange
29. Warehouses associated with exchange
30. Ports or docks associated with exchange

Archaeology: Although, it is possible that the presence of non-local material culture or natural resources at a site-phase may indicates trade or exchange, this was not used in relation to the archaeological samples as this evidence could relate to the

spoils of war or raiding. For the archaeological site-phases evidence of exchange networks (1 = present) relates to the recording of:

(1) shared aspects of material culture between site-phases in a regional or supra-regional context In this sense we are looking at shared material culture that can be examined typological/stylistically to demonstrate connectedness or a network associated with exchange or trade, i.e.:

- Technology e.g. farming techniques or water technology
- Architecture
- Commodities: pottery etc.
- Weapons
- Ritual/religious items
- Ritual/religious practices

The recording of exchange networks can be examine

1. where previous network analysis has been undertaken in a region
2. where analysis of artefacts demonstrates increasing geochemical diversity in a material (e.g. obsidian) and an increasing density of non-local beads, indicating increased and geographically wider trading activities through time
3. Where there is evidence that material culture and practices are shared between sites

The evidence for exchange networks relates tom the identification of 4 of 28 criteria:

1. Similar buildings at other site-phases in the region or in larger geographical area
2. Similar exterior architecture of domestic dwelling(s)
3. Similar interior architecture of domestic dwelling(s))
4. Similar decoration of domestic dwelling(s) (ostentations)

5. Similar exterior architecture of communal buildings(s)

6. Similar interior architecture of communal buildings(s)

7. Similar decoration of communal buildings(s) (ostentations)

8. Similar exterior architecture of communal ritual buildings(s)

9. Similar interior architecture of communal ritual buildings(s)

10. Similar decoration of communal ritual buildings(s) (ostentations)

11. Similar of symbols associated with communal ritual buildings(s) (ostentations)

12. Similar artefacts associated with communal ritual buildings(s) (ostentations) this includes caching or presence of figurines or decoded pottery etc.

13. Similar architecture of communal monuments buildings(s); this includes totems, megaliths, barrows and henges etc.

14. Similar of symbols associated with communal monuments

15. Similar artefacts associated with communal monuments this includes caching or presence of figurines or decoded pottery etc.

16. Stylistic similarities in relation to pottery including:

- Shape
- Decoration
- Designs on the pottery

17. Stylistic similarities in relation to weapons including:

- The materials used
- Shape
- Decoration
- Designs on the weapon

18. Similar burial/interment practice at other site-phases in the region or in larger geographical area:

- Similar location of burials/interments associated with burial/interment location
- Similar orientation of burials/interments associated with a particular burial/interment location
- Similar interment type associated with a particular burial/interment location:
  - grave cuts in the ground,
  - cists,
  - urns
  - barrow(s),
  - burial mound(s)
  - interment in a monument/tomb e.g. megalithic tomb(s)

19. Similar burial/interment of the body associated with a particular location:

- Flexed inhumation
- Extended inhumation
- Articulated
- Disarticulated
- Single inhumation burial/interment
- Group inhumation burial/interment
- Level of completeness of inhumation
- Single Cremation
- Comingled cremation
- Level of completeness of cremations

20. Similar of grave goods associated with a particular burial/interment location. Including:

- beads
- weapons

- pottery
- utilitarian object
- carved stones
- human bone relics
- animal bone

21. Similar of bodily adornment associated with a particular burial/interment location.

22. Similar of primary burial practice in a particular location

23. Similar of secondary burial practice in a particular location. Including

24. repetition/diffusion/standardisation of design associated with a particular burial/interment location

25. Similar architecture associated with a particular burial/interment location

26. Similar ritual symbols associated with a particular burial/interment location

27. Similar grave markers used at a particular burial/interment location

28. Evidence of a port that is associated with exchange. i.e. a ship wreck with material for export or import

15. Storage of cultural knowledge: this category is recorded in terms of: 0 = absent, 1 = present.

The storage of cultural knowledge refers to direct actions to externally maintain or store cultural knowledge; knowledge that is stored, normally, for the purposes of preserving and transmitting. This relates to the storage of information relating to group history, mythology, beliefs, social practices, ritual/religious practices and technology. This category can range from the storage of historic or cultic objects in a home to curation in a formal setting such as a museum or educational institute to organised educational systems. This section is used to record the evidence of an attempt to actively store cultural knowledge.

eHRAF: For each eHRAF culture, evidence in the group comes for the examination of 35 criteria in the eHRAF database: Reference to or description of:

1. libraries
2. museums
3. communal buildings for display
4. communal buildings cultural events
5. re-enactments and reconstructions
6. oral tradition re storage and dissemination of history, music, myths and practices
7. community historian
8. community storyteller
9. community bard
10. formal education systems
11. places of education
12. apprenticeships
13. religious educational/instruction centres
14. subjects covered in educational system
15. length of time in educational system
16. start of education
17. end of education
18. formal educations
19. informal education
20. standards of education
21. inspection of education
22. writing system
23. secular system of characters/depictions
24. secular system of characters/depictions

25. books, parchment etc.

