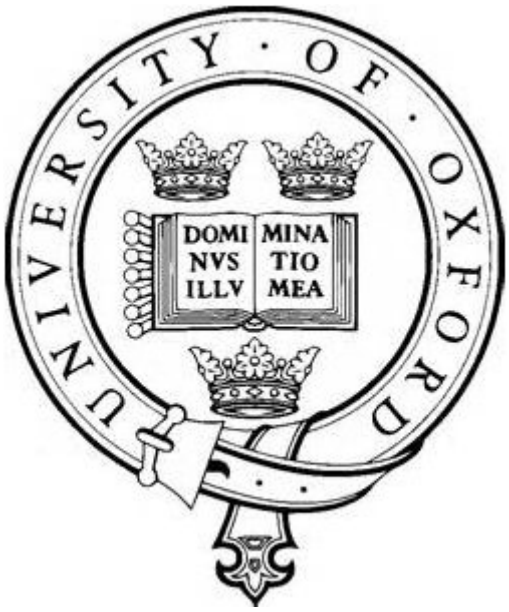
Organizational Modes of Non-state armed groups



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A thesis submitted for the degree of
Doctor of Philosophy
Trinity 2017

Abstract

To what extent can two 'Modes' be found amongst non-state armed groups (NSAGs)? The Modes theory hypotheses that NSAGs are organized into two distinct Modes, either the 'Imagistic' or the 'Doctrinal' Mode, with each Mode characterised by a particular organisational structure and type of resource extraction. Previous preliminary research on this had three limitations: 1) it used a sample of only five groups; 2) "Galton's problem", i.e. non-independence of groups was not taken into account, and 3) the theory of resource extraction was underdeveloped. The present research overcomes each of these limitations.

First, can the patterns found in the 5-group case study be replicated with a larger sample? A dataset with 50 NSAGs was constructed, with variables that were derived from the theory and resembling those used for the 5-group case study. Analysis results showed that a few 'Doctrinal' variables were significantly correlated and 'Doctrinal' rituals had a frequency distribution as predicted. Yet, most correlations between all Modes variables were not significant, and analyses did not convincingly show that there were two distinct Modes.

Second, to what extent does "Galton's problem" (autocorrelation) play a role amongst NSAGs regarding their Modes properties? Data on relations between armed groups and their geographical locations were added to the sample. Using Moran's I, it appeared that two to four Modes properties were significantly autocorrelated. With geographical region as covariate, analyses were redone. Results remained basically the same as without regional covariate.

Third, what is the relationship between Modes and the type of Resource extraction? Resource types were operationalized and Resource type data were added to the sample of NSAGs. A theory on Risk, and a ROI (Return on Investment) and Risk index were developed. Regressions showed no change in ROI or Risk over time. Low ROI did not typically predict Doctrinal-related Modes properties, and high-ROI did not typically predict Imagistic-related Modes properties. The significance of relations between Modes properties and Resource types strongly depended on whether the analysis was a correlation or a regression. Overall, only a few relationships were significant and no consistent pattern emerged.

Limitations of the present research, and suggestions for further research are discussed, as well as an overall assessment of the Modes theory.

Acknowledgements

Harvey Whitehouse

Indisputably the number one. Thank you so much for all the discussions, the opportunities you gave me, the general supervision, and for accepting me as student in the first place.

Quentin Atkinson

For our discussions, and your subtle but always important suggestions for (oftentimes major) improvements.

Oliver Curry and Pieter François

For being my harshest-yet-constructive critics; especially Oliver for challenging me that extra mile, but with fostering guidance along the track.

Admin at Anthro

For solving things at the practical level, with preemptive warnings about required GSO's and looming deadlines, and useful directions to let me navigate through Oxford's Doctrinal Mode.

All the experts who provided data

Without your help, there would not have been much to report.

The ESRC

For giving me a grant that paid for my university fees, part of the ESRC Large Grant entitled "Ritual, Community, and Conflict" (REF RES-060-25-0085).

New College

For being such a beautiful, welcoming environment. Quite frankly, I could not remember that I had applied for New College, but somehow I ended up there — with your added funding as well (?!). (1379 Society Old Members Scholarship). Many thanks!

Many other students

For being my peers, my social embedding, my mirrors, my joy, my irritation, my surprise, my grief, my relief, and all other things that emerge during participant observation of fellow subjects.

Oxford town

For being an awesome physical environment. For about two years, I deliberately did my groceries inefficiently, so that I had to walk through the center every day —will walk for food— to enjoy the scenery. An excellent combination of architecture, knowledge and history. I hope to reproduce some of that for future generations. And Blackwell's bookshop is best to be avoided, for sake of keeping (grant)money in one's pocket.

Parents

Zonder jullie was het toch wel een stuk lastiger geworden. Bij deze zwart op wit: dank voor de opvoeding en de steun! En de subsidies (MEHA 1945-46-1-2-3-4).

Venetia

Unexpressable. For all your support, and the nearness of you.

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Introduction

> *Hereby it is manifest that during the time men live without a common Power to keep them all in awe, they are in that condition which is called War; and such a war as is of every man against every man. In such condition, there is no place for Society; and which is worst of all, there is continual Fear, and danger of violent death; And the life of man solitary, poor, nasty, brutish, and short.* (Hobbes 1651: Chapter 8).

Thomas Hobbes argued that it is in the interests of the individual to surrender power to a sovereign, who would rule all subjects in a certain jurisdiction. It is a worldview of societies full of individuals directly falling under the supreme power of the state. Briefly he considered the possibility that individuals could cooperate in alliances so that life of man would be not as solitary, poor, nasty, brutish, and short, but he rejected this outlook because it would be *irrational* to do so: it would replace the internecine war from the individual level to the group level, and mankind would still be in the 'state of nature', which, in Hobbes' interpretation, comes back to internecine war.

A similar view permeated much of the post-WW II scholarship on wars and fighting: the world system was one of individuals under the rule of states, in which significant wars were between states, and individuals were made to fight in the name of the state. In this view, warring groups at the intermediate level, perhaps divided along ethnic, cultural or linguistic lines, were proxies for states and a passing phase on the road to nationalization, not warranting much dedicated research. However, the question is whether that is justified. In what follows below, a brief introduction will be given how academic research went from studying war from a worldview that consisted of individuals and states only, to one that added the intermediate *clan-tribe-group* level as well. That will set the background for the main target of this thesis: how the Modes theory —a theory that concentrates on group formation— can be applied to fighting groups in civil wars and violent political conflict.

Social science and the problem of war

The 'Western liberal bias' implicitly assumed —perhaps for no small part influenced by Cold War politics— that the world was made up of individuals under the umbrella of governments, either democratic or despotic. This dichotomy between individuals and state, without taking the intermediary group level such as tribes and factions into account, could be found in many strands of social science research. For instance, civil war studies used indicators like the Gini-index of a country —charting the difference in wealth between individuals— to predict civil wars; or used democratization indices —rights and voting abilities of individuals— to predict state instability. The first datasets on conflict —notably Correlates of War— predominantly focused on wars at the state level. From the 1960s onwards, anthropology and archaeology by and large held the view that fighting in groups in hunter-gatherer societies did not occur, and certainly could not be called war — cutting the links between tribes or groups and conflict. Lawrence Keeley called this "Pacifying the past" (Keeley 1996, ch 1), and Mark Allen called this the "multi-decadal moratorium on violence research" (Allen and Jones 2014, 15). War was thought to be an invention of modern societies —states—, or, if tribal groups engaged in warfare, then it was thought to be a consequence of interference by colonial states (Ferguson 1999).

Perhaps the first signs that seeing the world consisting of individuals under the umbrella of states had its limits is when the Soviet Union collapsed. Soon thereafter, former USSR countries reasserted themselves along ethnic lines and language barriers. In addition, several conflicts emerged in former Soviet states, including several wars in the Caucasus (Nagorno-Karabakh, Abkhazia, Chechnya, Georgia) and Yugoslavia. A multitude of provisional proto-state armies and corollary militias took up arms to fight for ideals, *Volk*, nationhood, religion, ethnicity, profit, revenge, adventure, fear, or anything else — not only to pick up guns and kill, but to form *groups* with this clear purpose. Similar patterns emerged a decade later in Iraq

and Afghanistan. The Coalition of the Willing[1] thought that if a *democratic* central government could be installed and *civilians* would be free to vote, the *country* would soon turn into a democracy. Instead, a multitude of factions and armed groups emerged, again along ethnic and tribal lines. Similarly, the so-called 'Arab Spring' was greeted with enthusiasm in Western liberal democracies. After all, dictators were toppled by a seemingly undifferentiated mass of *the people* calling for democracy (and a different distribution of resources). Yet again, the world did not work in this dichotomous way. Egypt went back to autocracy, Libya descended into civil war with several -perhaps a two thousand[2]- warring *militias*, and Syria descended into an even more brutal civil war with hundreds, if not a thousand[3] *armed groups*.

Who are these groups? Why are they there? What motivates them? Why so many? How is it even possible that groups exist at all? Isn't it more 'rational' for individuals to subject to a democratic state, or is more to be gained to form alliances in groups?

The research community, consisting of academia and non-academic research institutions[4], are gradually catching up in trying to formulate answers to such questions. Whereas the *individual-state* worldview can lay claim on 65 years of research, the *clan-tribe-group* worldview started mainly after the fall of the Soviet Union, reinforced by the 9/11 WTC attacks and the invasion of Iraq in 2003. As the Geneva Centre for the Democratic Control of Armed Forces (DCAF) describes it: "The study of non-state actors does not fit into conventional paradigms of international relations based on a state-centric worldview. As for armed groups, [they] have traditionally been considered challengers without formal responsibility, while

1 The US led army that invaded Iraq in 2003. https://en.wikipedia.org/wiki/Coalition_of_the_willing

2 http://www.bbc.co.uk/news/world-middle-east-19744533

3 http://www.bbc.co.uk/news/world-middle-east-24403003

4 Such as the Rand Corporation, Geneva Centre for the Democratic Control of Armed Forces (DCAF), the Council for the Development of Social Science Research in Africa (CODISERA), the Civil-Military Fusion Centre (CIMIC), the Berghof Research Center for Constructive Conflict Management, the World Bank, the Small Arms Survey, Chatham House (or Royal Institute of International Affairs), the Washington Institute for Near East Policy, the Institute for Security Studies (ISS), the Rift Valley Institute (RVI), etc.

governments are the upholders of order and security, the providers of public goods. Yet, it is increasingly recognized that [armed non-state actors] are key actors in contemporary armed conflicts and that interest in studying them is well-based in both academia and policy research." (DCAF & Geneva Call 2015, 7). DCAF continues in that publication by providing an overview of the many dimensions amongst which armed groups can be understood, for instance security destruction vs. security building, political vs. non-political goals, resource extracting versus resource providing, territory-seeking vs. non-territory seeking, etc. Until now, there is no consensus how to categorize various armed groups or which criteria could be used for a typology (Engels 2010, 75). As a result, these categorizations come in various forms; for instance, based on historic developments, based on the aims of the group, based on the relationship with the state and with community linkage, based on methods of violence, based on recruitment, etc. The most basic form is an all-or-nothing classification, that sticks labels to groups. An example of such a classification, informed by the course of history, is that of Clapham (1998). He roughly followed the post-WW II chronology in the African continent by creating the categories 'liberation movements' (against colonial rule), 'secession movements' (to split off from a newly established state), 'reform insurgencies' (accepting the state, but not its type of politics) and the rest category 'warlord insurgencies'. All of these categories hint on the motives of the armed groups as well. The somewhat similar classification of Zohar (2016) seems to have more intuitive than analytical value, given the rather loose assembly of the categories 'secessionists', 'radical left revolutionary', 'sectarian-based revolutionary' and 'global revolutionary organizations'. McQuinn (2012a, [b] 2012) provided a typology based on formation history, combined with the dimensions 'integration with local authorities' vs. 'community linkage'. That typology consisted of 'revolutionary brigades', 'unregulated brigades', 'post-revolutionary brigades' and 'militias'. However, his typology is, in the first instance, specifically targeted at understanding groups in the Libyan 2011 revolution.

Carey and Mitchell (2017) split up the dimension of relationship with the state into 'informal' on the one hand and 'semi-official' on the other, and split up the community linkage into the four sub-categories 'local', 'ethnic/nationalist/religious', 'ideology/political party' and 'non-civilians, incl. (former) policy, military, mercenaries', all in all eight types. However, they focus on militias only. Engels (2010) creates a quadrant (matrix) of two dimensions: support for the state (support—non-support), and the monopoly on violence (coexist—replace). Volders (2016) also creates a quadrant (matrix) of two dimensions, consisting of a 'structural' dimension (representing the physical anatomy of an organization in membership and space), and a 'structuring' dimension (representing behavioral restrictions through formalization and centralization). Notably, Volders' theory deals with a specific class of non-state armed groups, namely 'terrorist organizations', as Volders calls it. In short, the research community has not established a single way to subdivide or categorize armed groups.

Similarly, databases that aim to inform empirical research with data on armed groups also use various approaches. The database ACLED (Raleigh et al. 2010) recognizes eight categories of groups, containing such categories as 'Government or mutinous force', 'Rebel force', 'Political militia', 'Civilians', etc. In contrast, several databases do not place groups in predefined or analytical categories, but instead simply collect data on group properties. Datasets such as CDC (Bartusevičius 2016), NSAEX (Cunningham, Gleditsch, and Salehyan 2009), GROWup (Girardin et al. 2015), and OSAM (Haer 2012) follow this approach.

A particular dimension that has been singled out to understand armed groups and their dynamics, has been resource use. The publication of Collier and Hoeffler (2000) on the role of resources in civil wars sparked a 'greed' versus 'grief' debate. They suggested that rebel groups were predominantly profit-seeking organizations ('greed'), making them in the end quite similar to mobs, pirates or bandits. Several scholars reacted on this, pointing out that groups could have reasons other than purely economical to take up arms and rebel, for instance, to combat corruption, or

because of lack of political power, lack of protection, lack of accountability of the existent rulers, etc. ('grief') (Abdullah 2006). A host of publications was dedicated to this debate, trying to disentangle the relationship between resources, civil war and the dynamics of armed groups (review in Ross 2004; and other studies like Gilmore et al. 2005; Humphreys 2005; Lujala 2010; and many others). Weinstein (2005) tries to combine both 'greed' and 'grief' in a model that reverses the argument; armed groups adapt to the available resource environment, whereby "economic endowments makes it possible for leaders to recruit on the basis of short-term rewards", with the consequence that "these groups are flooded with opportunistic joiners who exhibit little commitment to the long-term goals of the organization" (*a la* 'greed'). Conversely, in "resource-poor environments, leaders attract new recruits by drawing on ethnic or class solidarity, nationalist sentiments, and local community ties to make credible promises about the private rewards that will come with victory" (*a la* 'grief'). In the final chapter (Discussion), more will be said about Weinstein's theory. However, not everyone would agree with such dichotomies as proposed by Collier & Hoeffler and Weinstein (e.g. Vinci 2006; Keen 2008; Davis 2009). Engels (2010) remarks that

> "Definitions of armed non-state groups frequently build upon the characteristic of 'the use of violence for specifically political ends' in contrast to 'the desire for private gain'. As a consequence, typologies of armed non-state groups state that warlords and criminals had economic objectives, whereas rebels and terrorists had political ones. This motive-based approach is normatively loaded and tends to (re)produce a 'rebels versus bandits' dichotomy having analytical and political consequences. Assuming armed non-state groups to be either politically motivated rebels or loot-seeking bandits, analytically we fail to acknowledge the diversity of non-state armed actors, their genealogy and their social base." (p. 75).

Whatever the viewpoint or the categorization, whatever the motivation, all armed groups have to acquire at least some amount of resources to sustain their activities. Indeed, the later iteration of the greed argument is based on ''feasibility'' (Collier and Hoeffler 2005, 629) of, and ''opportunity'' (Collier, Hoeffler, and Sambanis 2005, 3) for insurgencies: movements can only be sustained when

resources are available to finance them. The research community at least seems to agree that resources are a *conditio sine qua non*, that they do influence the dynamics and duration of armed conflict, and that not all groups treat resources equally.

It is within this broader context that an existing anthropological theory was newly applied to armed groups to get to grips with their structure, behavior and type of resource extraction: the Modes theory (Whitehouse 2004). The Modes theory predicts that groups come in one of two 'Modes': so-called 'Imagistic' groups and so-called 'Doctrinal' groups, with little overlap in between these two Modes. 'Imagistic' groups are small-scale, and are characterised by very few hierarchical levels, by absence of centralized leadership, low-frequency high-arousal rituals, slow group size growth, a lack of standardized ideology and a lack of social services for the local population. 'Doctrinal' groups are large-scale, and are characterised by elaborate hierarchies, centralized leadership, high-frequency low-arousal ideology spreading rituals, more rapid group size growth, and standardized ideology for all members and provision of social services for the local population. In addition, 'Imagistic' groups employ high-risk high-Return-on-Investment (ROI) resource extraction strategies; 'Doctrinal' groups employ low-risk low-ROI strategies.

The Modes theory does not have some of the limitations of the approaches outlined above: it is not limited to, for instance, militias or terrorist groups only, yet still has a group typology; it provides justifications for the categorization with a background theory of group cohesion; it is quantifiable and testable; it is not limited to the modern period only but can in principle be applied to millennia of human group formation; and it has some basic hypotheses on resource use of groups as well. These properties of the Modes theory make it a good candidate to speak about questions on armed groups. However, the Modes theory is one of the 'new kids on the block' as far as armed groups is concerned: although the Modes theory is more than two decades old and has been applied in contexts such as religion, archaeology, and the

emergence of social complexity, it has only been applied to the structure of armed groups in a very preliminary way (Whitehouse and McQuinn 2012).

It is desirable to change that situation. The main aim of this thesis is to investigate to what extent the Modes theory can be applied to the context of non-state armed groups. Indeed, as suggested above, there are various theories that might have something to say about the dynamics, structure, behavior or resource extraction of armed groups. However, given that this will be a first large study on how well the Modes theory fares when applied to armed groups, there is a relative strong focus on testing the Modes theory on its own terms. Would it make sense anyway to use the Modes theory as it stands now in the context of armed groups? Potential comparisons of empirical support for (competing) theories will not be done in this thesis, although in the Discussion chapter at the end of this thesis a section will be dedicated to Weinstein's (2005) recruitment theory, given some of the similarities with the Modes theory regarding the aims of both theories.

This thesis proceeds as follows.

Chapter 1 sets out the Modes theory and its links to armed groups in violent political conflict. After a short introduction to the Modes theory and its history, the translation is made to applying the Modes theory to armed groups. This is done by discussing why the Modes theory promises to be applicable to armed groups, and by discussing the two publications that are the target of this thesis because they take the first step towards applying the Modes theory to the context of armed groups. The first of these publications is Whitehouse and McQuinn's (2012) "Ritual and Violence: Divergent modes of religiosity and armed struggle". In that book chapter, the authors argue that armed groups are organized as either an Imagistic group, or as a Doctrinal group, with little overlap in between. They provide a list of five groups and

demonstrate how they match the properties of either of the Modes. The second is Beardsley and McQuinn's so-called 'Predator Profile Matrix theory' ('PPM theory'), as laid out in their (2009) publication "Rebel groups as predatory organizations: the political effects of the 2004 tsunami in Indonesia and Sri Lanka". This publication does not, in first instance, directly refer to the Modes theory, but many of the general hypotheses of the Modes theory are consistent with the PPM theory. Just like the Modes theory, the PPM theory also poses that on the one hand there are non-state armed groups that are loosely organized, remain relatively small scale and have predatory types of resource extraction without much long-term perspective or large investments. These properties resemble the 'Imagistic' Mode. According to the PPM theory, these groups have a high Return on Investment (ROI), but also live in a risky environment. On the other hand, there are large-scale well-organized groups that provide services to the local population, and are able to harvest large amounts of resources in the long run through taxes and voluntary contributions. These groups resemble the 'Doctrinal' Mode. According to the PPM theory, such groups have a resource base that is more dispersed over a larger area and therefore have a low ROI, but also a lower risk to lose their resources.

These publications, and the Modes theory more generally, hold promise to improve the understanding of armed groups and warring factions; the Modes theory in general because there has been a great deal of previous research, including field-based observations, cases studies, psychological experiments, surveys, other databases, etc. (see next chapter), suggesting that the theory may be generalizable cross-culturally and historically. Extrapolating such principles to the context of armed groups might prove to be fruitful. The two target publications, on their turn, are compelling as they take the first concrete step in applying the Modes theory to the context of NSAGs. However, these two publications suffer from a few limitations:

1) Whitehouse & McQuinn's (2012) hypotheses about the organizational Modes were based on a sample of only 5 groups;
2) The problem of non-independence of data points, whilst most frequentist statistical tests require independence of data points (anthropologists commonly call it "Galton's problem"), was not taken into account in both studies; and
3) The claims about the link between resources and the type of group organization were underdeveloped because (a) the Beardsley & McQuinn (2009) article was based on a case study with two groups, which again is a very small sample —and also contained different groups than the Whitehouse & McQuinn's (2012) study, raising questions about compatibility—, (b) were of a non-quantified nature, raising questions about operationalization, and (c) were lacking a theory about the Risk of resource extraction, raising questions about theoretical completeness.

Each of these three main limitations will be tackled in subsequent and incremental chapters in this thesis. The method to do so is with a large-N dataset, and the construction of that dataset is discussed in the second chapter before the results of actual tests can be presented.

Chapter 2 addresses the main methodological foundation of this thesis' research: the large-N dataset. In particular, its sampling strategy, main data content and quality assurance are discussed.

It will be briefly explained why random sampling was impossible, after which the pragmatic sampling method is laid out; mainly approaching experts on armed groups when available, and presenting these experts a question list. Their answers to the questions constituted the dataset, with occasional additions of some data from other datasets and encoded literature data.

The non-randomness of the sampling strategy might result in some skews, the most important potentially being an overrepresentation of post-Cold War groups,

an over- or underrepresentation of certain regions in the world, and an overrepresentation of large and active groups. It is especially this latter skew that might have bearing on the results in this study, and its potential pitfalls and some solutions will be discussed.

One of the hallmarks of the Modes theory is that it can be subjected to empirical, statistical investigation. For that, the theory needs to be operationalized, and a general discussion will be presented about concept validity and the experts' understanding of the questions. As it turned out, there are no reasons to suspect misunderstandings by experts, except for some of their answers on the questions of frequencies of occurrence of rituals and shared negative experiences. Solutions that were implemented to increase the consistency of coding are presented. The last section of the chapter discusses the six solutions that were implemented in sequential order to deal with missing data. These solutions resulted in a complete dataset of 50 non-state armed groups from all over the world. With that dataset in place, the first of the main research questions could be addressed, which is the topic of the next chapter.

Chapter 3 addresses the question: To what extent can the two Modes be found amongst non-state armed groups (NSAGs)?

Whitehouse & McQuinn (2012) contended that NSAGs are organized either along the lines of the 'Imagistic' Mode, or along the lines of the 'Doctrinal' Mode, with little in between. They based this statement on five case studies, which may be a case of 'cherry picking'. This chapter describes the results when their study is repeated with a tenfold more armed groups — a sample size of 50 — to see whether the patterns hold.

With variables that were derived from the Modes theory, and closely resembled the categories as used by Whitehouse & McQuinn (2012), statistical analyses were done. A Fisher exact tests tested whether there is an inverse

relationship between ritual frequency and emotional arousal of rituals, a Spearman's correlation tested whether the individual Modes variables relate to each other as predicted, a PCA and MDS revealed whether there is one Component, or there are at most two, to which the variables can be reduced which would show that most variation is explained by the two Modes, a bi-modality test revealed whether variable values have two statistical modes, suggesting two Modes as attractor states, a cluster analysis of ritual frequencies showed whether rituals separate into two distinct Modes, and a PCA and an MDS on individual groups demonstrated whether there are two clusters of groups.

The results were mixed. On the one hand, certain aspects of the Modes theory were corroborated. It was found that the low-arousal ideology spreading rituals indeed have a monotonic increasing number of groups that perform these rituals when the ritual frequency is getting higher, confirming that aspect of the Modes theory. Also, most correlations between the variables tended to be in the predicted direction, confirming that aspect. In addition, the MDS of variables suggested that Doctrinal variables clustered together, and Imagistic variables formed another cluster, indicating some support for the theory. Colouring the individuals on the MDS with values of separate variables suggested again that the 'Doctrinal' variables were arranged in the same direction along the first dimension, lending support for the Modes theory, though not for a few variables that are central to the Modes theory (group size, number of hierarchies). On the other hand, high-arousal rituals did not have a predominantly low frequency, contradicting that aspect of the theory. Most correlations between the variables did not differ significantly from zero, negating that aspect of the theory as well. Three to five components were found for the PCA of variables, indicating that NSAGs cannot be simply placed on the dimension Imagistic-Doctrinal. No bi-modal distribution of (semi)continuous variables was found, negating an arrangement of NSAGs in non-overlapping Modes. In addition, the majority of groups did not have Doctrinal rituals only or Imagistic rituals only. And finally, groups did not cluster in two clusters, neither in the PCA, nor in the MDS.

All in all, it can be said that certain *aspects* of the Modes theory were confirmed, whereas the main claim —a division of armed groups into two distinct Modes— was not. The minimum argument that can be made is that whereas Whitehouse & McQuinn (2012) found clear patterns when using five groups, those clear patterns disappeared when a sample of ten times more groups was used. This suggests that either the methodology followed here was insufficient to demonstrate that armed groups as a whole are organized along the lines of the two Modes, and/or that the Modes theory does not apply to the level of entire armed groups.

Yet, one issue was still left unaddressed in both the Whitehouse & McQuinn (2012) study and this chapter: Galton's problem. That was partially for space reasons, but also to be able to ascribe potential differences with the Whitehouse & McQuinn (2012) study to sample size only, unobscured by other techniques; to be able to keep analyses that could not be corrected for Galton's problem comparable with those that can; and to be able to see the influence of different solutions to Galton's problem, which might be worth a dedicated chapter — the next one.

Chapter 4 addresses the question: To what extent can the two Modes be found amongst non-state armed groups (NSAGs) when corrections for Galton's problem are being used?

In the dataset as used in this study, the data points (NSAGs) are not independent because NSAGs interact in various ways; for instance, they inspire each other, split, merge, trade, etc. Most statistical tests assume in first instance independence of data points. Hence, applying statistical analyses that assume independence of data points on non-independent data points ('autocorrelated data') may give spurious results. It is therefore desirable to repeat the study of the previous chapter, but now with corrections for interrelatedness / autocorrelation. By and large, this chapter is subdivided in two conceptual parts: start with investigating to what

extent groups are related to each other and to what extent there actually is a "Galton's problem"; then make corrections for that, where necessary and possible.

First, it was assessed via which relation types the individual Modes properties were transferred between the groups in the sample, if at all. Data on relation types, such as 'explicitly inspired by', 'got leader(s) from', etc., and the duration and intensity of these relations between groups were added to the sample. A network matrix of relations between all groups was constructed from those data. With Moran's I, and after Holm adjustments, it appeared that none of the Modes properties was significantly autocorrelated for any relation type. Also unadjusted, no relation type influenced many variables. That strongly suggests that no single relation type is responsible for "Galton's problem" / autocorrelation.

Second, it was assessed which Modes properties were (most) influenced by the interrelatedness; this was again done using Moran's I. It appeared that especially the 'number of Doctrinal ideological properties' was autocorrelated, and to a lesser extent the 'religiosity of the explicit ideology'. The majority of the Modes properties were not autocorrelated.

Generally, the correction methods that are used to correct for autocorrelation are based on a covariate, often a category like geographic proximity or the broad religious tradition that groups had in common, etc. Here, all groups were categorized into various geographical world regions that constituted the covariate. It was shown that this covariate had a reasonably good match with the Modes variables that appeared to be autocorrelated, so that using this region is probably a workable proxy to model autocorrelation. However, most, if not all, statistical techniques that use covariates are regressions or correlations. This study uses more types of analyses than those two types of statistical models only. This study overcomes the limitation that regressions and correlations are the only type of analysis that can be used with geographic proximity or other network data, by developing a two-step correction

method that allows for many other types of analyses, like Spearman correlation matrix, a PCA and an MDS as used in the previous chapter.

Thirdly, with these techniques in place, the question of whether the Modes variables relate to each other as predicted was re-addressed. It was found that the correlations between Modes variables were perhaps slightly weaker and less often significant, and that the direction of correlation was also slightly less often according to the prediction. The related variable PCA and variable MDS were also slightly less in support of the Modes theory. Neither the bi-modality test, nor the PCA of the individuals nor the MDS of the individuals gave convincing evidence of two clusters of groups.

The suggestion that follows from this research is that perhaps the Modes variables by and large might relate to each other as expected, but that this does not necessarily lead to two attractor states. Evidence suggests that at least for armed groups, there is a smooth gradient of properties, not that there are divergent Modes.

Chapter 5 addresses the question: In what way is the type of resource extraction of NSAGs related to the two Modes?

Publications on the Modes theory make occasional reference to, and very general suggestions about, the hypothesis that the Modes might be adaptations to solve various collective action problems, including resource extraction (e.g. Whitehouse 2004, 77–8; Whitehouse and Hodder 2010; Whitehouse and Lanman 2014, 681–3; Whitehouse, Francois, and Turchin 2015). Indeed, there is some empirical evidence for a link between the Modes and resource extraction, notably the intensity of agriculture (Atkinson and Whitehouse 2011). However, the Atkinson and Whitehouse (2011) study was done in the context of historic non-pacified societies; moreover, the statements of the general Modes theory about the link between Modes and different types of resource extraction are formulated in very broad strokes, leaving uncertainty about the contexts and operationalization about this link, and the

statements were invariably formulated in terms of 'hunting vs. agriculture', which is not exactly what one would expect for armed groups. The question remains to what extent this link between the two Modes and their respective resource extraction typology can be found amongst NSAGs, and how to operationalize it. As a starting point and to make the predictions more concrete regarding NSAGs, the Beardsley & McQuinn (2009) 'Predator Profile Matrix' (PPM) theory was used. It looks promising to link that theory with the Modes theory given the resemblance between the two. The PPM theory states that well-organized, hierarchical, ideological groups (~Doctrinal groups) tend to provide social services for the local population to be able to do long-sustained taxation, whereas localized, less well-organized groups without much ideology (~Imagistic) tend to rely on looting and natural resources more often. In addition, the PPM theory hypothesizes that armed groups in general tend to maximize their Return on Investment (ROI). Despite the more concrete translation to the context of NSAGs, the Beardsley & McQuinn (2009) article has a few limitations as well: only two cases (groups) were presented to support the theoretical argument, they were presented in a discursive way and were not fully operationalized, and the theory was lacking the influence of Risk on resource extraction.

Hence, a theory about the Risk of resource extraction was developed first. To operationalize the ROI and Risk, a literature study was conducted to make a list of types of resources that NSAGs are using, and this list was checked by several experts on NSAGs. The sample of 50 armed groups was extended with data on the type of resources that were used by the armed groups, for how long and to what degree per armed group. A method was developed that enabled the conversion from resource types to ROI and Risk indices, which were calculated per group.

First, it was asked what the most prevailing resource types are for armed groups. Resource types were counted per group and per 'Degree of reliance' (i.e. 'minimal', 'moderate', 'substantial', etc.), weighted for the duration of usage. It appeared that the resource type that was used the most was 'local support / voluntary contribution', and that the top five of resource types as used by armed

groups were all population based — be it voluntary or coerced, be it locally or in diaspora. A test was done to see whether the consistency in usage of resource types had any relation to the Risk, as assessed per resource type. There was no convincing relation between the two. There was no indication that armed groups typically favour either low, medium or high ROI or Risk resources.

Second, it was investigated whether the ROI of resource usage is increasing and the Risk of resource usage is decreasing over time. Stacked plots of low, medium and high ROI and Risk showed no obvious change over time. A regression was used to further test this. All regressions with a geo-cluster correction had a better model fit (lower AIC) than without geo-cluster correction. However, despite that, none of the slopes was significant after Holm adjustments. Without Holm adjustments, the slopes that were most consistently significant indicated that Resource types with a high 'Risk to lose the resource' tend to increase over time.

Third, it was assessed in what way resource extraction is related to individual Modes properties. Initially, the research question of this chapter would have asked to what extent the two Modes are linked to two different types of resource extraction. This can no longer be answered precisely in that way, given that the two distinct Modes were not found in the first place. Hence, the question for this chapter is changed so that relationships between resources and individual Modes properties will be investigated, rather than between resources and complete Modes *per se*. All combinations of the low, medium and high ROI and Risk to obtain and Risk to lose a resource were used as IVs in a regression as predictor for every individual Modes property. The regression with the lowest AIC for every Modes variable was assumed to indicate which scores of ROI and Risk could best predict a Modes property. Within these regressions, significant p-values for every predictor variable were assessed. When Holm adjustments were applied to these p-values, only two IV-DV combinations were significant, namely a low ROI consistently predicted the number of social services provided ($\beta=0.11$), in accordance with the Modes theory, and a medium Risk-to-lose a resource type nearly consistently predicted the number of

shared negative experiences, though with a much smaller slope (β= -0.018). However, with or without Holm adjustments, there was no single predictor, be it 'low ROI' or 'medium Risk to lose a resource' or any other combination, that consistently predicts either Doctrinal Modes properties or Imagistic Modes properties.