26. maps

27. carving and engraving

28. sculpting and art

29. depictions or inscriptions relating to history, myths or beliefs in public areas e.g. plaques, cenotaphs, monuments, tombs or tapestries

30. depictions, inscriptions or writing relating to history, myths or beliefs in domestic settings e.g. in books, parchment, on pottery or tapestries

31. educators/teachers/instructors

32. formal dissemination of group history

33. formal dissemination of group myths

34. formal dissemination of group beliefs

35. religious education/instruction

36. rites of passage associated with receiving knowledge

Archaeology: For the archaeological site-phases evidence of the storage of cultural knowledge (1 = present) relates to the recording of 3 of 21 criteria:

1. Storage or caching of figurines at communal building(s)

2. Storage or caching of decorated pottery at communal building(s)

3. Use of wall painting at communal building(s)

4. Use of at wall carvings/reliefs at communal building(s)

5. Repeated use of symbols at communal building(s)

6. Storage or caching of figurines at communal ritual building(s)

7. Storage or caching of decorated pottery at communal ritual building(s)

8. Use of wall painting at a communal ritual building(s)

9. Use of at wall carvings/reliefs at communal ritual building(s)

10. Repeated use of symbols at communal ritual building(s)

11. The presence of megalith(s)

12. Use of wall painting at megaliths
13. Use of at wall carvings/reliefs at megaliths
14. Repeated use of symbols at megaliths
15. The presence of henge(s)
16. Use of wall painting at henge(s)
17. Use of at wall carvings/reliefs at henge(s)
18. Repeated use of symbols at henge(s)
19. The presence of totems
20. Use of at wall carvings/reliefs at a number of grave markers
21. Repeated use of symbols associated with grave markers

16. levels of religious hierarchy: this category is recorded in terms of a likert scale: 0, 1, 2, 3, >3 *

For the eHRAF cultures the evidence for the purpose of recording are outlined in the *General ritual/religious characteristics* section above

17. Evidence of interpersonal violence: this category is recorded in terms of: 0 = absent, 1 = present

This section is used to examine the evidence of interpersonal violence within a group and between the groups. Interpersonal violence is taken as the deliberate use of physical force against an individual, group or community that results in or has a high probability of resulting in physical injury, death or psychological trauma.

eHRAF: For each eHRAF culture, evidence in the group comes for the examination of 36 criteria in the eHRAF database: Reference to or description of:

1. Interpersonal violence
2. Attacks on individuals

3. Attacks by individuals

4. Warriors or army

5. Taking part in attack or conflict

6. Volunteering for conflict

7. Conscription

8. Attacks on groups

9. Attacks by groups

10. Episodes of conflict

11. Types and reasons for conflict:

- Conflict within groups
- Conflicts between groups
- Conflict for resources
- Conflict for prestige
- Conflict for revenge

1. Preparing for conflict people e.g. training

2. Preparing for attack or conflict weapons and resources (logistics)

3. Fortifications

4. Types of Weapons

5. Weapon production

6. Weapon training

7. Issuing and distribution of weapons

8. Destruction and violence as a result of attack or conflict

9. Destruction of property during attack or conflict e.g. burning

10. Trophies or tokens from attack or conflict (material and resources including slaves)

11. Trophies or tokens from attack or conflict (e.g. head taking)

12. Spoils of attack or conflict

13. Wounds and physical trauma as a result of attack or conflict
14. Treatment of wounds trauma as a result of attack or conflict
15. Disability as a result of attack or conflict
16. Victims or dead following attack or conflict
17. Death following attack or attack or conflict
18. Retrieving or repatriation of dead following attack or conflict
19. Ceremonies associated with the dead following attack or conflict
20. Burial of the dead following attack or conflict
21. Mass graves associated with the dead following attack or conflict
22. Recording of the dead following attack or conflict
23. Monuments for the dead following attack or conflict
24. Remembering the dead following attack or conflict
25. Ceremonial violence e.g. associated with rites of passage
26. Ceremonial violence (human sacrifice)
27. Rules associated with attack or conflict
28. Laws associated with attack or conflict
29. Arbitrations before conflict
30. Arbitrations after conflict
31. Sanctions associated with attack or conflict
32. Punishment associated with attack or conflict
33. Reparations/compensations associated with attack or conflict
34. Treaties/ settlements associated with attack or conflict
35. Resolutions associated with attack or conflict
36. Revenge associated with attack or conflict

Archaeology: Although, it is possible to examine the presence and production of weapon at a site, it was decided to specifically examine direct/definite evidence of interpersonal violence. Thus, evidence of interpersonal violence in the

archaeological record was examined by the presence of human remains with evidence of violent peri- and antemortem traumatic injuries associated with violet incidents. A Perimortem injury refers to trauma at or near the time of death. For in perimortem injuries, the bone will not have any evidence of healing. Antemortem trauma refers to trauma before the time of death. For ante mortem injuries, bone shows evidence of healing. Thus, is distinguished from perimortem trauma by the appearance of new bone deposits, resulting in callus formation or bevelled edges. Evidence of interpersonal violence was examined via the skeletal record relating to human remains in:

1. the settlement
2. isolated burials
3. Mass graves
4. Non-sectioned off location
5. Any sectioned-off specific location for burial/interment containing human remains; physical barriers include walls, ditches or palisades:

- in the settlement the settlement
- in the surrounding landscape

6. Domestic buildings
7. Communal building(s)
8. Communal ritual building(s)
9. Burial mound (s), barrow(s)
10. Monument(s)/tombs e.g. megaliths

Interpersonal violence (1 -= present) was recorded in relation to the identification of any peri- and antemortem traumatic injuries from blunt and/or sharp-force trauma through the palaeopathological identification of:

(1) Fractures; as a result of abnormal forces or tension, compression, torsion, bending, or shearing applied to the bone

(2) Crushing injuries: as a result of abnormal forces causing compression of the body

(3) Dislocation: when surfaces that once were continuous no longer meet or they meet at an unnatural angle

(4) Bone wounds caused by sharp instruments e.g. cut marks

(5) Evidence of soft tissue injury or wounds in the context of preserved soft issue including:

- Contusion (hematoma)
- Abrasions
- Puncture wounds
- Lacerations
- Avulsion defects

18. Evidence of single individual burial: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF cultures and the archaeology the evidence for the purpose of recording are outlined in the *Mortuary practices* section above

19. Evidence of grave goods: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *Mortuary practices* section above

20. Evidence of special burial treatment: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *Mortuary practices* section above

21. Evidence of cemeteries: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *Mortuary practices s*ection above

Sharing avoidance

This section of the database was used to record the evidence and level of sharing avoidance or theft control recorded in eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.5) were used. This section used categories of absence or presence to identify and record the level of sharing avoidance in each culture or site-phase. Following the pilot study, it was decided to add a separate sub-category focussing on the evidence of sharing avoidance to the social complexity category. The presence of communal food storage was used to indicate a low level of sharing avoidance. The evidence of domestic food storage was used to indicate an increased/high level of sharing avoidance or theft control. The evidence of communal cooking was used to indicate a low level of sharing avoidance/theft control. The evidence of domestic cooking was used to indicate an increased/high level of sharing avoidance or theft control. The categories were recorded as:

1. Evidence of communal food storage
2. Evidence of domestic/private food storage
3. Evidence of communal cooking area
4. Evidence of domestic/private cooking area

Table 1.5 the eHRAF OCM codes for sharing avoidance

OCM Code	Description
251	preservation and storage of food
252	food preparation
261	gratification and food control
264	eating
341	architecture
342	dwellings
362	housing

1. Evidence of communal food storage: this category is recorded in terms of: 0 = absent, 1 = present. This section refers to any food source that is stored in an area that can be accessed by other members of the group examples include: community store houses, granaries or silos.

eHRAF: For each eHRAF culture, evidence of communal food communal storage is scored in relation to the examination of 33 criteria:

1. Large supra-domestic buildings for communal food storage
2. Description of communal storage strategy employed by a group
3. Communal storage used to supplement food source in times of scarcity
4. Design/architecture of communal food storage area/building
5. Construction of communal food storage area/building
6. Location of communal food storage area/building
7. Communal food storage by placing food in:

- pit(s)

- cist(s)
- pottery
- Jars
- basket(s)
- granary/granaries
- silo(s)
- storage house(s)

8. Processing of food source for communal storage (preparation)
9. Preservation of food source for communal storage
10. Drying, curing or freezing of meat and fish for storage for communal storage
11. Types of food sources stored in communal area/building
12. Hanging of food ,for example peppers, in a communal storage area/building
13. Communal storage of wild (gathered) fruit, nut, seeds, plants etc and
14. Communal storage cooking of processed wild (hunted) animals
15. Communal storage of domesticated crops
16. Communal storage of harvest yield
17. Organisational aspects of communal food storage
18. Records and accounts associated with communal food storage
19. Sharing or dividing out of food stored in communal area/building
20. Access to communal food store
21. Raiding of communal food store
22. Destruction of communal food store
23. Security of communal food store
24. Rules associated with communal food storage
25. Laws associated with communal food storage
26. Sanctions associated with communal food storage
27. Punishment associated with communal food storage

28. Reparations/compensations associated with communal food storage areas

29. Symbols associated with associated with communal food storage areas

30. practices, ceremonies and dedications attended at communal food storage areas

31. Practices, ceremonies and dedications performed at communal food storage areas

32. Myths and beliefs associated with the practices of communal food storage

33. Myths and beliefs associated with the location of communal food storage

Archaeology: For the archaeological site-phases evidence of communal food storage (1 = present) relates to the storing of wild or domesticated plants or animals in an area that (1) contains more than one kin-group; (2) is considered is considered as a communal building (permanent or temporary); and (3) can be accessed readily by many (if not all) the members of a community. This generally related to the locations such as community storehouses or the storage of food in squares or in front of one or a group of domestic dwellings or a community building (permanent or temporary). The identification of communal food storage relates to the recording of 3 of 18 criteria:

1. Evidence of large supra-domestic buildings with evidence of communal food storage

2. Storage of food in community accessible structures such as

- granary/granaries
- silo(s)
- storage house(s)

3. Storage of food in communal storehouse in:

- Pit(s)
- Cist(s)

- pottery
- Jars
- Basket(s)
- On racks such as smoked, cured or dried of meat or fish

4. Storage of food community accessible areas (outside domestic or communal dwellings or in a square) in:

- pit(s)
- cist(s)
- pottery
- jars
- basket(s)
- on racks such as smoked, cured or dried of meat or fish

5. Communal building(s) associated with surplus food storage via large amount of stored or charred seeds or grains in niches, pottery, baskets or grain bins (processed and unprocessed)

6. Communal building(s) associated with the storage of animal remains via large amount of stored or charred animal bones with indication of butchering

7. Communal building(s) associated with the storage of smoked, cure or dried of meat or fish associated with a domestic dwelling(s)

2. Evidence of domestic/private food storage: this category is recorded in terms of: 0 = absent, 1 = present. This section refers to any food source that is stored in a domestic/private setting that can be only accessed by certain members of the group examples include: pits, granaries, grain bin or domestic outhouses. In general, the food source is not shared with people outside a certain family or kin group

eHRAF: For each eHRAF culture, evidence of domestic/private food storage is scored in relation to the examination of 35 criteria:

1. Part of a domestic buildings used for food storage
2. Description of domestic/private storage strategy employed by an individual
3. Description of domestic/private storage strategy employed by a group
4. Domestic/private storage used to supplement food source in times of scarcity
5. Design of domestic/private food storage area
6. Construction of domestic/private food storage area
7. Location of domestic/private food storage area
8. Additions/augmentations to domestic house for the purpose of domestic/private food storage
9. Additional outhouse for the purpose of domestic/private food storage
10. Domestic/private food storage by placing food in:

- pit/pits
- cists
- pottery
- Jars
- baskets
- granary/granaries or
- grain bin(s)
- outhouse

11. Processing of food source for domestic/private storage (preparation)
12. Preservation of food source for domestic/private storage
13. Drying, curing or freezing of meat and fish for storage for domestic/private storage

14. Types of food sources stored in domestic/private area/building

15. Hanging of food in a domestic/private storage area/building

16. Domestic/private storage of wild (gathered) fruit, nut, seeds, plants etc.

17. Domestic/private storage cooking of processed wild (hunted) animals

18. Domestic/private storage of portion of a harvest yield

19. Organisational aspects of domestic/private food storage

20. Records and accounts associated with domestic/private food storage

21. Sharing or dividing out of food stored in domestic/private area

22. Access to domestic/private food store

23. Raiding of domestic/private food store

24. Destruction of domestic/private food store

25. Security of domestic/private food store

26. Rules associated with domestic/private food storage

27. Laws associated with domestic/private food storage

28. Sanctions associated with domestic/private food storage

29. Punishment associated with domestic/private food storage

30. Reparations/compensations associated with domestic/private food storage areas

31. Symbols associated with associated with domestic/private food storage areas

32. Practices, ceremonies and dedications attended at domestic/private food storage areas

33. Practices, ceremonies and dedications performed at domestic/private food storage areas

34. Myths and beliefs associated with the practices of domestic/private food storage

35. Myths and beliefs associated with the location of domestic/private food storage

Archaeology: For the archaeological site-phases evidence of domestic food storage (1 = present) relates to the storing of wild or domesticated plants or animals in an area that (1) is considered as a domestic dwelling used by one family group (permanent or temporary); (2) cannot be access readily by other members of a community. This generally related to the location of a food storage area inside a more secure area of a house such as under the floor or separated from the access point to the dwelling by room(s)or wall(s)

The identification of communal food storage relates to the recording of 1 of 5 criteria

1. Storage of food in a domestic setting via:

- pottery
- jar
- granary
- grain bin
- silo
- niches,
- cists
- baskets
- additional storage house-extension

2. Domestic dwelling(s) associated with surplus food storage via large amount of stored or charred seeds or grains in niches, pottery, baskets or grain bins (processed and unprocessed)

3. Domestic dwelling(s) associated with the storage of animal remains via large amount of stored or charred animal bones with indication of butchering

4. Domestic dwelling(s) associated with the storage of smoked, cure or dried of meat or fish associated with a domestic dwelling(s)

5. Secure storage area for surplus food; located in the inner section of house

- No. of rooms Between Dwelling Entry Point and Food Storage Area <1
- No. of Walls Between Dwelling Entry Point and Food Storage Area <1

3. Evidence of communal cooking area: this category is recorded in terms of: 0 = absent, 1 = present. This section refers to cooking food in an area that can be accessed by other members of the group examples include: community heaths, stoves and cooking houses. Generally, the (1) cooking of the food is shared or rotated and (2) cooked food is shared with other group members.

eHRAF: For each eHRAF culture, evidence of communal cooking is scored in relation to the examination of 28 criteria:

1. Description of communal cooking
2. Communal cooking used to supplement food source in times of scarcity
3. Design/ of communal cooking area
4. Construction of communal cooking area
5. Location of communal cooking area
6. Communal cooking using:
   - pit/pits
   - hearth(s)
7. Preparation of food for communal cooking
8. Preservation of food source for communal cooking
9. Communal storage of cooking implements
10. Types of food sources cooked in communal area
11. Communal cooking of wild (gathered) fruit, nut, seeds, plants etc.

12. Communal cooking of processed wild (hunted) animals
13. Communal cooking of domesticated crops
14. Communal cooking of harvest yield
15. Organisational aspects of communal cooking
16. Records and accounts associated with communal cooking
17. Sharing or dividing out of food cooked communally
18. Destruction of communal cooking area
19. Security of communal cooking area
20. Rules associated with communal cooking
21. Laws associated with communal cooking
22. Sanctions associated with communal cooking
23. Punishment associated with communal cooking
24. Symbols associated with associated with communal cooking areas
25. Practices, ceremonies and dedications attended at communal cooking areas
26. Practices, ceremonies and dedications performed at communal cooking areas
27. Myths and beliefs associated with the practices of communal cooking
28. Myths and beliefs associated with the location of communal cooking

Archaeology: For the archaeological site-phases evidence of communal cooking (1 = present) relates to the cooking of wild or domesticated plants or animals in an area that (1) contains more than one kin-group could use in a given season (2) is considered as a communal building (permanent or temporary) (3) can be accessed readily by many (if not all) the members of a community. This generally related to the locations such as community squares or in front of one or a group of dwellings or a domestic or community building(s) (permanent or temporary). The identification of communal cooking relates to the recording of 2 of 11 criteria:

1. Evidence of large supra-domestic buildings with evidence of communal cooking

2. Cooking of food inside community accessible structures via

- pit/pits
- hearth(s)
- fire place(s
- stove(s)

3. Cooking of food outside community accessible structures via

- pit/pits
- hearth(s)
- fire place(s
- stove(s)
- This can be indicated by the presence of many hearth(s)/pit(s)/fire place(s)/stove(s) in close proximity or one large hearth etc.

4. Cooking of food in a community accessible area such as a square or plaza such as:

- pit/pits
- hearth(s)
- fire place(s
- stove(s)
- this can be indicated by the presence of many hearths etc. in close proximity or one large hearth etc.

5. Cooking of food outside a group of domestic dwellings (temporary or permanent) in a:

- pit/pits
- hearth(s)
- fire place(s

- stove(s)
- this can be indicated by the presence of hearth or hearths etc. in close proximity or one large hearth etc.

6. inside or outside of domestic building(s) associated with evidence of plant cooking via charred seeds or grains in associated with a hearth(s) etc.

7. Inside or outside of Communal building(s) associated with the cooking of animal remains via charred animal bones with indication of butchering

8. Area of a settlement with evidence of plant cooking via charred seeds or grains in associated with a hearth(s) etc.

9. Area of a settlement with evidence the cooking of animal remains via charred animal bones with indication of butchering associated with a hearth(s) etc.

10. Inside or outside of domestic dwelling(s) associated with evidence of plant cooking via charred seeds or grains in associated with a hearth(s) etc.

11. Outside of domestic dwelling(s) associated with the cooking of animal remains via charred animal bones with indication of butchering

4. Evidence of domestic/private cooking area: this category is recorded in terms of: 0 = absent, 1 = present. This section refers to any food source that is cooked in a domestic/private setting that can only be accessed by certain members of the group examples include: heaths, fire places and stoves. For the most part, the cooked food is not shared with people outside a certain family or kin group.

eHRAF: For each eHRAF culture, evidence of domestic/private cooking is scored in relation to the recording of 33 criteria:

1. Domestic buildings in which cooking takes place
2. Description of domestic/private cooking by a family member
3. Description of domestic/private cooking by a group

4. Domestic/private cooking used to supplement food source in times of scarcity

5. Design of domestic/private cooking area

6. Construction of domestic/private cooking area

7. Location of domestic/private cooking area

8. Additions/augmentations to domestic house for the purpose of domestic/private cooking

9. Additional outhouse for the purpose of domestic/private cooking

10. Domestic/private cooking using:

- pit/pits
- hearth(s)
- fire place(s
- stove(s)