Relating individual Resource types to individual Modes properties, overall and after Holm adjustments, it was not found that any Resource type related to any Modes variable, perhaps with two exceptions: using Spearman rank correlations, 'taxation of the local population' was significantly correlated with 'installing a law'; and using regressions, 'booty/looting of civilians' was a positive predictor for the 'number of Imagistic rituals'. Without Holm adjustments, there was a mild support for the Modes and the PPM theory, with significant positive relations between for instance the 'number of Imagistic rituals' and 'booty/looting of civilians'. All in all and overall, though, the general impression is that the analyses of the relationship between resources on the one hand and Modes properties on the other do not give results that support the predictions.

Chapter 6 is the final discussion chapter, mainly focusing on proposals for future research. That is done at two levels: recommendations based on what seems to directly flow out of the current thesis, and more broader suggestions for researching the Modes, or even human culture at large.

Throughout the results chapters, various suggestions were made for a potential next increment of the current research. The most important ones of these are presented as one combined list. They are: to research subgroups within armed groups, in search of more Imagistic properties; to improve data quality by using more data sources per group and more assessors per conversion (e.g. from resource type to ROI); to do a similar study in other types of groups, for example on historic non-pacified societies in the eHRAF dataset; to expand the research on relations between groups, that is, to focus on "Galton's asset" rather than "Galton's problem"; to

improve the resource research, for instance by including local resource availability and by making more explicit links with existent research on resources and armed groups; to compare the Modes theory in the context of armed groups with other theories that try to explain the dynamics and structure of armed groups in relation to resources, most notably Weinstein's (2005) recruitment theory; and to expand the database created for this project into a data hub for all datasets concerning War and Peace.

The largest part of the final chapter will be dedicated to a critical evaluation of some aspects of the Modes theory, and suggestions to improve both theoretical rigorousness and empirical support will be given.

Much emphasis in the first two decades has been put on cognitive aspects, notably memory, and on religion. However, it seems the emphasis of the Modes theory no longer is on two types of memory as the most important two psychological mechanisms underlying the two Modes, but now on fusion and group identification; and that the emphasis is no longer on two types of religion, but rather on adaptation to two types of resource extraction, with group selection as main selection level instead of the structure of human memory as the selection force.

First, it will be evaluated what the research on armed groups would look like if the original religious outlook of the Modes theory were to be vindicated. That does raise a question, though, whether the Modes theory in its original form would be the most fruitful way to research religion amongst armed groups. Second, because the Modes theory now seems to make stronger evolutionary claims, it is suggested that it should deliver stronger evolutionary proofs. Three ways to do that are offered by this thesis: addressing all four of Tinbergen's question (Tinbergen 1951, 1963), manly expanding the phylogenetic research (what is the starting point of Modes properties, akin to "Galton's asset"); implementing Brandons five criteria (Brandon 1990) for a proof of adaptation; and expanding the multi-level selection research. Third, it will be discussed to what extent the Modes theory has something to say

about cohesion, and whether the hypothesized two underlying psychological mechanisms —fusion for the Imagistic Mode, group identification for the Doctrinal Mode— are necessary and especially sufficient concepts to explain cohesion or the existence of Modes. The suggestion is made to include more types of psychology, and perhaps social mechanisms, to explain the Modes' existence and structure. Finally, it is argued that if the two Modes are an adaptation to two broad strategies of resource extraction —call them hunter-gatherer and agriculture— and if it is acceptable to make two ideal types —call them the Imagistic and the Doctrinal Mode— then it is plausible that there could be a third Mode: one that is adapted to the type of resource extraction of fossil fuels (tentatively called the 'Experiential Mode'). A sketch of the structure of that third Mode will be given.

The final parts of this thesis consist of a critical evaluation of some of the concrete tenets of the Modes theory —all of which can be found in the Appendix— and an overview of the contributions of this thesis.

Chapter 1 – Theory

Armed groups show a remarkable difference in aims, methodology, organizational capacity, longevity and firing power. Yet, there also seem to be commonalities. What explains these differences, when and where are groups similar?

The Modes theory states that armed groups are by and large ordered along the lines of two organizational Modes, the 'Imagistic' and the 'Doctrinal' Mode, with little overlap. Whilst the application of the Modes theory in the context of armed groups is a relatively recent idea, the Modes theory itself has a history of more than two decades. It comprises a suite of theories, predictions, hypotheses, and empirical results, backed up by an active research program.

Initially, the Modes theory was nearly entirely conceptualized in religious terms: it was inspired by religious dynamics (Whitehouse 1995), it was conceived as a theory of religion (Whitehouse 2000, 2004; Whitehouse and Laidlaw 2004; Whitehouse and Martin 2004; Whitehouse and McCauley 2005; Whitehouse and Hodder 2010), it claims to have the aim to explain religion (Whitehouse 2004, and see tenet 0 in Appendix 2), and various arguments rest on religion (see Appendix 2, esp. tenets 0.x – 3.x). However, in more recent years the theory was applied to domains outside of religion. Several statements in the Modes theory do not deal with religious content but rather with human behaviour, general human psychology, and social structure. That means that in principle (those parts of) the theory could be applicable to non-religious contexts as well. For instance, ideas about social cohesion in general (Whitehouse and Lanman 2014; with a precursor in Whitehouse 2011), forms of social complexity (Turchin et al. 2012; Whitehouse et al. 2013; Whitehouse, Francois, and Turchin 2015; with a precursor in Atkinson and Whitehouse 2011) and pathways to extreme group cohesion (Whitehouse et al. 2014) are now also being studied with the Modes theory as guide.

The domains outside of religion that are the most important for this thesis are inter-group conflict and resource extraction. The Modes theory in its older form made some cursory reference to inter-group conflict and violence (Whitehouse 2004, 124–5), but in recent years one dedicated publication tried to predict forms of inter-group conflict along the lines of the Modes theory: Whitehouse and McQuinn's (2012) "Ritual and violence" book chapter. That publication lays out the arguments why and how armed groups can be categorized along the lines of the Modes theory. Somewhat of a precursor to that publication was the second publication that is used as a starting point in this thesis, Beardsley & McQuinn's (2009) article, where a broadly similar pattern in group organization was noticed as in the Modes theory -though not called 'Modes-, yet, a distinct set of hypotheses was proffered regarding the link between the type of group organization (~Modes) and the type of resource extraction. In what follows, for brevity of writing, those two articles will be referred to as 'target publications' where applicable. Before those two articles are discussed, first the most important aspects of the general Modes theory are presented. These aspects form the background to the hypotheses being tested and research questions being asked.

The Modes theory in its general form[1]

The Modes theory states that there are two distinct Modes of group organization, labelled 'Imagistic' and 'Doctrinal'. It further states that these Imagistic and Doctrinal Modes constitute *universal* features of group formation (Whitehouse, Francois, and Turchin 2015; Appendix 2, tenet 3.3). In brief, the Imagistic Mode is thought to consist of small groups without elaborate standardized ideology, without a central leader who spreads a semantic worldview, with few hierarchical levels, and with highly arousing rituals that are performed in a low frequency (once or a few

[1] One of the contributions of this thesis is to provide a complete and formalized formulation of the Modes theory. It is placed in Appendix 2 to save space in the main body of text and to keep the flow of the discussion.

times per lifetime). The Doctrinal Mode is thought to consist of large groups with an elaborate standardized ideology, with a central leader spreading the semantic worldview, various hierarchical levels, and high frequency low-arousal rituals that spread the semantic worldview.

Until about a decade ago, perhaps culminating in Whitehouse and Laidlaw (2004) and Whitehouse (2004), the thought was that there are two Modes -and not one, three, or more- because ritual frequency and ritual arousal are shaped, if not determined, by principles of selection (Whitehouse 2004, page 74, 148; and see Appendix 2, tenet 3.11), whereby the selection force is the structure of human memory (*id.*: 17-22, 144-8). Human memory, in its turn, was thought to come in two forms: 'flashbulb' memory and 'semantic' memory (Apdx. 2, tenet 2, 2.1). Flashbulb memory can store experiences with great personal consequence, whereby the probability of storing those experiences gets higher when the experience is more emotionally arousing (tenet 2.18.3). Semantic memory can store general facts about the world, though these facts do not, in first instance, need to have much personal consequence, and the learning experience can generally not be traced back to a particular event (tenet 2.2). Those two types of memory processing were thought to give rise to a series of psychological and social dynamics that —in interaction with each other— ultimately form two 'attractor states' (tenet 3.9). One example of this line of thought is that low-frequency rituals can be stored in flashbulb memory when they are highly arousing, because such rituals will be experienced as meaningful and with personal consequence. However, when they would be in the form of a doctrine they would be forgotten quickly when they were low-frequency and low-arousal. Because low-frequency high-arousal rituals do not create a semantic web of understanding, and because low-frequency low-arousal rituals with semantic context will be forgotten, there is no way a central preacher of doctrine can meaningfully exist in a situation with low-frequency rituals only. As a result, the ideology cannot spread quickly, personal experience rather than a taught worldview is the basis for group dynamics, and groups tend to remain small. Conversely, frequent repetition of

teachings allows for the establishment of explicit and intricate verbal knowledge in semantic memory (*id.*: 66). This makes a meaningful existence of a central preacher possible, oratory techniques enable a quick spread of the ideology to large groups of people which are thereby homogenized in their beliefs, and large groups are possible, which can be managed from a central point.

Such features of both Modes are, within a Mode, mutually reinforcing (*id.*: 70; tenet 2.11, 2.30, esp. 3.8). According to Whitehouse (2004: 74) the consequence is that Modes constitute attractor positions around which ritual actions and associated concepts cumulatively tend to cluster (tenet 3.14). As a result, there is hardly any overlap between the two Modes (tenet 2.1). Still, the Modes are in practice rarely purely Imagistic or Doctrinal (*id.*: 75; tenet 3.9). For instance, a group with all the elements of the Doctrinal Mode can also exhibit some of the features of the Imagistic Mode, or some rituals may be low-frequency low-arousal, other rituals may be frequently performed but lack exegesis, or the Doctrinal corpus is largely confined to elites, etc. In reality, there is a *tendency* for human groups to gravitate towards divergent attractor positions (*id.*: 75-6; tenet 3.9). In addition, interacting Modes can exist when large populations are composed of many locally distinctive ritual communities (*id.*: 76; tenet 3.16). The cohesion of locally distinctive communities —the Imagistic Mode— may readily be projected onto a wider religious community —the Doctrinal Mode— (*id.*: 76; tenet 3.17).

Condensed into one table, the Modes theory reads as follows (*id.*: 74 — Table 4.1, order of Imagistic and Doctrinal column swapped):

Variable	**Imagistic**	**Doctrinal**
Psychological features		
Transmissive frequency	Low	High
Level of ritual arousal	High	Low
Principal memory system	Episodic / flashbulb memory	Semantic schemas and implicit scripts
Ritual meaning	Internally generated	Learned / acquired
Techniques of revelation	Iconicity, multivocality and multivalence	Rhetoric, logical integration, narrative
Socio-political features		
Social cohesion	Intense	Diffuse
Leadership	Passive / absent	Dynamic
Inclusivity / exclusivity	Exclusive	Inclusive
Spread	Slow, inefficient	Rapid, efficient
Scale	Small scale	Large scale
Degree of uniformity	Low	High
Structure	Non-centralized	Centralized

Table 1.1 — The main properties of the Modes

According to Whitehouse (2004: 75), it would make no sense to try to single out any one of the psychological causes as somehow prior to any of the others; there is no independent variable driving the rest, only a set of conditions that some patterns of human activity manage to satisfy, thus accounting for their cultural success (tenet 3.6). Hence, a Modes variable on itself with a value as specified in one of the two Modes columns (see table above) cannot be said to be either Doctrinal or Imagistic (*id.*: 75; tenet 3.7); it is rather the *clustering* of values of the variables that make a Mode what it is.

There are some take-away points from this section that are important for the empirical chapters, especially chapter 3 and 4; in the final chapter (6), these points will be critically discussed in the light of the findings. The take-away points are:

a. There are two universal Modes of group formation, labelled 'Imagistic' and 'Doctrinal' (t 3.3)
b. The Imagistic Mode has small groups, few hierarchical levels, high-arousal low-frequency rituals, no standardized ideology, no central leader, and what ideology there is cannot spread quickly (t 3.1)
c. The Doctrinal Mode has large groups, several hierarchical levels, low-arousal high-frequency rituals, a standardized ideology, a central leader, and the possibility of a quickly spreading ideology (t 3.1)
d. There is an inverse correlation between ritual frequency and ritual arousal (t 3.10)
e. These internal features of the Modes are mutually reinforcing; as a result, there is hardly any overlap between the two Modes (t 3.8)
f. However, the Modes are in practice rarely purely Imagistic or Doctrinal (t 3.9)
g. Interacting Modes can exist when large Doctrinal populations are composed of many locally distinctive Imagistic ritual communities (t 3.16)
h. Of the Modes properties, there is no independent variable driving the rest, but they should be seen as a clustering set (t 3.14)

Yet, in the last decade, the Modes theory de-emphasized the causal influence of memory, and instead brought the psychological mechanisms of fusion and identity to the fore. Additionally, the Modes theory de-emphasized memory as selection force, and instead brought group-level Collective Action Problems to the fore as selection force. This updated outlook of the Modes theory will be the topic of the next section.

Fusion and identification – solving Collective Action Problems

According to more recent versions of the Modes theory, two of the major Collective Action Problems (CAPs) that groups are facing are inter-group conflict and resource extraction. These problems are thought to be mitigated by the psychological processes of 'fusion' and 'group identification', as they create more cohesion within

groups. According to the research on fusion (Swann Jr et al. 2009; Swann, Gómez, Dovidio, et al. 2010; Swann, Gómez, Huici, et al. 2010; Gomez et al. 2011), when individuals are 'fused', social identity becomes an essential part of the individual's self-concept (tenet 4.8.1); when a group member is threatened, it prompts the same defensive reactions as a personal attack or an attack on one's kin (tenet 4.8.2); since social identities are essential parts of fused individuals' personal self-concepts, physiological arousal of the individual translates into pro-group action (tenet 4.8.3); and fused individuals demonstrate a significant willingness to sacrifice themselves for their group (tenet 4.8.4).

It is hypothesized that three psychological processes underlie identity fusion and its ability to explain costly altruistic action: kin detection through phenotypic matching (Whitehouse and Lanman 2014, 676), shared negative experiences (Jong et al. 2015; Whitehouse et al. 2017), and the construction of self-concepts through episodic memory (id.) (tenet 4.9). These processes create the link with the Imagistic Mode (tenet 4.19). The later iterations of the Modes theory hypothesize that through participation in collective dysphoric rituals, persons become 'fused' with each other, so that participating group members are not perceived as mere co-operators, but as psychological kin (tenet 4.11, 4.12). Hence, personal and group interests and destinies are aligned, and threats to the group are experienced as threats to self. It is hypothesized that in the course of cultural evolution, collective rituals involving shared dysphoria hijacked this mechanism favouring the survival of groups with an "imagistic mode of religiosity" facing collective actions problems involving high risk and strong temptations to defect (Whitehouse and Lanman 2014, 683; and see tenet 4.19 in Appendix 2). It is this mechanism that creates in the Imagistic Mode the link with CAPs, because individual group members are more prone to be altruistic to each other as the result of it, increasing the chance that cooperation is achieved.

Group identification, on the other hand, involves categorical rather than relational ties with others (Whitehouse and Lanman (2014), and Appendix 2, tenet

4.17 and 4.18). Hence, when someone is identified with a group, that person is not perceiving other members as unique individual persons, but simply as anonymous members of the same social category who share certain prototypical characteristics with other group members, such as the group's beliefs, practices, and values; those features are not essential to their individual, personal identities (tenet 4.17.1-2). The Modes theory states that group identification can be amplified by perceptions of threat and uncertainty and by witnessing others displaying strong commitment to the prototypical norms of the group. Group identification can produce prejudice and preferential cooperation (tenet 4.17.4), but it is relatively weak in producing the extreme pro-group behaviours as seen with fusion (tenet 4.17.6).

Rituals can assume a potentially infinite range of forms, hence, they can serve as very distinct group markers, enhancing the possibility to categorize based on behaviours and appearance (tenet 4.20). The problem of monitoring the reputations of others and decide whom to trust can be addressed by external mnemonics (e.g., writing and record keeping), the postulation of morally concerned and punitive deities, and the spread of more costly credibility enhancing displays like regular ritualized behaviour but also (monetary) contributions to a common pool (Whitehouse and Lanman 2014, 680) (tenet 4.24). All of this is part of the Doctrinal Mode; hence, the Modes theory states that the Doctrinal Mode enables one to monitor and increase trust with otherwise complete strangers who did not share important parts of one's life history (tenet 4.22). In this way, otherwise disaggregated patches of people are homogenized under the same ideological umbrella, with the same worldview, the same perception of the past and future of the world, and the same values, so that the behaviour of large groups of people can be aligned. Added to it that the Doctrinal Mode can incorporate hierarchies which can increase the span of control, and it can be surmised that the Doctrinal Mode offers its own tools to mitigate or solve the collective action problems of inter-group conflict, in which larger size and better coordination gives a higher probability to win, and large-scale resource extraction.

Resources

In the Modes theory publications, general descriptions were given how the two Modes could be adaptations to different types of resource extraction (see also Appendix 2, statements 5 - 5.14, with the following summary of that section from Whitehouse (2004, 77–8), Whitehouse and Hodder (2010), Whitehouse *et al.* (2012), Whitehouse and Lanman (2014, 681–3), and Whitehouse, François and Turchin (2015)):

Whilst egalitarian foragers in resource rich environments in general seem to have relatively simple rituals, this might no longer be sufficient when there are increasingly harsh conditions that require dangerous collective strategies of resource extraction (tenet 5.1-2). The Modes theory hypothesizes that hunting large and dangerous game and warfare are two prime examples of collective action problems that present individuals with strong reasons to defect and free-ride on the risky actions of others (tenet 5.3). Facing such problems, intense cohesion amongst group members is required to make group members more altruistic, which might be provided by the bonding rituals of the Imagistic Mode (tenet 5.3).

Conversely, large-scale farming (and large-scale warfare) require a complex division of labour. In that situation, the risk of defection and the requirements for coordination are different (~tenet 5.7). If individuals with no experience of one another are to trust each other enough to cooperate, then shared beliefs, values, and other identity markers are required. If societies dependent upon such strategies are to flourish, they must possess some method by which to transmit these shared norms (tenet 5.7). The theory hypothesizes that large-scale agricultural societies with seasonal labour and an increasingly complex nature of social cooperation may well have fostered the routinization of ritual and the centralization of religious authority, allowing other core elements of the Doctrinal Mode to coalesce (tenet 5.8). With the invention of agriculture, so the theory hypothesizes, larger and denser populations

no longer needed costly dysphoric rituals to bind together a band of brothers for the purposes of defence or hunting. The groups that flourished and spread were those that could overcome local divisions by eliminating or tamping down imagistic tendencies and cultivate instead a sense of shared identity ('identification') on a much larger scale (tenet 5.9).

As such, the Doctrinal Mode is thought to be adaptive for groups seeking to pool small amounts of resource from individuals in a much larger population so as to create a large, centralised resource in the form of charitable donations, legacies, tax or tribute – for example, when competing coalitions are organized via categorical ties of caste, race, ethnicity, or belief (tenet 5.11).

Indeed, an inverse correlation between rare, dysphoric rituals and levels of agricultural intensity has been found for historic non-pacified societies (Atkinson and Whitehouse 2011), suggesting a link between a society's mode of resource acquisition and the frequency and emotionality of its rituals (tenet 5.6).

All in all, the Modes theory states that different societies require higher or lower levels of fusion or identification to fulfil their basic material and economic needs in diverse resource environments, and the two Modes are thought to evolve, through a process of cultural group selection, so that they produce the required levels of fusion or identification (tenet 5.12). The Modes are thought to be adaptations to varying ecological conditions, often including competition with other cultural groups for scarce resources (tenet 5.12, 5.14). This is thought to be the ultimate causation of how and why the Modes of religiosity emerge and spread (tenet 5.13, 5).

War as Collective Action Problem

War has collective benefits and costs, and individual benefits and costs. The Modes theory assumes that typically the costs fall on the individual, and the benefits

on the collective[1]. The thought is that in war, individuals are fighting (or running away); however, the effects of victory (and loss) fall typically on the group level. That is a recipe for making freeriding attractive: one could be inclined to not -or hardly- participate in fighting to avoid death or injury, hoping that the other group members will fight and secure a victory, which then also is beneficial for those who did not contribute. However, if everyone would have such inclinations, victories are few and far between. The two Modes are thought to mitigate the CAP of war each in their own way. In its briefest form, the Imagistic Mode is thought to increase binding between individuals in a group and thought to promote self-sacrifice; this means that there are less defectors in the group (~tenet 5.17.1). The Doctrinal Mode is thought to increase the chances on detecting transgressors and punishing them; and it is thought to ideologically align group members so that group goals are more shared (~tenet 5.17.2).

Again, there are a few take-away points from this literature review as well which are important for what follows in the rest of the thesis (notably chapter 5, Resources, and chapter 6, Discussion) and which will be re-addressed in the final chapter:

i. The psychological state of 'fusion' exists, and leads individuals to sacrifice themselves for the group with whom they are fused (t 4.8)
j. Fusion is the basis for the Imagistic Mode, because fusion can be triggered by shared dysphoric rituals and shared dysphoric experiences (t 4.16, 4.19)
k. When group members are fused, the collective action problem of war and high-risk high-reward resource extraction are mitigated because fusion decreases the

[1] To what extent this is correct will be debated in the final chapter, from page 349 onwards, point 'III'. Here, a charitable stance is taken: to the extent that war is a CAP, the psychological states that the Modes theory proposes might help to mitigate the CAP, and hence the Modes may be useful for warring groups.

chance on free-riding and increases the chance on self-sacrifice for the group (t (5.1-)5.3)

l. Through cultural group selection, a positive correlation exists between warring and high-risk high-reward resource extraction on the one hand and the Imagistic Mode on the other (t 5.4)
m. The psychological state of 'group identification' exists, and leads to a feeling of shared beliefs, values and goals (t 4.17)
n. Group identification is the basis for the Doctrinal Mode, because group identification can be nurtured by regular and consistent spreading of standardized group values, beliefs and practices (t 4.22)
o. When group members are group-identified, the collective action problem of war and gradual resource extraction —when seeking to pool small amounts of resource from individuals in a much larger population so as to create a large, centralised resource in the form of charitable donations, legacies, tax or tribute— are mitigated because trust between group members is increased because behaviours of group members can be more effectively monitored (t 4.17.2, 4.23-4.24, 5.11)
p. Through cultural group selection, a positive correlation exists between warring and low-risk low-reward resource extraction on the one hand and the Doctrinal Mode on the other (t 5.11)

War and resource extraction are the two main collective action problems with which this thesis is concerned, and both Modes offer their own way of dealing with the challenges of these. That suggests that the general Modes theory offers promising, if not compelling reasons to have a closer look at the context of group conflict and resource extraction.

As a guideline to do so, two relatively recent publications will be used to make this more concrete: Whitehouse and McQuinn's (2012) "Ritual and Violence: Divergent modes of religiosity and armed struggle", which deals with the Modes per se amongst armed groups, and Beardsley and McQuinn's (2009) "Rebel groups as

predatory organizations: the political effects of the 2004 tsunami in Indonesia and Sri Lanka", which deals with resource extraction. Both of these publications will subsequently be discussed in more detail below.

The Modes theory and armed groups

In a preliminary publication, Whitehouse and McQuinn (2012) applied the Modes theory to concrete armed groups in civil war. As a first step, the authors took some distance from the religious outlook of the Modes theory by stating that "[a]lthough the term 'modes of religiosity' suggests that the target domain of the hypotheses above must be 'religion' rather than any other type of organization, the DMR theory is more accurately understood as a theory of modes of ritual group formation." (p. 5). Instead, they argued that the Modes theory "can be extended to explain recurrent features of ritual traditions that lack many or all beliefs typically labelled 'religious'" (p. 6). Rituals were interpreted somewhat loosely, and could be represented by e.g. fierce introduction rituals like killing a family member (indicating an Imagistic ritual), or daily Marxist training (indicating a Doctrinal ritual), etc. Similarly, a central proselytizing leader no longer needed to be a religious leader, but could be preaching any type of ideology. By making such generalizations, the Modes theory and categories were applied to five rebel groups, to see how well the theory matched the groups and vice versa: FARC, AUC, Hezbollah, CPN-Maoist, and the RUF. Of these groups, the AUC and RUF were categorized as being Imagistic; the FARC, Hezbollah and CPN-M were categorized as being Doctrinal. The following examples might illustrate why (summarized from Whitehouse and McQuinn 2012).

As an entry requirement for RUF, recruits were forced to murder someone, possibly a family or community member, or at least witness a murder. This was 'augmented by periodic acts of group violence like public executions' and 'systematic drugging of recruits with stimulants also served to heighten the emotional and physical experience'. This is a set of highly arousing (mostly dysphoric) rituals forced

upon recruits. The only ideological writing that was produced was copied from another group; no further publications or exegeses were produced. As Whitehouse & McQuinn (2012) notice, commentators highlighted the lack of ideology of the RUF. While evidence was sparse, interviews with former combatants suggest that each subgroup was autonomous with little shared sense of common identity. In addition, the RUF had only a minimal hierarchy.

A similar analysis was applied to the AUC, suggesting that they used killing of a friend (a highly negatively arousing entrance ritual) as *rite de passage*; that they did not have an elaborate body of written text; no ideologues; lack of centralized leadership; autonomous sub-units; lack of sophisticated hierarchies (<8 levels); and a wide variation in the explanation of AUC members with respect to the purpose and meaning of the homicidal initiations[1].

In contrast, the FARC, CPN-M and Hezbollah provided quite a different picture. To take the example of Hezbollah, it has an elaborate ideology and emphasizes its unity as a movement. A well-honed ideological machine extends recruitment to the Shi'ite community. The movement provides daily political, ideological and normative training. Group symbols like flags and clothing colours are highly standardized. In Hezbollah-controlled areas, daily prayer and regular mosque attendance prevails in which religious and political doctrines are intermingled. Ideologies are transmitted via print, internet, radio, a TV network and public speeches. Unauthorized ideological innovations are sanctioned. Hezbollah has a well-organized hierarchical structure with clearly separated, specialized departments. It can organize attacks with new military technologies, but it is also able to run a newspaper, radio, TV network, to set up schools and hospitals, distribute food to the Shi'ite community, etc. Through these channels, through sermons in mosques and through prolific writing of imams, the

[1] Note that the variation in explanation of the purpose and meaning of homicidal initiations is different from variation in explanation of the group's purpose.

central leaders are able to reach and recruit large groups quickly and efficiently and to shape their perceptions. Hezbollah's hierarchy is a structured, many-level organization with specialized departments, quite different from the loosely unified RUF, as indicated above.

Similar analyses were applied to the FARC and CPN-M, suggesting that they used explicit and standardized (communist) teachings; daily political and ideological training; taught group norms; recognized leaders of collective rituals; elaborate and repetitive sermonizing of gathered combatants; prolific writers and theorists; elaborate ideologies; elaborate hierarchies (12-17 levels); specialized social service organizations; central leadership; mobilization of local communities under a unified leader and ideology; and modern mass-communication.

They summarized these findings in a table somewhat similar as given in Whitehouse (2004, 74; table 4.1) (see above, page 25), however, without subdivision into psychological and socio-political features, without the 'principal memory system' and 'ritual meaning' in the psychological features, and without 'leadership', 'inclusivity/exclusivity' 'degree of uniformity' or 'structure' in the socio-political features, but with 'social structure (hierarchy)' added. When an attempt was made in this thesis to keep the labels for the 'Variable' the same as for the general theory (which renders a few empty categories), the table yields:

Variable	**Imagistic**	**Doctrinal**
Psychological features		
Ritual frequency and arousal	Rarely performed dysphoric ritual ordeals (with little or no doctrinal transmission)	Daily collective rituals (including doctrinal repetition)
Principal memory system	-	-
Ritual meaning	Meaning of rituals inferred independently	Transmission of exegesis to all members
Techniques of revelation	-	-
Socio-political features		
Social cohesion	Intense, based on relational ties	Diffuse based on categorical ties
Leadership	-	-
Inclusivity / exclusivity	-	-
Spread	Slow or fragmentary	Fast, efficient, homogenous
Scale	Small, face-to-face communities	Large "imagined communities"
Degree of uniformity	No standardized ideology / dogma	Standardized body of ideology / dogma
Structure	Authority exercised personally rather than institutionalized	Highly elaborated hierarchy with designated ranking of offices

Table 1.2 — The predicted Modes properties of armed groups

The five example groups were placed in this table to check, or even demonstrate, how well they fit either the Imagistic or the Doctrinal Mode (adapted from Whitehouse and McQuinn 2012):

Variable	Imagistic					Doctrinal				
	AUC	RUF	CPN	FARC	Hezb.	AUC	RUF	CPN	FARC	Hezb.
Ritual frequency and arousal	High arousal / low frequency					Low arousal / high frequency				
	✓	✓	×	×	N/E	×	×	✓	✓	✓
Codification	Absent or stagnant					Elaborated ideology				
	✓	✓	×	×	×	×	×	✓	✓	✓
Exegesis	Not transmitted					Transmission to all members				
	N/E	N/E	×	×	N/E	N/E	N/E	☑	☑	N/E
Scale	Autonomous					Imagined community				
	✓	☑	×	×	×	×	☒	✓	✓	✓
Spread	Group oriented / inefficient					Fast, efficient transmission				
	☒	☒	×	×	×	×	×	✓	✓	✓
Structure	Less elaborated hierarchy					Highly elaborated hierarchy				
	✓	✓	×	×	×	×	☒	✓	✓	✓
Cohesion	Intense					Diffuse				
	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E

Legend: ✓ = strong evidence for prediction; ☑ = weak evidence for prediction; × = strong evidence against prediction; ☒ = weak evidence against prediction; N/E = no evidence.

Table 1.3 — Matching predicted Modes properties with specific armed groups.

All in all, signs are there that when armed groups are analysed at the level of the entire group with aid of the Modes properties, that indeed patterns do emerge: the suggestion is there that armed groups are by and large structured according to either of the two Modes, with little overlap in between. The question is whether such preliminary evidence can also be found regarding resource extraction of armed groups.

Resources

According to Whitehouse & McQuinn (2012), not only do the Imagistic groups of RUF and AUC have different social typologies compared to the Doctrinal groups of Hezbollah, FARC and CPN-M, they also have different challenges to obtain resources. For instance, the resource extraction of the RUF requires not much investments, certainly not in the 'hearts and minds' of the local population, because their main resource —surface diamonds— is concentrated on one or a few locations and relatively easy to extract without much support. They argue that an Imagistic group with very few service organizations —but instead nearly all group members dedicated to fighting— and few hierarchical levels is the most adaptive for such localized, high-value resources. They contrast this with the CPN-M, where the primary income are donations and 'taxes' from the local population, to be collected in difficult and rugged terrain over a wide area. That requires a high degree of organization and a consistent collection of many small resources to create one large pool of resources. Without the CPN-M's ideology and discipline, they argue, there was a small chance the organization could have obtained all necessary resources.