11. Preparation of food source for domestic/private cooking

12. Preservation of food source for domestic/private cooking

13. Domestic/private storage of cooking implements

14. Domestic/private cooking of wild (gathered) fruit, nut, seed, plant resources

15. Domestic/private cooking of wild (hunted) animals

16. Domestic/private cooking of domesticated crops

17. Domestic/private cooking of portion of a harvest yield

18. Organisational aspects of domestic/private cooking

19. Records and accounts associated with domestic/private cooking

20. Sharing or dividing out of food cooked in domestic/private area

21. Access to domestic/private cooking area

22. Raiding of domestic/private cooking area

23. Destruction of domestic/private cooking area

24. Security of domestic/private cooking area

25. Rules associated with domestic/private cooking

26. Laws associated with domestic/private cooking

27. Sanctions associated with domestic/private cooking

28. Punishment associated with domestic/private cooking

29. Symbols associated with associated with domestic/private cooking areas

30. Practices, ceremonies and dedications attended at domestic/private cooking areas

31. Practices, ceremonies and dedications performed at domestic/private cooking areas

32. Myths and beliefs associated with the practices of domestic/private cooking

33. Myths and beliefs associated with the location of domestic/private cooking

Archaeology: For the archaeological site-phases evidence of domestic cooking (1 = present) relates the cooking of food in an area that (1) is considered as a domestic dwelling used by one family group (permanent or temporary); (2) cannot be access readily by other members of a community. This generally related to the location of a food cooking area inside a more secure area of a house separated from the access point to the dwelling by room(s) or wall(s)

The identification of communal food storage relates to the recording of 1 of 4 criteria

1. Cooking of food in a domestic setting via:

- pit/pits
- hearth(s)
- fire place(s
- stove(s)
- additional storage house-extension

2. Evidence of domestic cooking by charred remains of processed plants in the context of a hearth inside a domestic dwelling

3. Evidence of domestic cooking by charred animal bones with indication of butchering

4. Secure cooking area for heath/ stove/pit fire; located in the inner section of house:

- No. of rooms Between Dwelling Entry Point and Food Storage Area <1
- No. of Walls Between Dwelling Entry Point and Food Storage Area <1

* recorded only for archaeological site-phases

* recorded only for eHRAF cultures

Community, ritual and monumental architecture

This section of the database was used to record the evidence of community, ritual and monumental architecture connected with each eHRAF culture and archaeological site-phase. For the eHRAF cultures, a specific set of OCM codes (Table 1.6) were used. Following the pilot study, it was decided to add a separate sub-category focussing on the evidence of community, ritual and monumental architecture to the social complexity category. This section used categories of absence presence to identify and record the level of evidence of community, ritual and monumental architecture. The four categories used to identify the presence of community, ritual and monumental architecture were:

1. Evidence of communal building(s)

2. Evidence of communal ritual structures

3. Evidence of communal ritual monuments/monuments in the landscape

4. Evidence of large statues (and totems)

Table 1:6 the eHRAF OCM codes for architecture

OCM Code	Description
340	structures
341	architecture
344	public structures
346	religious and educational structures
621	community structures
628	inter-community relations

1. **Evidence of communal building(s)**: this category is recorded in terms of: 0 = absent, 1 = present. This category is used to record communal buildings used for communal activity such as (1) convening meetings; (2) community administration; (3) craft such as tool, pottery or basket production and (3) food storage or processing.

eHRAF: For each eHRAF culture, evidence of communal buildings (1 = present) is indicated by the examination of 20 criteria relating directly to the presence of communal buildings, in the eHRAF database: Reference to or description of:

1. presence of communal building(s)
2. design of communal building(s)
3. construction of communal building(s)
4. use of communal building(s)
5. the convening of meetings at communal building(s)
6. meetings attended at communal building(s)
7. organisational aspects of meetings at communal building(s)
8. architecture of communal building(s)
9. production of materials at communal building(s)

10. partaking in the production of materials at communal building(s)
11. supervision of the production of materials at communal building(s)
12. processing of animals at communal building(s)
13. partaking in the processing of animals at communal building(s)
14. supervision of the processing of animals at communal building(s)
15. processing of food at communal building(s)
16. partaking in the processing of food at communal building(s)
17. supervision of the processing of food at communal building(s)
18. storage of food at communal building(s)
19. partaking in the storage of food at communal building(s)
20. supervision of the storage of food at communal building(s)

Archaeology: This section is for the recording of buildings that were used by the community but probably not for rituals. In general this is identified in the archaeological record by the presence of large, supra-domestic buildings that are associated with communal activity such as (1) the ability to house meetings (2) craft such as tool, pottery or basket productions (3) food storage or processing. Large in this case refers to buildings that are bigger (area) that the typical domestic buildings at the site. For the archaeological site-phases the evidence of communal structures (1 = present) is recorded form the available sources that identify and record of 2 of 14 material culture criteria. Recording of:

1. large supra-domestic buildings
2. large supra-domestic buildings associated with craft such as tool, pottery or basket productions; via scattering of debitage or incomplete products.
3. large supra-domestic buildings associated with a number of finished or unfinished pottery
4. large supra-domestic buildings associated with a number of finished or unfinished stone tools

5. large supra-domestic buildings associated with finished or unfinished pottery

6. large supra-domestic buildings associated with a number of finished or unfinished anthropomorphic figurines

7. large supra-domestic buildings associated with a number of finished or unfinished zoomorphic figurines

8. large supra-domestic buildings associated with food processing via large amount of stored or charred seeds or grains (process and unprocessed)

9. large supra-domestic buildings associated with food storage via large amount of stored or charred seeds or grains in niches, pottery, baskets or silos (process and unprocessed)

10. large supra-domestic buildings associated with animal processing via large amount of stone tools associated with animal process—especially if microware analysis indicates animal processing

11. large supra-domestic buildings associated with animal processing via large amount of stored or charred animal bones with indication of butchering in the building or an associated spoil heap

12. large supra-domestic buildings not associated burial(s)

13. large supra-domestic buildings not associated with skull caching, painting or plastering

14. similar buildings at other site-phases in the region. This is used to consider a shared belief or ritual practices across a number of sites which may be indicative of ritual standardisations.