A part of this argument was based on, or at least linked to, an earlier article (Beardsley and McQuinn 2009) that argued that insurgent groups in civil wars can be placed along the two dimensions of the so-called Predation Profile Matrix (PPM). This matrix places on one dimension the Return On Investment (ROI) and on the other the territorial objectives of the group. ROI may be characterized as "the ratio of resources gained from an investment relative to the amount invested" (Beardsley and McQuinn 2009). In the matrix, the ROI scale is simplified to 'Resource-based' versus 'Community-based' resource extraction strategies. Resource-based strategies typically entail extraction from high-value localized sources like surface diamond mines and timber, whereas Community-based extraction strategies typically entail voluntary or forced contributions of the local population to the insurgent group. The second dimension with the territorial objectives of the group distinguishes either

'localized' or 'national' objectives, expressing which part of the country the group seeks to control (secession or overthrow of the ruling government). Intersecting the two dimensions gives the four quadrants depicted below (adapted from Beardsley and McQuinn 2009):

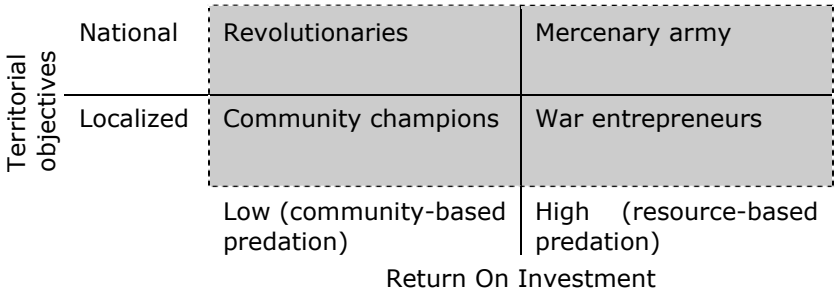

Figure 1. 1 - The Predation Profile Matrix

Although the authors argue that insurgent groups can be placed into one of these four quadrants or at least along the two axes, they focus on one axis: the relationship between resource extraction and group structure. In that domain, they make a few predictions:

- Groups strive to maximize their ROI. If a group starts with a low resource extraction strategy but is able to maximize their resource pool, they will do so. Hence, the resource extraction strategy changes towards maximizing ROI. Conversely, if a group starts with a strategy that provides a high ROI but finds itself blocked in continuing that strategy, it will seek to continue it, and only reluctantly adapt to strategies with lower ROI[1].
- Different resource extraction strategies require different forms of organization. Hence, only groups that have a resource extraction strategy matched with their

[1] In practice, groups will often have more than one resource extraction strategy. Given the high-risk and dynamic environments the groups operate in, they tend to increase the amount of time and effort towards the high ROI strategies and away from less efficient ones, without necessarily relinquishing the lower ROI strategies altogether to spread the risk and to make additional money from the lower ROI ones too.

type of organization will be able to continue to obtain sufficient resources, and only those groups will be able to continue to exist. Hence, a match between the type of resource extraction and the type of organization should generally be found in insurgent groups. Moreover, with changing resource conditions, changing forms of organization are expected. In particular, the authors discern three implications for the organizational behaviour of insurgent groups:

- Divergent command structures follow resource extraction patterns. High ROI from concentrated resources allows groups to reduce personnel and complexity of command structure necessary for the extraction and defence of resources. Conversely, low ROI from dispersed sources like accumulated contributions from local populations forces groups to mount a sophisticated organization with greater span of command and territory. More leaders with decision-making powers for local divisions are required; this increases the necessity of doctrines and ideologies to maintain the coherence, discipline and unity of the movement.
- Divergent forms of militarization follow resource extraction patterns. Resources with a greater ROI require greater militarization — that is, a greater part of the group's resources, members and actions is dedicated to fighting, defence and armament. This is because high ROI resources are more easily seized, not only by the group itself, but also by competing groups or the state. These resources are more lucrative to other parties too and their exact location is often known. In addition, the supply lines to markets also require higher levels of defence. Hence, a greater emphasis on defence and violence ensues. Conversely, dispersed, small amounts of resources with lower ROI are harder to poach and need less protection per individual source. In addition, a more elaborate command structure consumes more resources, reducing the means available for militarization.
- Divergent responsiveness to the local community follows from the resource extraction patterns. Groups feeding on high ROI resources have a high level of

militarization yet a weaker command structure and subsequently a lower degree of discipline; hence, they have a higher probability to become a menace to the local population. Given that their resources come from different sources than the local population, they are less dependent on that population and do not need to win over the hearts and minds of the public at large. Conversely, the groups with low ROI extraction strategies are dependent on keeping a sufficiently good relationship with local communities to maintain the resource stream, support, shelter and goodwill. Providing services for the local communication is one obvious way to do this.

When both the group structure and resource extraction strategies of the Predation Profile Matrix and the Modes theory are laid side by side, the hypothesis emerges that the Two Modes and their responses to resource extraction problems can also be found among insurgent groups. As described in Whitehouse and McQuinn (2012), the main resource for the RUF is the yield from surface diamond mining; a high ROI activity. Their form of organization is small-scale and regionally fragmented. The function of every group member is mainly to be a soldier in one form or another, which is another way of saying that the group has a high level of militarization. By randomly performing executions of family and community members and providing no services, their relation to the local population can be characterized as a menace. In short, an Imagistic group linked to a high ROI resource extraction strategy. In contrast, while for instance Hezbollah does get notable contributions from Iran (and formerly from Syria), they also depend on contributions from the local population, a low ROI activity. Their organizational structure has high degrees of sophistication. Given the specialized bodies for social affairs, trade, information, finance, health and education, their degree of militarization is much lower (although their weaponry tends to be more sophisticated than that of the RUF). Additionally, these specialized departments do provide several services to the local population –in the Hezbollah controlled area, that is– so by these means Hezbollah is able to keep the support of

the local population. In short, a Doctrinal group linked to a low ROI resource extraction strategy.

Armed groups, divergent Modes and the level of analysis

The Modes theory states (see above, and see tenet 3.9 in Appendix 2) that religious systems rarely can be found in the 'pure' forms of either Imagistic or Doctrinal, but rather that there is a *tendency* for religious systems to form around either of the two Modes, and that religious systems gravitate to divergent attractor positions. However, the Modes theory also states (see above, and tenets 3.15-3.17 in Appendix 2) that Imagistic sub-groups can exist in larger Doctrinal groups.

When the Modes theory was applied to the context of armed groups, such sub-groups seemed not to have been clearly in the picture. Instead, Whitehouse and McQuinn (2012) start by noting that "[t]he theory of divergent modes of religiosity […] proposes that ritual traditions tend to cluster around two sociopolitical 'attractor positions': the one large scale and hierarchical (doctrinal) and the other highly cohesive but localized or regionally fragmented (imagistic)." (p. 598). They make it more specifically dichotomous by stating that "preliminary research suggests that rebels, whether or not they are religious, typically utilize either doctrinal or imagistic dynamics rather than exploiting both modes at the same time", and that there is "detailed evidence that the five rebel groups in our sample cluster around one or other of these respective modes, but not both" (p. 605).

Such statements strongly suggest there is no -or hardly- a mixed version of the Modes for armed groups. When referring to the PPM theory, they note that "[the] matrix […] creates four categories of groups: war entrepreneurs, mercenary armies, community champions, and revolutionaries. Preliminary research suggests that when armed groups are plotted onto the matrix, they exhibit remarkably similar characteristics within quadrants and starkly contrasting characteristics between quadrants" (Whitehouse and McQuinn 2012, 613). Again, that strongly suggests

there is no -or hardly- a mixed version of the Modes for armed groups. Indeed, such predominant non-mixed Modes of organization are also suggested in a more recent publication on the Modes theory (Whitehouse, Francois, and Turchin 2015). They notably refer to the link between Modes and resource extraction, stating that "[t]he Imagistic mode is thought to be adaptive for groups that need to stick together in the face of strong temptations to defect—for example, when engaging enemies on the battlefield or large prey on the hunting ground. The Doctrinal mode is thought to be adaptive for groups seeking to pool small amounts of resource from individuals in a much larger population so as to create a large, centralised resource in the form of charitable donations, legacies, tax or tribute – for example, when competing coalitions are organized via categorical ties of caste, race, ethnicity, or belief." Again, the strong impression one gets is that Modes are thought to be active and distinctive predominantly at the level of the entire group — there is no mention of subgroups utilizing different resource extraction approaches. In fact, in the more recent articles on the Modes theory, the Modes are broadly placed in the framework of evolution, such that Modes are thought to be adaptations to collective action problems. The 'collective' in the context of armed groups is the entire armed group; the adaptation is their Mode of organization and their ritualistic behaviour -so as to generate altruistic or cooperative behaviour of its members-, the selection force is hard-core group competition (groups and their members can actually die and become extinct), the mediator is resource extraction.

Given these considerations, this research took the vantage point that whilst armed groups may have Imagistic sub-groups as suggested by some of the Modes publications, it is not relevant here: not only are the properties of groups described at the entire group level, the hypothesized mechanism is also that of group selection of entire (armed) groups, not of revivalist movements of subgroups or subgroups projecting their locally distinctive culture on the entire group. When comparing apples with apples, the resource extraction is at the level of the entire group, hence, the

primary hypothesis is also that the entire group predominantly operates in the Imagistic Mode, or in the Doctrinal Mode — divergently, i.e. non-overlapping.

The main research questions

The two target publications have a few limitations. The first is the limited amount of cases. The Whitehouse and McQuinn (2012) publication presented five cases (2 and 3 groups per Ritual Mode, respectively), the Beardsley and McQuinn (2009) article presented only one group per resource extraction strategy (the Sri Lankan LTTE and Aceh's GAM). Hence, any form of conclusion may have been spurious as a result of 'cherry picking' to support the theories of divergent strategies and divergent Modes.

The second limitation with the Whitehouse and McQuinn publication is that no attention is paid to the possible influence of relationships between groups. For instance, both the FARC and the CPN-Maoists have a firm base in Marxist ideology, sharing a common cultural ancestor, and both the FARC and the AUC stem from Colombia, with not only a common cultural ancestor but also contemporary mutual influence to be expected. Such relationships may not present a problem if the theory is purely meant to describe that groups come in two types, without any hypothesis of what causes the dichotomy. However, as it stands, the Modes theory does hypothesize causes for this dichotomy; in its earlier form, it was memory, in this study —in the context of civil war— it is resource extraction. That means that cultural inheritance and mutual influence should be filtered out to get a good understanding about the extent to which resource extraction actually influences the structure of the group. The phenomenon that a relationship between two variables other than cultural descent or mutual influence is obscured because of that cultural descent is known as "Galton's problem". In a statistical sense, Galton's problem can be seen as the problem that data points are non-independent, whilst most statistical tests assume independence of data points. Often, the modern statistical term "autocorrelation" is

used instead of "Galton's problem". Another issue is that interrelatedness between groups can reduce the effective sample size. For instance, in the Whitehouse and McQuinn (2012) article the effectively sample size might be more like four or even three than five groups, given that the FARC and the CPN-M might collapse to one, and perhaps the FARC and the AUC are also strongly related. When the studies of both target publications are repeated with a much higher number of groups, as will be done for this thesis, then it is almost certain that groups influence each other, and it becomes more pressing to correct for autocorrelation.

A third limitation concerns mainly the Beardsley and McQuinn study. Apart from the very small sample size (namely two), and the question whether the group typologies from both target publications really match, is the fact that the Beardsley & McQuinn study was qualitative. It is unclear how their Return on Investment (ROI) can be operationalized. In addition, there is a case to be made that ROI alone is not enough to understand resourcing decisions: a high ROI might be desirable, but if the risk of obtaining or losing the resource is also high, it might be more prudent to settle for a lower-ROI yet lower-risk resource.

This thesis aims to address those three main limitations in three subsequent chapters. The main research questions per chapter are:

- *(Chapter 3:) To what extent can the two Modes be found amongst non-state armed groups?*

  The Whitehouse and McQuinn study will be repeated with that publication as a broad guideline, but now with a large-N sample. A tenfold more groups will be used, namely 50. Construction of the sample will be the topic of chapter 2, the actual analyses of the data will be the topic of chapter 3.
- *(Chapter 4:) To what extent can autocorrelation between armed groups be found regarding the Modes properties, and can the two Modes be found amongst non-*

state armed groups (NSAGs) when corrections for Galton's problem are being used?

Some of the analyses of chapter 3 will be repeated, but now with corrections for autocorrelation, but after the extent of autocorrelation has been investigated. The reasons to present the uncorrected analyses as well in chapter 3 are threefold. First, not for every statistical technique the same correction for Galton's problem is available. Corrections for a correlation matrix, an MDS and a PCA can be made based on geographic proximity. However, that correction method is not available for, say, the Fisher exact test when the correction is done via a categorical covariate. It would render the analyses incomparable if some results are presented with one correction method, others with another correction method, and yet others without correction. Hence, all are presented initially without correction to be able to compare all analyses amongst each other. Second, it is interesting in its own right to what extent armed groups relate — this has also been dubbed "Galton's asset" (Hendrix 1997; Korotayev and De Munck 2003). Both the method of using region as a simple covariate, and using geographic proximity and actual links between groups in a network/matrix structure, will be used for analysing the interrelatedness between groups regarding the Modes properties. Third, after corrections for autocorrelation have been applied (in this thesis the region as covariate), a better comparison with the Whitehouse and McQuinn (2012) article can be made. If both sample size and corrections are implemented in one go and results turn out to be different, it is unknown whether the sample size or the corrections for autocorrelation caused that difference, and to what effect. Separation makes it clear.

- *(Chapter 5:) In what way is the type of resource extraction of NSAGs related to the two Modes?*

After theory development for Risk, both ROI and Risk can be operationalized, which addresses one of the limitations of the Beardsley and McQuinn study. The original sample of 50 armed groups will be extended with

resource data, so that the same 50 groups will be used as for chapter 3 and 4, which addresses the question whether the groups from both target studies are comparable or not. Simply using the same groups makes for a 100% comparability. With this dataset in place, the relationship between Modes and the type of resource extraction can be investigated.

Those three questions are broadly formulated and will be refined in each respective chapter.

The road ahead

This thesis somewhat has the structure of a Matryoshka doll. The grand structure is fairly standard — an introduction, piece of theory (this chapter), methodology (next chapter will lay out the structure of the sample and the general dataset), results (the three chapters thereafter are data driven chapters) and Conclusion/Discussion (last chapter). Yet, every data driven chapter that centres around one of the three main research questions also has an intro with a brief reminder of the applicable theory, where applicable a methodology section for the chapter at hand, sub-questions that refine the main research question of the chapter, and a discussion per chapter, as well as a 'road ahead'. Each sub-question per chapter can also have a methodology section and has a results section that is applicable to that sub-question only. This nesting is done to keep all methodologies and applicable discussions as close to the actual analyses as possible, with the aim to increase clarity.

The main method to address the research question is dataset analysis. Exactly how the dataset was constructed, how the data were obtained, the operationalization of the hypotheses, some possible pitfalls in the construction of the dataset and how the quality of the dataset was increased —including the number of non-empty values— will all be the subject of the next chapter.

Chapter 2 — Methodology

In the previous chapter, the theoretical background of this research and its two main research questions were described: to what extent are non-state armed groups (NSAGs) structured according to the two Modes, and to what extent is there a relationship between the two Modes and the type of resource extraction. This chapter describes the construction of a large-N dataset that can address the research questions. It also describes the most important challenges for constituting this dataset. First the sampling method is discussed, and issues with skewing. The principles that guided shaping the variables are thereafter discussed. The third section deals with methodological challenges. Finally, the basic procedures how this study deals with missing data are addressed.

Construction of the sample of non-state armed groups

Two practical points regarding the construction of the sample of non-state armed groups are worth stating at the outset. First, the sample was not based on a formal method such as random sampling, which most likely would have resulted in hardly any data. Instead, pragmatic sampling was used: to get data on armed groups whenever it was available. Second, the decision of which groups to include in the sample was based on the very general principle that a group should be armed, not be the state, and engage in violent action for political goals; inclusion was not based on a set of more detailed or indisputable criteria. Instead, basic fact checking and 'best professional judgement' guided which groups were to be included in the sample, if possible.

Impossibility of random sampling for this research

Several social science studies and cross-cultural studies draw random samples from a grand population of groups (see Otterbein (1976) for an overview of the types of grand populations of groups). Examples of such grand populations are lists of groups in an appendix of a book (as used in e.g. Sosis and Bressler 2003), electronic catalogues with society data such as eHRAF (e.g. Chrisomalis (2006), Sosis *et al.* (2007), Atkinson and Whitehouse (2011), Mullins *et al*. (2013), etc.), or the Ethnographic Atlas (e.g. Botero et al. 2014). However, despite the usefulness of random sampling as a method, it was not used in this research. The reasons are threefold.

First, there is no clear and well-defined grand population to sample. For instance, the (2015) UCDP Actor dataset is probably the most complete with respect to non-state armed groups; it lists about 1000 of such groups. Yet, although it lists some 40 groups from Burma/Myanmar, a monograph that was specifically dedicated to the armed groups in Burma (Keenan 2014) also listed around 40 groups in the appendix (p. 250-2), 28 of these groups were not listed in the (2015) UCDP Actor dataset. By far most of these groups from the monograph were small (twenty to a few hundred members) and several of them were short-lived splinter groups. Such groups are relevant for this research, yet, not present in the UCDP dataset. Hence, there are indications that the UCDP dataset is skewed towards larger groups and hence a skewed source for this research. In addition, *post-hoc* it appeared that in the dataset of the present research, 88 groups were included that do not exist in the (2015) UCDP Actor dataset. What is applicable for the most complete dataset -UCDP- is even more applicable for smaller datasets: they do not provide a complete list of NSAGs relevant for this research. Hence, one of the prerequisites of random sampling cannot be met: a known, unbiased, representative (leave alone complete) grand population to sample from in the first place.

Second, even if there were a grand population of groups from which a random sample could be drawn, it is likely that for many groups in the resulting sample *no* data can be found, either from literature, datasets or experts, simply because the groups are obscure and never described.

And third, the worst pitfalls of non-random sampling may be overcome by doing corrections for known deviations. Random sampling is also not immune to the potential need to correct for known biases (Worrall 2007). Likewise, this research takes into account a few potential confounding factors that were theorized to be important. For the flow of the discussion, first the sampling method is described; thereafter, the resulting skews and their solutions are discussed.

Operationalizing 'non-state armed groups' and construction of the sample

Instead of sampling from a grand population, the aim was to maximize the amount of data from as many groups as possible from all over the world, with as much diversification as possible, though within a certain bandwidth to reflect the characterization (see below) of NSAG as used for this research. The three main sources of data were experts on particular NSAGs, literature, and third-party datasets. In total, workable data on 52 groups were collected, and most of the group profiles (answers) were complete. Two group profiles were rejected because the quality of the data as given by the expert was not considered sufficiently trustworthy[1]. Hence, the final sample size was 50 groups.