2. Evidence of communal ritual structures: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General Ritual* section above

3. Evidence of communal ritual monuments/monuments in the landscape: this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General Ritual* section above

4. Evidence of large statues (and totems): this category is recorded in terms of: 0 = absent, 1 = present.

For the eHRAF culture and the archaeology the evidence for the purpose of recording are outlined in the *General Ritual* section above.

Appendix 2: List of Irish sites showing scoring/selection method

Scoring: 0 to 5 scale; based on (1) the accessibility of site (site-phase) information including excavation reports, peer-reviewed Journals, published books and online resources which were scored on a 0 to 2 scale (0 = poor accessibility, 1 = medium accessibility, 2 = good accessibility) and (2) the presence of ritual, subsistence and social organisation data which were scored in terms of absence or presence (0/1) for each category: (1) Ritual [Rit. (0/1)]; Subsistence [Sub (0/1)]; and Social Complexity [Soc. Com(0/1)]

Total of 34 potential sites with 11 sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Access (0-2)	Rit. (0/1)	Sub (0/1)	Soc. Com(0/1)	Score (0-5)
Mount Sandel Co. Derry	Mesolithic	700 sqm of settlement occupation. Including faunal Remains.	**2**	**0**	**1**	**0**	**3**
Killuragh Co. Limerick (Hermitage)	Mesolithic and Neolithic	Cave site with Early Mesolithic human remains (2 individuals) and microliths. Neolithic layers present. Animal bone of wild and domestic species.	**1**	**1**	**1**	**0**	**3**
Lough Boora Co. Offaly	Mesolithic	Lake side seasonal settlement camp	**2**	**0**	**1**	**1**	**4**
New Ferry Co. Antrim	Mesolithic	Several Mesolithic occupation layers	1	0	1	1	3
Ferriter's Cove Co Kerry	Mesolithic	Site with domestic animal evidence dated to 4300 BC	**2**	**0**	**1**	**0**	**3**
Ballykeel Co. Armagh	Neolithic	28m long sub-rectangular cairn with tomb at southern end	**1**	**1**	**0**	**0**	**2**
Ballybriest Co. Antrim	Neolithic	Court Cairns Covered earlier structure	**1**	**1**	**0**	**0**	**2**
Ballymarkagh Co. Antrim	Neolithic	Semi- circular court tomb, pot sherds, cremated human bone representing 5 or 6 Adults	**1**	**1**	**0**	**1**	**3**
Ballygalley Co. Antrim	Neolithic	Sub-rect house. Cereal Grains. 7 querns in annex. Potsherds. Axes pitchstone re Scotland & Cornwall	**2**	**0**	**1**	**1**	**4**

Total of 34 potential sites with 11 sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Access (0-2)	Rit. (0/1)	Sub (0/1)	Soc. Com(0/1)	Score (0-5)
Ballintaggart Co. Down	Neolithic	Multiple rectangular house structures	**1**	**0**	**1**	**1**	3* inst
Ballynagilly Co. Tyrone	Neolithic	Burnt remains of a rect. timbre house pottery and animal bones	**2**	**0**	**1**	**1**	4* inst
Creggandevesky Co. Tyrone	Neolithic	Court Tomb with fragmentary and cremated remains of possible 21 adults; secondary mechanical crushing	**1**	**1**	**0**	**0**	**2**
Cohaw Co. Cavan	Neolithic	Court Tomb with fragmentary human remains including cranium and teeth. Cremated remains of adult and sub-adult	**1**	**1**	**0**	**0**	**2**
Magheraboy Co Sligo	Neolithic	Large Causewayed enclosure with pottery and flints placed in ditch	**1**	**0**	**1**	**1**	3* inst
Creevykeel Co Sligo	Neolithic	Court Tomb. Axes and beads found in forecourt	**2**	**1**	**0**	**0**	**2**
Carrowmore Co Sligo	Neolithic	Megalith Cemetery site	**2**	**1**	**1**	**1**	**4**
Carrowkeel Co Sligo	Neolithic	Megalith Cemetery site	**2**	**1**	**0**	**0**	**3**
Ballyglass Co. Mayo	Neolithic	Adj to Ceide Fields. Large House with Annex beneath megalithic tomb. 2 court Cairns covered earlier house	**2**	**1**	**1**	**1**	5* inst