1 It concerned data on two central-African groups. The decision to reject these group profiles was made in deliberation with Dr. Henning Tamm, who specializes on Sub-Saharan African groups. There were several quality issues with the French answers: sentences were sometimes broken off and hard to interpret, there were issues with frequencies, and the profile of the expert itself gave a cause for concern.

What are non-state armed groups?

For this research, a so-called descriptive definition[1] was developed for the object of study, the non-state armed group. Experts were *not* given this definition, because experts were only approached when there already was a good indication that they had expertise on the right type of groups; moreover, experts know themselves what specific group they are an expert on and don't need a generalized characterization. Instead, the descriptive definition was used as guideline to approach the appropriate experts. This guideline was worded as:

> *An identifiable, named group that does not officially represent a state, and which intentionally engages in armed violence to accomplish one or more political goals for themselves, or the goals of other parties who primarily exist for political purposes (including states). Such groups take diverse forms, and may be referred to as 'insurgents', 'tribal warriors', 'guerrillas', 'mercenaries', 'fraction of the local population that took up arms', 'terrorists', 'militias', etc. Such groups come in different sizes and with different structures; they may or may not have political wings, service organizations, and other such elements besides their fighting elements. Not meant are organizations with commercial aims like drug cartels or semi-legal groups with occasional (or regular) non-political violence like motor gangs or city gangs.*

Experts

Data collection for the NSAG dataset was mainly expert-based, in line with the data collection method of some other researches on armed groups (Cederman, Wimmer, and Min 2010; Haer 2012). From the research aims and hypotheses as discussed in the previous chapter, variables (types of data) were derived to test the

1 See the Stanford Encyclopaedia of Philosophy for an overview of the type of definitions used in science (https://plato.stanford.edu/entries/definitions/).

hypotheses (and see the next three chapters on Modes, "Galton's problem", and Resources for more details on these variables). These variables formed the basis for a questionnaire that was given to experts, whose answers constituted the bulk of data in this dataset. The reason to use experts as the main data source rather than codifying literature or re-analyzing third party datasets were threefold. First, asking experts to fill in the question list is much quicker than manual encoding of applicable literature. Second, research via experts can be targeted to the particular areas of interest for this project, and their knowledge often goes beyond what can be found in publications. A similar argument holds for third party datasets: they are always constructed with a certain research goal, which is unlikely to be the same as for this research. Experts are not confined to that limitation. Third, there has been some criticism (Schrodt 2013) that the same datasets are used repeatedly, which is a form of auto-correlation between researches, which can magnify the error of conclusions. Freshly collected data mitigates that issue.

Experts were selected based on a thorough research into staff at websites of research institutions that deal with subjects like conflicts and non-state armed groups, based on personal interactions at relevant events (conferences, seminars etc.), and based on recommendations from other experts

Experts were generally contacted by a standardized email, and the question list was directly included so that experts could assess what was being asked from them. The email and the question list were in English. Experts were given a small incentive beyond altruism to cooperate: the approaching email stated that "we would acknowledge your contribution by mentioning your name in the codebook of the dataset; in the acknowledgements of the first publication of the dataset (probably in the appendix on a journal's website due to space issues); and on a website dedicated to the dataset after its publication. Furthermore, as a small token of appreciation for your efforts, we would give you the option to choose either a £25 voucher on Amazon or a £25 donation to UNICEF.". It was left to every individual expert whether they considered themselves to have enough expertise on a certain group. Around 215

experts were asked to fill in the question list[1], in total 52 experts sent in a filled-in group profile for a total of 49 groups (some experts filled in question lists for more than one group, some groups had more than one expert, and some groups were filled in based on literature).

Literature encoding

The same question list as used for experts was used for manual encoding of literature on NSAGs. In total 3½ groups were manually encoded from literature. (The half is to supplement a group questionnaire that was not fully answered by an expert.)

Third party datasets

The UCDP group size data (Uppsala Conflict Data Program n.d.) were used when group sizes were missing in the expert answers. This was applicable for only a few cases. Data from Cunningham, Gleditsch, and Salehyan (2009) were used when the type of group end was missing in the expert answers. This was applicable for only one case. The 'type of leadership' data from the MAROB database (Asal, Pate, and Wilkenfeld 2008) were used when these data were missing in the expert answers. This was applicable for only a few cases.

Pragmatic sampling and its limits

The main factor that determined which groups were included in the sample was the availability of experts and their willingness to provide data by filling in a questionnaire. Such non-random sampling may lead to a certain skew in the types of

1 A special thanks to postdoc Dr. Henning Tamm, who approached slightly more than 50 experts on Sub-Saharan African groups. He knew many of these experts in person. Nearly 40% of the experts he approached filled in the question list and sent it back.

groups in the sample. To avoid that, two strategies can be followed: (1) to deliberately increase the number of cases in the opposite direction of a suspected deviance, and (2) to apply corrections for suspected deviances. The first strategy will be further specified below, and the second strategy is partially dealt with in this chapter ("Solutions to increase the consistency of encoding" from page 78 onwards), and partially in the next chapter (chapter 4) on "Galton's problem".

The most important expected (and found) skews in the dataset are (a) an overrepresentation of modern / recent / post-Cold War groups, (b) regional under- or overrepresentation, and (c) an overrepresentation of large and active groups and an underrepresentation of small groups with a low activity level in the sample.

(a) Overrepresentation of modern / recent / post-Cold War groups

Most NSAGs in the dataset were active in post-Cold War conflicts. The reason for perhaps over-sampling relatively recent groups is that more data is available for such groups given the increase in media coverage and scholarly activity in the last decades regarding armed groups. In addition, experts can more easily be found for recent groups because they are still professionally active. Yet, when data was found for groups that were active before, say, 1989, then the data was included in the dataset as well, because there is no theoretical reason to surmise that the principles of group organization, also in relation to their resources, changed after the Cold War. Hence, no specific bias is expected from this source of skew, and no compensation measures were taken.

(b) Over- and underrepresentation of certain regions

In this research, there was no focus on any particular region; or in other words, the aim was to collect data for groups from all over the world. In practice, it appeared that certain regions were far more present in the sample than others

(see below on page 71, a map of the world with all reported home bases of all groups in the sample). That does not necessarily mean that regions were over- or underrepresented. For instance, North America, Oceania and the vast swaths of land of Siberia are known to have very few (if any) non-state armed groups that use violence to further their political goals. Hence, it is plausible that no or very few groups from these regions are present in the sample anyway. On the flipside, there were about 20 groups from Sub-Saharan Africa in the sample, mainly from East Congo and South-West Africa. Whilst that is a strong clustering with respect to geography, it is not necessarily an overrepresentation, because those areas are known to be plagued by violence and civil wars. However, only one group from South America was present in the sample, which is an underrepresentation of the number of groups in that continent. The attempt to diversify as much as possible for regions was not successful there. Attempts are made to mitigate such over- or under-representations by applying corrections for Galton's problem based on region (see chapter 4), although that probably does not fully correct the issue of geographical over- or underrepresentation.

(c) Overrepresentation of large and active groups

There are reasons to suspect there will be more large and active than small and inactive groups in the sample. Probably, the amount of activity per group will follow a 'long tail' distribution, asymptotic to zero: a small number of groups is responsible for most casualties and incidents, a large number of groups makes few casualties and has few recorded incidents of activity. As a consequence, a small number of groups is well known, a large number of groups is unknown or not considered to be as important. That increases the chance that data on the best-known groups -with the most influence, either because of their size, military success or wanton violence- constitute the dataset, and a large number of lesser known groups is not part of the dataset. The relevance for this

research is that these best-known groups may well tend to be Doctrinal; probably they are larger, and the best-known groups are usually able to withstand or even overpower a state, which suggests the organizational capabilities of a Doctrinal Mode. Whether there is technically an *overrepresentation* of Doctrinal groups cannot be tested, because there is no grand population so comparison is not possible. However, already based on studies such as the one on Burma mentioned above (pg. 50), it can be surmised that often small groups and splinter groups will get less attention.

As for militias, there may be a tendency for scholars to focus on bigger ones for similar reasons: they draw more attention. Even if scholars look at smaller, village/town-level militias, they tend to look at a larger number of them, studying each in much less detail, making it unlikely that they could fill out the full questionnaire for any of them[1].

That said, even if the dataset contains more large-sized, Doctrinal groups, that may not necessarily be detrimental. First, the research concerns the difference between Doctrinal and Imagistic groups, and larger, well-known groups might be Imagistic as well: the target articles that inspired this research (Beardsley and McQuinn 2009; Whitehouse and McQuinn 2012) state that well-known armed groups in well-known political conflicts follow a bi-Modal (or quadrant) distribution, not a single blob of group types. Well-known groups like the RUF (Sierra Leone), the ELN (Colombia), and the Tamil Tigers / LTTE (Sri Lanka) were described to be 'Imagistic' or similarly organized. Hence, if it is correct that such well-known groups can be Imagistic, then no detrimental skew should be expected. Even then, absence of Imagistic groups in the sample may alter our understanding about how armed groups are organized — perhaps far less often Imagistic than suggested by these target publications. Second, the

[1] Dr. Henning Tamm, personal communication

Modes theory states that the Modes properties (variables) cluster and this can still be tested, even if all groups are large: do they have all other Doctrinal properties or not? Third, the present research does not concern the frequencies of group size or the frequency of Imagistic versus Doctrinal groups per se; or in PPM terminology, does not concern the frequency of resource based versus community based predatory organizations, so if there is a skew in the sense that there is a relatively low number of small groups or Imagistic / resource based groups in the dataset compared to the real world, the conclusions are not spurious when placed in the right context. All in all, if there is a skew, it might not be detrimental for this research.

However, there is a risk that certain patterns concerning small or Imagistic groups or the difference between Imagistic and Doctrinal groups may remain unnoticed because the number of small or Imagistic / resource based groups is too small, with the possible result that several statistical results become non-significant. There may also be a risk that some variables that would clearly have been bi-modal with an equal division of small and large groups would now display a less clear pattern, making understanding and subsequent analysis more difficult.

The most detrimental bias would be one that one that blurs the *distinction* between the Imagistic and the Doctrinal Mode, or one that distorts the relationship between the organizational Mode and the type of resource extraction, because these two topics are the main ones of this study. There are no *a priori* reasons to think this distinction or this relationship will be strongly biased in the dataset, although biases are always possible.

As for the distinction between the Imagistic and the Doctrinal Mode, the expectation is that scholars tend not to study too closely the most violent groups (like Isis or the LRA) because it is too dangerous. Perhaps this affects the type of data that can be obtained; for instance, the most emotionally arousing rituals

might not be observed, and hence left out of the dataset. That might mean that the presence or frequency of the Imagistic Mode is underestimated. Also, anthropologists (but not all of them) tend to leave an area of conflict when that conflict becomes too intense and therefore too dangerous for the field worker. It is conceivable that biased data on such a category as 'shared negative experiences' are obtained because of this understandable appetite for safety. As a consequence, the more extreme forms of shared negative experiences might not be reported. That would mean that one of the potential bigger drivers of the Imagistic Mode would be missed. On the other hand, it is quite common that researchers do interviews with ex-combatants and hear about the most negatively arousing acts (many examples, but see e.g. NGO reports like Human Rights Watch (2005) about lootings, rapes and killings in West Africa, articles and books like Verwimp (2006) and Hatzfeld & Coverdale (2006, 2007) regarding mass machete killings in Rwanda, the documentary 'The act of killing' (Oppenheimer 2012) for in-depth interviews with perpetrators of the mass murders in Indonesia in 1965-66, etc.). Such interviews might compensate for the lack of presence during the most dangerous phases of the conflict. Indeed, several of the experts of the current dataset have done such interviews and one expert was an ex-combatant himself. All in all, the expectation is that the distortion of the distinction between the Imagistic and the Doctrinal Mode is not pronounced in this research.

As for the relationship between the organizational Modes and the type of resources, one might be tempted to think that the driver for the type of resources that are extracted from the environment is simply the local availability of these types of resources —which was not recorded for this research— and not the organizational Mode of a group. Whilst that may certainly be the case, meaningful analysis of the relationship between organizational Mode and the type of resources extracted can be done based on the current dataset, even without data

on local availability of resources. First, the hypothesis is that group organization (here: a Mode) is an adaptation to the type of resources. If so, then different availability of resource types should lead to different presence of Modes linked to those resource types because of selection, hence, a correlation between organizational Mode and the type of resources can be expected. Second, the hypotheses regarding resources are partially caught in terms of ROI and Risk, not purely in terms of specific resource types. Hence, local variations in actual availability of specific resource types are less relevant because several types coalesce into broader, similar, abstract categories of ROI and Risk. That said, the fact remains that it would be scientifically interesting to check to what extent the *availability* of specific types of resources precedes cultural morphology. Such a check is not part of the current study but could be done in future research (see chapter 6 for several suggestions for future research).

All cases are given a brief description hereunder. The 'size' is the weighted group size.

ADF Alliance of Democratic Forces Size: 1375	Stemming from Uganda, mainly active in the North Kivu Province, Congo (DRC). They fought against the DRC, Uganda and the UN, 1995/6-now. Islamic group, Doctrinal practices to be expected, though it sometimes operated as a cult.
Ahrar al-Sham Size: 13592	Active in the Syrian civil war, with as base the province of Idlib. 2012-now. Islamic group, Doctrinal practices to be expected.
Arrow Boys Size: 7500	Strongly linked to the Teso Sub-region, Eastern Uganda. Activemid-2003 to mid-2005. The Arrow Boys militia regarded themselves as a tool of self-reliance and self-defence, fighting the LRA (and fending them off).

Boko Haram Size: 8000	With their home base in Maiduguri (Borno State), Northeastern region of Nigeria, they managed to be quite active from 2009-now not only in Nigeria but also in Cameroon, Niger, and Chad. With daring and incessant actions, they manage to reach international news fairly often. Strictly Islamic, Doctrinal practices to be expected.
CDF – Koinadugu Civil Defence Force, subgroup Koinadugu Size: 7400	Active from 1997-2002 in Sierra Leone in the Koinadugu district (hence the name). Fought against the RUF and the AFRC. Not much ideology, the main aim was self-defence.
CIRA Continuity Irish Republican Army Size: 152	Active in Northern Ireland and Britain from 1993 onwards, and itself being a faction, it was continuously subject to splits. Its main enemies were nearly more other factions (PIRA, RCIRA) than Britain or Ireland. Mainly a secular liberation ideology.
CNDD-FDD National Council for the Defense of Democracy-Forces for the Defense of Democracy Size: 22500	A Hutu group from Burundi (1993-2004), also active in the DRC and Tanzania. Merger group of CNDD and FDD. Had a few central leaders in succession.
CPN-M Communist Party of Nepal-Maoist Size: 17958	Active from 1996-2006 in Nepal, they managed to achieve a victory and take over the government. Their ideology was, as the name suggests, clearly based on communist and Maoist doctrines, so Doctrinal practices can be suspected.
Dozos Size: 34128	Active from 1991-2001 in the Ivory Coast, the Dozos are based on a historical fighter group of unknown origin, possibly pre-thirteenth century. Historically, Dozos found themselves among the armies of pre-colonial West African polities. Their aim is protecting local communities, their ritual lore makes

	reference to Qur'anic figures, but Dozos have a rich corpus of their own, with songs, medicinal practices, dance, and ritual sacrifices. Despite its group size and Islamic influence, Imagisticness can be expected.
El-Merscer Battalion Size: 600	This short-lived group was active in the Libyan revolt in 2011 against Khaddaffi. There were many Battalions, this was one of the bigger ones. Groups that were successful and grew tended to have a good, single leader — including this group. Up to a certain point, there was not much ideology, other than to get rid of Khaddaffi. Islamic practices were standard, but did not give this group its specific identity.
EPLF Eritrean People's Liberation Front Size: ?	Fought a non-colonial liberation war against Ethiopia from 1974-1991. The group was officially fully secular; while they did not have an official ideology, the EPLF did have a political training manual for the cadre. The group had congresses to develop their political program. Based on such phenomena, Doctrinalness is to be expected.
ETA *Euskadi Ta Askatasuna* Basque land and Freedom Size: 324	An independence movement, active from 1961-1999, that tried to secede from Spain and establish a separate Basque country. Consisting of small groups from villages, it did have a central bureau that was modelled on communist congresses. Throughout its lifespan, the ETA split several times, not in the least because it had a consistent identity issue itself: nationalist or communist? A mixture of Imatistic and Doctrinal practices can be expected.
FARC *Fuerzas Armadas Revolucionarias de Colombia* Revolutionary Armed Forces of Colombia	Fighting in Colombia from 1964-2016/7, the FARC became receptive to the idea of a peace agreement after heavy losses and a forgiving deal in a pleasant negotiation environment. They started off as a Marxist guerrilla, but many find they have ended as a narcotics trading organization. Because of its

Size: 11000	Marxist roots, Doctrinal practices can be expected; due to its narcotics trade, Imagistic practices can be expected.
FDLR Democratic Liberation Forces of Rwanda Size: 80667	A Hutu rebel group with origins in Rwanda, though mainly active in the DRC between 1994-now. An ethnic and territorial group.
FNCI *Les Forces Nouvelles de Côte d'Ivoire* The New Forces of the Ivory Coast Size: 29138	Active in the Ivory Coast between 2002-2011, the FNCI consisted of several subgroups and ethnicities, and several languages were spoken in the group. Being an umbrella organization, both Imagistic and Doctrinal practices can be expected.
FNL *Front National pour la Libération* National Liberation Front Size: 4352	With origins and Tanzania, the Hutu-based FNL also stretched out to Burundi and the DRC. It fought against the CNDD-FDD (also in this sample) and Burundi between 1991-2009, ending with a peace agreement and a transformation to a political party. Because of its increasingly pyramidal and political organization, Doctrinal practices can be expected.
Forces of the Caucasus Emirate Size: 1000	As can be inferred from the name, this group is active in the Caucasus and they strive for an Islamic state. They started to become active from 2007 onwards. Doctrinal practices can be expected.
FUC *Front Uni du Changement* United Front for Change Size: 5000	With origins in Chad and activity in Chad and Sudan (Dafur), this short-lived group was active between December 2005 and December 2006, when a peace agreement was signed. Reportedly, this group did not have much of an ideology, and there was a large gap between the political leaders who came from various regions and ethnic backgrounds and resided in Khartoum and France, and the rank-and-file who came from Chad.