Total of 34 potential sites with 11 sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Access (0-2)	Rit. (0/1)	Sub (0/1)	Soc. Com(0/1)	Score (0-5)
Lyles Hill Co. Antrim	Neolithic	Hill top enclosure; with occupation evidence including pottery, hearth and pollen indicated barley cultivation	2	0	1	1	4
Rathlackan Co. Mayo	Neolithic	East of Céide Fields Survey reveals court tomb and enclosure as part of a 10km field system circa Middle Neolithic	1	1	0	1	3
Belderg Beg, Co. Mayo	Neolithic	Field system 7km from Ceide Fields with pottery, flints and polished stone axes	1	0	0	1	2
Gransha (site-phase 11 & 12) Co Derry	Neolithic	Burnt Mound with occupation evidence including pottery, worked flint and hazelnuts	2	0	1	1	3
Newtown Co.Meath	Neolithic	Rectangular house with internal divisions	1	0	0	1	2
Lough Crew Co. Meath	Neolithic	Megalith Cemetery site	2	1	0	1	4
Brú na Bóinne Co. Meath	Neolithic	Megalith Cemetery site	2	1	1	1	5* inst
Clowanstown Co.Meath	Mesolithic, Neolithic	Neolithic burnt mounds and Mesolithic Subsistence evidence. Possible Mesolithic Neolithic continuity	1	0	1	1	3* inst
Kilshane Co. Dublin	Neolithic	Enclosure with possible feasting evidence incl. cereal	1	0	1	1	3
Townley Hall Co.Louth	Neolithic	Temporary settlement with subsistence evidence beneath a megalithic passage tomb	2	1	1	0	4* inst

Total of 34 potential sites with 11 sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Access (0-2)	Rit. (0/1)	Sub (0/1)	Soc. Com(0/1)	Score (0-5)
Cohaw Co. Cavan	Neolithic	Court Tomb with fragmentary human remains including cranium and teeth. Cremated remains of adult and sub-adult	1	1	0	0	2
Ceide Fields System Co. Mayo • Ceide Fields Co Mayo • Rathlackan Co. Mayo	Neolithic	Large field system and East of Céide Fields Survey reveals court tomb and enclosure as part of a 10km field system circa Middle Neolithic	2	0	1	1	3
Belderg Beg, Co. Mayo	Neolithic	Field system 7km from Ceide Fields with pottery, flints and polished stone axes	1	0	0	1	2
Newtown Co. Meath	Neolithic	Rectangular house with internal divisions	1	0	0	1	2
Ardcrony Co. Tipperary	Neolithic	Polygonal cist in a cairn with burial of two sub-adults and one adult (unburnt disarticulate) placed in separate deposits associated with pottery	1	1	0	0	2

No. 1 - 8 of the 16 selected Irish sites; including sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Score (0-5)
Mount Sandel Co. Derry	Mesolithic	700 sqm of settlement occupation. Including faunal Remains.	3
New Ferry Co. Antrim	Mesolithic	Several Mesolithic occupation layers	3
Lough Boora Co. Offaly	Mesolithic	Lake side seasonal settlement camp	4
Lyles Hill Co. Antrim	Neolithic	Hill top enclosure; with occupation evidence including pottery, hearth and pollen indicated barley cultivation	4
Gransha (site-phase 11 & 12) Co Derry	Neolithic	Burnt Mound with occupation evidence including pottery, worked flint and hazelnuts	3
Ballintaggart Co. Down	Neolithic	Multiple rectangular house structures	3* inst
Ballynagilly Co. Tyrone	Neolithic	Burnt remains of a rect. timbre house pottery and animal bones	4* inst

No. 9 - 16 of the 16 selected Irish sites; including sites from INSTAR Cultivating Societies Project (* inst**)**

Site	Period	Brief description	Score (0-5)
Carrowmore Co Sligo	Neolithic	Megalith Cemetery site	5
Ceide Fields System Co. Mayo • Ceide Fields Co Mayo • Rathlackan Co. Mayo • Ballyglass Co. Mayo	Neolithic	Large field system and East of Céide Fields Survey reveals court tomb and enclosure as part of a 10km field system circa Middle Neolithic	5
Brú na Bóinne Co. Meath	Neolithic	Megalith Cemetery site	5* inst
Clowanstown Co.Meath	Mesolithic, Neolithic	Neolithic burnt mounds and Mesolithic Subsistence evidence. Possible Mesolithic Neolithic continuity	3* inst
Ashley Park Co. Tipperary	Neolithic	Cairn circa 90m. Deposit contained mixed unburnt human (adult & sub-adult) and animal bone (cattle, sheep and pig). Decorated Bowls. Ritual associated with consumption of food	3
Lough Gur Co. Limerick,	Neolithic	Large megalithic monuments site with settlement evidence eg knockadoon	3
Tankardstown, Co. Limerick	Neolithic	Rect. house 47.3msq. Possible ritual, Charred Cereals, Animal Bones. Second structure possible deliberate destruction	3* inst
Poulnabrone Co.Clare	Neolithic	Portal Tomb with unburnt animal and human Bone. Human bones represent 16 adults and 6 sub-adults. Evidence of interpersonal violence. Dietary information suggests use of cereals. Burial goods include bone pedants, bone pins, several chert and flint implements and stone axes	3
Gortore Co.Cork	Neolithic	Neolithic Rectangular house structure. Association with Mesolithic material culture in the areas of site	3* inst