	If any practices are to be expected, then it is probably more Imagistic.
GAM *Gerakan Aceh Merdeka* Free Aceh Movement Size: 5619	With a long history against (colonial) rulers, this group, based in Aceh, Sumatra, Indonesia, fought between 1977-2005, when a peace agreement was signed after a tsunami put the eye of the world to that region. They have their roots in Islamic thought, though much of its aims are independence. Doctrinalness can be expected.
Ganda Iso Size: 577	Starting in 2008, and with a home base in Fafa, Northern Mali, they are local-bounded militia that aims at protecting their "own land". Probably Imagistic practices can be found.
GATIA *Groupe Auto-défense Touareg, Imghad et Allié* Size: 1000	The GATIA has been created when General Ag Gamou broke out of the army during fightings in July 2014 in Mali. Then, a political bureau and a manifesto were created. That, together with the traditions of the region, suggests Doctrinalness.
Hamas (Islamic Resistance Movement) Size: 71499	Well-known group that has the power in the Gaza strip. Started in December 1987. Stemming from the Muslim Brotherhood and being fiercely Islamic, many Doctrinal practices are to be expected.
Hezbollah (Party of God) Size: 22000	One of the best-organized groups in the world, thoroughly based on Shia Islam, starting in 1982, they effectively rule the south of Libanon as a proto-state. Many Doctrinal practices are to be expected.
Ikhwanis Size: 728	Kashmir-based "village defence committee", started early 1995 to fight against Islamic groups. Fighting group members are organized in small groups of usually 5, sometimes numbering up to 10. This, combined with its general typology of a militia, suggests that Imagistic practices can be found.
ISIS Size: 25000	With its origins in the remains of the disgruntled Baath party after the fall of Saddam Hussein, it started in the spring of

	2013 and quickly took over large areas of Iraq and Syria. Explicitly Sunni Islam based, with origins in a state-party, many Doctrinal practices can be expected.
Jemaah Islamiya (Islamic Community) Size: 1100	With origins in Malaysia, its main activity is (was) in Central Java, Indonesia from 2000 onwards. The activities and group size have faded since then. As the name reveals, the group is explicitly Islamic and several Doctrinal practices can be expected.
Jewish Underground Size: 27	Active in the West Bank and Jerusalem from 1980 onwards and all arrested by 1984, this group had an explicitly Jewish religious ideology, aiming Palestinian targets. The ideology suggests Doctrinalness, the size suggests Imagisticness.
Kamajors Size: 15536	Originated in Sierra Leone, also active in Liberia. Started in 1994, it ended in 2002 as a result of a peace agreement. It was a 'civil defence force'. Originally Kamajor militias were hierarchically flat and minimally organized, with local leaders who were generally appointed by consensus among their peers, and who also participated in defensive operations. Gradually the leadership became more codified and distinct from the rank-and-file fighters. There was not much of an ideology. In first instance, a mix of Imagisticness and Doctrinalness is to be expected.
KIA Kachin Independence Army Size: 7207	One of the many ethnicities in Burma with an army and an aim for independence since 1964 — two years after the military coup in Burma. In principle, many Kachin are now Christians and want to establish a state (having been a kinship-based animist chiefdom in pre-colonial times). Skirmishes continue until this day, despite a nominal peace agreement after heavy military and economic losses. Given its religious and statist background, generally Doctrinal practices are expected.

KNU Karen National Union Size: 19609	Like the Kachin in Burma, several Karen are now Christian, and the KNU has been a political body even under British colonial rule. Since 1949, they fought for independence from, and later a federal association with, the Burmese state. Given its religious and statist background, generally Doctrinal practices are expected.
LIFG Libyan Islamic Fighting Group Size: 200	From 1995 onwards, the LIFG was active in eastern Libya (although the group was formed in Afghanistan). They were wiped out by the Ghadaffy regime by 2009. Given their explicit Islamic outlook, generally Doctrinal practices are expected.
LRA Lords Resistance Army Size: 2972	Established in the Acholi sub-region of northern Uganda in 1987, the group has been active not only in Uganda but also the CAR, the DRC and Sudan. The group size notably declined the last decade because of military counter-operations and peace talks that somewhat stabilized the region. Kony always has been the undisputed leader, offering a mix of unorthodox Christianity and military rule, mixed with regional animism. A mix of Doctrinal and Imagistic practices is expected.
LURD Liberians United for Reconciliation and Democracy Size: ?	With origins and activity both in Guinee and Liberia around 1999-2000, and consisting of a fluid amalgam of subgroups, it is hard to pinpoint shared cuture, language, or practices. The group ended after a victory in August 2003. Probably a relatively Imagistic group, given all of its subgroups, though the group as a whole must have some Doctrinalness to function.
Mai Mai Padiri Size: 17600	Originating and active in the South Kivu region in the DRC from end 1996-2003, this group had Padiri as charismatic leader, the ideology was mainly religious and the group had a military structure. Doctrinal practices are to be expected.

MFDC Movement of the Democratic Forces of the Casamance Size: 3000	This group originated in 1982 in Senegal as a main separatist movement of the Casamance region. It became military active from April 1990 onwards, and although a peace agreement has been signed in 2004, several factions continued fighting. For the period up to 2004, mostly Doctrinal practices are expected; thereafter, more Imagistic properties might be found.
MODEL MOvement for DEmocracy in Liberia Size: 1000	This short-lived group originated and was active both in Liberia and the Ivory Coast from March until August 2003. It was disorganized with many factions. Imagistic practices are to be expected.
NDV Niger Delta Vigilantes Size: 1876	Originated and active in the Niger Delta in Nigeria, the first major incidents occurred around August 2003. They predominantly fight the NDPVF (Niger Delta People's Volunteer Force). As of now the structure is diffuse, and there is no explicit ideology. Imagistic practices are to be expected.
NMSP New Mon State Party Size: 2223	The New Mon State Party is not a non-state armed group as such, but rather a council with political and social aims/wings which also ruled an armed wing, the MNLA (Mon National Liberation Army). They aim for a separate Mon state in what is now Burma. The date of origin is 1958, a ceasefire agreement in June 1995 because the Burmese army won. Given the statist origins, Doctrinal practices are to be expected.
NPFL National Patriotic Front of Liberia Size: 20000	Originated in Liberia and Libya in 1986 or 1987. In 1991 they captured Monrova. This gave them a permanent home base which considerably affected the structure, e.g. creation of courts, police, and esp. a government and a cabinet. While there was a victory, a peace agreement and an election in 1997, the new government kept their NPFL militia until 2003.

	Doctrinal practices are to be expected, though militias also tend to have Imagistic practices.
PARC-FAAL *Parti pour l'Action et la Reconstruction du Congo-Forces Armées Allelujah* Size: 410	Popularly known as "Mai Mai Yakutumba", this group originated in the DRC in January 2007. Its activities are in the DRC, Burundi and Tanzania. They are part of a larger amalgam of groups that also have a political wing etc. Although this larger conglomerate may well be Doctrinal, there are significant Imagistic practices expected for this sub-group.
PIRA Provisional Irish Republican Army Size: 686	Known by the wider public as the IRA, this group started in 1969 in Ireland. Not unlike the ETA (whom the IRA also worked with), cells tend to stem from local villages. Its members come from a highly Doctrinal society, and it may be questioned whether they introduced much Imagistic practices. In 1998 there was a Peace agreement which has kept quite well.
Ranvir Sena (Army of Ranvir) Size: 3000	Starting in 1995, this militia was active in the villages of Bihar in India. It is mainly an anti-communist militia, reportedly trained by the Indian army and with members of the Central Reserve Police Force. Interestingly, they copied tactics from the very enemy or ideology they opposed (Naxalistes, Mao). The broad structure of the militia is expected to be Doctrinal, though cells may well contain Imagistic practices.
RPF Rwandan Patriotic Front Size: 14550	Originated and organized in exile in 1987 in Uganda, this Tutsi group fought the Rwandan army from 1990 onwards and gained victory in 1994, ending the genocide. The top of the organization is well-trained in Doctrinal societies; whether rank-and-file are that Doctrinal remains to be seen.
RUF Revolutionary United Front	With an origin in Sierra Leone, and their main fighting in Sierra Leone but also in Liberia, this group was military active from March 1991 onwards and defeated in 2001. Although

Size: 13971	based on Whitehouse & McQuinn (2012) this should be a prime example of an Imagistic group, expert answers revealed a more complicated picture.
Shallgum Battalion Size: 85	Like the El-Merscer Battalion above, this short-lived group was active in the Libyan revolt in 2011 against Khaddaffi. Also in this case, up to a certain point, there was not much ideology, other than to get rid of Khaddaffi. Islamic practices were standard, but did not give this group its specific identity.
SPLM/A Sudanese People's Liberation Movement/Army Size: 23435	Eastern Sudan, Blue Nile region and Southern Kordofan in Sudan. Led by John Garang, the ideology was about a New Sudan, which should be egalitarian, secular, democratic, tolerant and pluralistic. Around 1991 they were no longer Marxists. In 2005 a comprehensive peace agreement was signed. Given the ideology and size, a Doctrinal group is expected.
Tamaboro Size: 1088	Originating and active in the Koinadugu District in Sierra Leone between 1992-1994. Tamaboro fighters were led by two or three charismatic individuals who were known for their occult powers. These leaders emerged by consensus and there was no formal hierarchical structure below them. The group was a militarized social (or patronage) network, with some individuals having more prestige or respect than others, but with no clearly articulated ranks or responsibilities. Given that, and the group size, Imagistic practices are expected.
UCK Kosovo Liberation Army Size: 4452	This group was active in the Drenica region in Kosovo between 1997-1998. The rationale for existence widely shared by its members was "to oppose Serbian oppression and to be pro-Albanian nationalist". Throughout the lifespan of the group (precursors from 1993 onwards), there was an increasingly centralized leadership. Based on that, and the origins of the group in a relatively developed society,

	Doctrinal practices are expected to be more and more prevalent throughout time.
UNITA *União Nacional para a Independência Total de Angola* National Union for the Total Independence of Angola Size: 109106	Originating and active in the highlands in central Angola, this group fought the Portugese from 1966 until the independence in 1974, and then the MPLA and FNLA for internal power in a proxy war of the Cold War, until its defeat in 2002. Since then, it has become a political party. Given its start as a Marxist movement, but then shift to Christian right-wing nationalism at the state level, it seems apt to expect predominantly Doctrinal practices.
UPC Union of Congolese Patriots Size: 10500	Active in the Ituri district in the DRC between April 2002 and November 2003. The UPC was trained by Uganda and Rwanda, and highly militarized and hierarchical. That suggests Doctrinal practices can be expected.

Table 2.1 — Case description of all armed groups in the sample.

Figure 2.1. Map of the locations of armed groups in the sample (n=50).

Data quality

Concept validity

The Modes theory offers categories that describe the different types of organization of Imagistic groups on the one hand and Doctrinal on the other (see tables on page 25 and 36). From these categories, variables were derived (for a further specification, see chapter 3 on Modes, chapter 4 on "Galton's problem" and chapter 5 on Resources for the variables in the applicable context). The required variables were converted into questions, which provided input for the coding manual: per category there were one or more sets of elementary questions, and per category there was an introduction given to facilitate the interpretation of the question(s). All in all, the question list consisted of eight categories / sets of questions:

Q1 General properties like group names, ethnicity, languages, countries of origin and activity, lifespan and type of group end[1] (if any)

Q2 Group and troop size[2] (time bound)

Q3 Ideology

Q4a Rituals [renamed to 'Conventional practices' to match with the expected common understanding from Conflict Studies and cognate disciplines.]

Q4b Shared negative experiences

Q5 Number of hierarchical levels (time bound) and type of leadership[3] (time bound)

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[1] The categories for 'type of group end' were quite similar to that of UCDP Conflict Termination data (Kreutz 2010), but 'defeat' is missing as explicit option in the UCDP dataset, and the UCDP data is at the level of conflict. Yet, in principle the translation could easily be made. Also for this variable, the data were in principle collected via expert answers; only when expert answers were missing, the UCDP data for the type of group end were used, and 'defeat' was added from Cunningham's e.a. dataset (Cunningham, Gleditsch, and Salehyan 2009). In practice, this resulted in group end data being added from 3rd party datasets for 9 groups.

[2] For troop size, data were primarily collected via expert answers; only when expert answers were missing, UCDP troop size data were used. These data were retrieved in 2011 via www.ucdp.uu.se/database; the codebook of that time is mentioning troop size (www.ucdp.uu.se/database/codebook.pdf; page 13). Since then, the bulk download facility seems to have disappeared from the website and the www.ucdp.uu.se/database link is forwarding to another URL. With use of the formerly available data from UCDP, group sizes were added for 3 groups.

[3] Same coding as in the MAROB dataset (Asal, Pate, and Wilkenfeld 2008) for the variable LEAD, though in the MAROB dataset the types of leadership were given per year, one type per year, whereas in the current project time was recorded in periods with the granularity of a month and more than one

Q6 Relation with the local population — like offering services y/n, etc.

Q7 Sources of income / resource base (time bound)

Q8 Relations (type & strength) with other actors (groups, countries and sometimes notable individuals) (time bound)

After development of the first question list (based on plausible derivations from the theory and comparison with other related datasets), the questions were presented to a few experts (±5) for feedback. With that feedback, the final question list was constructed. Answers to that final question list served as the actual data for the NSAG dataset of this research. During the initial phase of using the question list, minor clarifications to the explanatory text at the start of each question were implemented following preliminary implementation. For the full set of questions, see Appendix 1.

Operationalization and the understanding of experts

Once the Modes categories and the PPM hypotheses were operationalized by converting those to question lists, experts were the primary source of data. People may have different interpretations of the questions for various reasons, therefore, the inter-rater reliability may have been different for the same question, making them less commensurable. For only seven groups there was more than one expert; hence, it was deemed not very meaningful to calculate an actual inter-rater reliability. It was not always possible to know whether interpretations of the various experts and codifiers were different for the same question, so without evidence of the contrary, it was assumed that all experts and codifiers had the same understanding

leadership type per period was possible. In addition, the MAROB dataset only deals with North Africa and the Middle East, whereas the dataset of the current project spans the entire world. Only when the expert answers were missing, the data for the type of leadership from the MAROB dataset were used, with year-based periods and one type of leadership per period, according to the structure of MAROB. In practice, this resulted in leadership data being added for 1 group.

of the question. Yet, for some questions there are indications that experts occasionally had different interpretations. Most difficulties appeared to exist for question 4a (rituals) and 4b (shared negative experiences):

- Probably the biggest problem for question 4a and 4b is that on occasion the frequencies of rituals or shared negative experiences seem to have been interpreted either colloquially or collectively and/or at the group level, not the individual level. To give an example, when the negative experience was 'house destroyed', experts sometimes rated 'often'. 'Often' was specified as 'from several times a day to weekly'. This cannot be true for the typical, average group member: to have one's house destroyed weekly or even more frequently is nearly impossible. Perhaps, then, that the expert rated what occurred in the entire population. It is indeed possible that roughly on a weekly basis the house of a group member can be destroyed. It is less clear that this therefore is an experience with personal significance. Similarly, for 'being forced to migrate', it is hard to believe that either a single individual or an entire population is forced to migrate weekly — or more often. Still, experts sometimes filled in the frequency 'often' for this. Maybe a handful of migrations comes across as 'often', comparatively. There are also rituals that can hardly occur as frequent as 'often' at the individual level, for instance initiations, because initiations occur mostly once in a lifetime, or 'having to kill a family member' which in one case got the response 'often' (see also pg. 80 for a partial solution to this problem). It was estimated that for around 5-6% of the frequencies of negatively arousing rituals, the frequency 'often' was filled in unjustified.
- A related topic in Q4a and 4b was what counts as an individual experience for a typical group member. Take for instance the ritual 'wedding'. It is not plausible that a typical group member is getting married monthly, seasonally or annually; so if an expert filled in 'sporadically' (which happened), it is an implausible frequency. Presumably, getting married as a person does not occur very often in life, somewhere between zero and a dozen times, with a strong skew towards zero

or once. That would translate to ‘rarely’ in the given frequency table. Yet, attending a wedding could occur a few times per year, translating to ‘sporadically’ indeed. The wording as used for such questions was unclear in that respect, it could have been more guiding; in this example e.g. “getting married in a wedding ceremony” vs. “attending someone else’s wedding”. One expert, who gave the frequency 'often' for ritual ‘humiliation’ added that “violent punishments & humiliations were common”, which seems to suggest that he filled in the frequency with the group in mind, not the modal/average group member.

- Question 4a listed various rituals. For some rituals, a short clarification was given to facilitate the interpretation. The listed option ‘ritual punishment’ had the clarification "punishing someone without actually finding that particular person guilty". Judging from the remarks experts gave, this was sometimes interpreted as 'punishing someone without a court process'. A few experts described how someone innocent was punished. The ‘right’ interpretation should have been how a stand-in (group of) person(s) was punished for something bad with the belief that this settles the score, not to do a fake court trial.
- It appeared to be unclear for some experts which rituals and practices (Q4a) constitute group identity, and which practices are merely present but do not constitute group identity and should therefore technically be left out of the answers. This lack of certainty was inferred from comments that were occasionally given in the description or remarks section.
- At the end of question 4a and 4b (‘Shared customs and practices’ and ‘Shared negative experiences’), an option was given to add more categories of shared customs or negative experiences in the form of ‘Other, please specify…’. The idea was that whilst great effort was made during design of the question list to include all relevant answer options, it was recognized that the list provided to experts might not be exhaustive; hence, if an expert knew about more types of shared customs or negative experiences, he or she was free to fill these in. However, whilst experts filled in the frequencies for all provided shared customs and

negative experiences, they very rarely added an extra answer option. That could either be interpreted as that that the list was more or less complete, or that experts in general only ticked the boxes that were given, neglecting the possibility to add more option answers. If it were the second case, then the comparability of presence and frequencies for the extra options given by some experts was close to non-existent, because of the lack of data, as other experts did not come up with the same extra answer option as well.

- Most of the time, experts did not fill in the description of the ritual (4a) or negative experience (4b), although it was being asked for. Lack of these data makes the assessment of the emotional intensity based on the *description* difficult. Instead, the ritual *type* was leading to assess emotional intensity. For instance, one can validly guess that sexual harassment is quite strongly dysphoric, whereas feasting is quite strongly euphoric, etc.
- Finally, for question 8, under the column "Other armed group name or state", some experts gave other types than an armed group or a state, either a person like Mao or supra-national actors like the UN. Perhaps this was a blessing in disguise, because such influences are meaningful for this research. For instance, if two or more groups were influenced by Mao, it gives an indication of a common source of, say, ideology and strategy. Therefore, it does have bearing on Galton's problem — the problem of non-independent cases in the sample. Perhaps the question text should have been something to the effect of: "Other actor, e.g. armed group, person or state". Some experts may have left out such influences —other than armed groups or states— because it was not what the question asked for. Hence, one may surmise there have been different interpretations with respect to how to interpret this column in this question.

Below (pg. 78, 'Solutions to increase the consistency of encoding'), some measures as used in this research to mitigate or even solve these issues are described.

Quality of expert answers

It is evident that the quality of the data can only be as good as the quality of the experts. The quality of the experts can be understood as to what extent they fill in the 'true' answers for the questions asked. However, it is impossible to measure to what extent an expert really is an expert; that would require a 'true' representation of the answers in the first place to assess the quality of the expert — which is a circular problem. Because it is not possible to assess the truthfulness of the answers of any individual expert, it was assumed that their answers were on the whole reasonably accurate; and it was assumed that in case the answers were not entirely accurate, that such inaccuracies were cancelling each other out in the bigger sample — though at the cost of introducing 'noise'.

A few groups did have more than one expert. In one case (the RUF), three experts commented on each other and reached more or less an agreement on the right type of answers. In six other cases (6 of 50), groups did have two experts who filled in data for the group, independently from each other. There was no good way of assessing whether the answers of one expert were more trustworthy than the answers of another expert. However, for groups that had more than one expert, data of all experts were taken into account in the following way:

- First of all, trying to resolve as many of the inconsistencies as possible. When there was evidence that one expert misinterpreted a particular question, it was corrected. The scale of the problem was described above: probably most of the problems were with the frequencies of some rituals and shared negative experiences; an estimated 5-6% of the answers regarding these two specific frequency questions gave rise to concern.
- Second, using random sampling. This was done in combination with Multiple Imputations to fill the gaps in the dataset. The basic idea is that $m_{max}=100$ imputed data files were created with one set of answers per armed group per imputed

dataset. When there was more than one set of answers per group because of more than one expert per group, the expert for the m^{th} imputed data file was randomly drawn per group to provide the answers. Per imputed data file the statistical analyses were done. The statistical analyses were pooled to reduce the statistical outcomes to single parameters. (More on imputations below in the section 'Dealing with missing data', pg. 80).

Solutions to increase the consistency of encoding

Three mechanisms were in place to increase the data quality and to decrease the potentially detrimental effects of the issues mentioned above: using input screens with constraints, using database constraints, and checks of the answers by the present author.

- Input screens — For this research, all data were collected in a relational database first. To facilitate data input, screens were added 'on top of' the database. These screens provided two functions: (i) to present the data in an understandable format, and (ii) to make sure the right data is put in the right place and format into the database. It is the second property that is relevant for the data quality. Per question, a screen (in the form of a tab) was developed that resembled the structure of the particular question and enforced the right type of answers. For instance, when the question gave several options to pick from, but only one of these options should be picked, a dropdown box was provided in the screen, enforcing that indeed only one answer could be put into the database. Other examples were that when the answer should consist of a number, the input control ('textbox') was set to only accept numbers; when dates were being asked, only dates could be fed into the database; when answers were conditional on previous answers given, input controls were enabled or disabled according to the circumstances; etc. An example of a screen is given below:

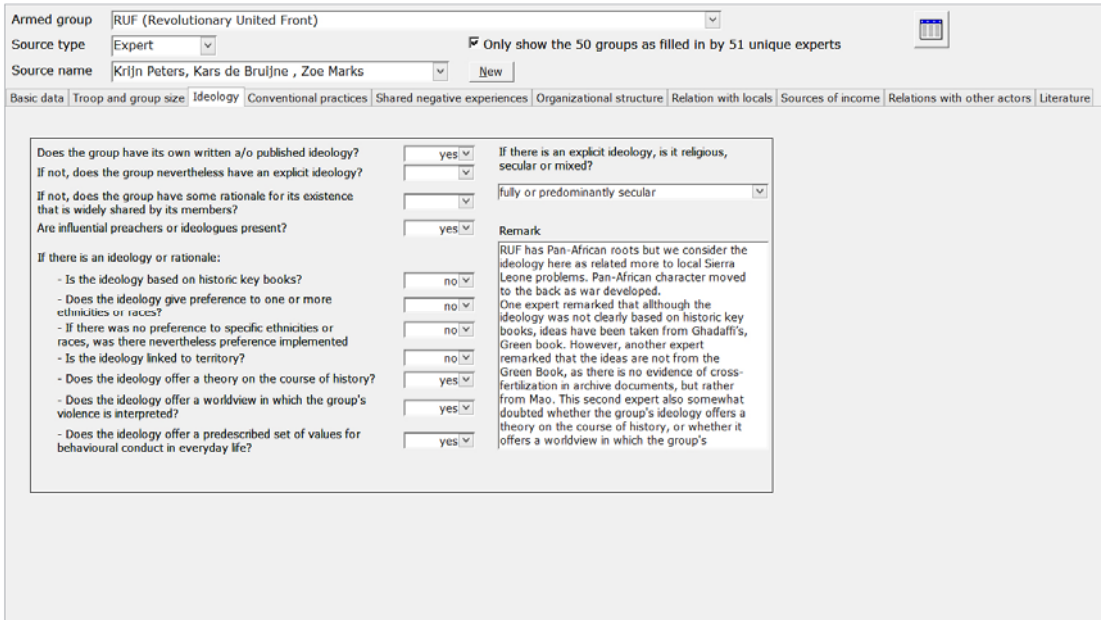


Figure 2.2 — Screenshot of the database interface

In this screen, it can be seen that per question ('Basic data' – Q1, 'Troop and group size' – Q2, 'Ideology' – Q3, etc.) there was a tab. For the question shown ('Ideology' – Q3), the answer types were mainly yes/no, though the sub-question regarding the nature of the ideology (religious, secular or mixed) was caught in one of six answer options. All such answers were constrained by dropdown boxes to make sure the right type of answer was given, with full consistency of answer options between all groups. An unconstrained textbox was provided for all questions so that clarifying statements and additional expert remarks etc. could be preserved as well. These remarks were not statistically analysed and hence not used as such in this research.

- Database constraints — In addition to the screen constraints, there were constraints implemented on the database with respect to which type of data should be contained in which columns / variables. The broad categories were numeric, text, and option data. In addition, it was specified in the database whether an answer was required or optional. Again, this enforced that the right type of answer was given at the right place.

- Checks by the present author — Although screen and database constraints can enforce the right format of the data, these constraints cannot enforce everything. Referring to the example given above, if an expert gave a frequency of 'often' for an initiation ritual, it was technically possible to fill it in in the screen and in the database, but that frequency seemed implausible for an initiation. When in doubt, experts were asked whether their answer actually was what they meant. Many experts did not respond to such queries for clarification. In such cases, the answers of experts could be converted to an answer that was considered to be more plausible. Every deviation from the answer of an expert was recorded in the textbox next to the input control or at least for the particular question. That ensures that later generations of researchers can trace and reinterpret or rectify such deviations.

Dealing with missing data

For several NSAGs, data were missing for one or more questions. Sometimes, the expert ran out of time to fill in the entire question list, in other instances the expert used an early version of the question list which contained one less question, in several other instances the expert simply did not fill in all questions when (s)he returned the question list.

Six solutions were implemented to deal with missing data, applied in sequential order. (1) 'vetting': ask the experts to fill in all answers upon reception of the incompletely filled-in question list, and completing certain values when they could be inferred; (2) top-up the answers with encoded data from literature; (3) top-up the dataset with data from other datasets, (4) use answers from a second expert when available; (5) use assumptions to fill in the gaps; and (6) use multiple imputations to infer the most likely answers.

Those steps will be described one by one.

Using available data sources

(1) When question lists were returned with some questions unanswered, experts were asked whether they had been able to form an opinion about the questions left unanswered or not. However, less than half of the experts who were asked to complete their answers actually responded. For those that did not respond to the second request, they were not asked again to fill in more.

The experts' answers were transferred to the central *database*, which is the primary storage entity for all raw data

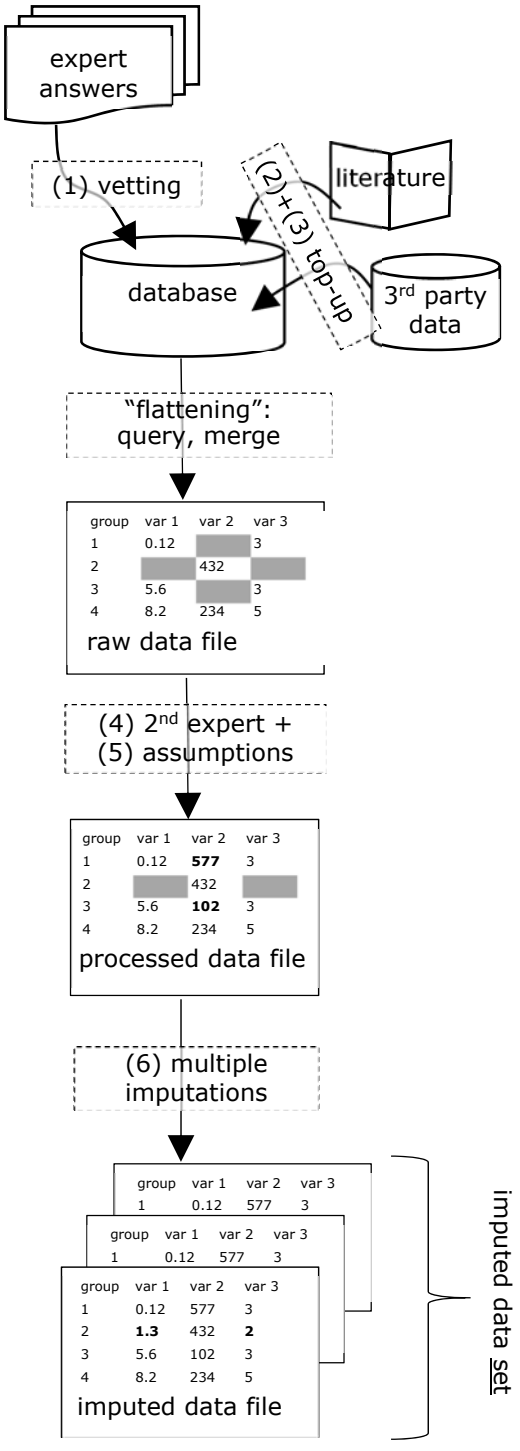


Figure 2.3 — The data process of this research

that has been collected from data sources.

(2) For some groups, literature existed that could serve as an aid to fill in gaps. This was the case for the Ranvir Sena militia and the PKK. For the NMSP the reverse process was used: first fill in the question list based on literature, then ask the author of the monograph to check and when necessary correct and complete the answers. Encoding was transferred into the central *database*.

(3) As described above (pg. 54 and 72), third party datasets were used for three variables to obtain data when it was not provided by experts. Because the central *database* is relational, these are mere extra tables in that database, separate from expert data and encoded literature data. A process of purging and re-coding is generally required to link data from various databases / datasets.

Because the data in the *database* is in relational form, i.e. one table per conceptual entity, and because statistical software can only deal with non-relational 'flat files', all data were 'flattened' through a process of querying and merging into one *raw data file* which contains all relevant variables for the analyses at hand.

(4) With the *raw data file* in place, further filling of the gaps was done. For some groups, data was provided by more than one expert. Coincidentally, there were no more than two experts per group in this research, except for the RUF where three experts commented on each other's answers and in a way created one set of answers, not three. The availability of precisely one extra expert for certain groups enabled to copy complete data from one expert to gaps in the data of the other, where possible and applicable.

Assumptions

(5) Thereafter, various assumptions were made to fill the gaps. These were:

a. For conventional practices and shared negative experiences, when no frequency was given, ‘never’ was assumed. This phenomenon occurred most for the negative experience 'adverse conditions', as it was added later by one or two experts under the ‘Other, please specify…’ option. Through observation of experts whilst they were filling in the question list, it became clear that they sometimes only filled in the frequencies of the rituals or experiences that were actually there, and skipped the ones that were not relevant for the group. That supported the idea that the frequency ‘never’ could be inferred for absent values.
b. Similarly, when experts did not fill in a rating for the intensity of resource extraction for a certain resource type, it was assumed to be 'none'.
c. Similarly, when experts gave no answers to some of the sub-questions regarding 'public works created by group' for the main question regarding ‘Relation with the local population’, and when the rest of that question was answered with 'yes', the empty questions were assumed to be answered with 'no'.
d. Regarding various questions, if end dates of a period were not filled in, then the end dates of that period were set to the answer date of (i.e. the date of filling in) the questionnaire. An empty end date always seemed to indicate that the item concerned was still going on whilst the question list was being filled in. The rationale to assume the answer date rather than no date, is that after that answer date, no data is available, so the only certain period is the period until filling in the question list. Hence, that period is taken as 'certain', rather than as open-ended with no clue about the end date.
e. When the duration of the period for some variable was calculated, a few sub-assumptions were made:
   - If the month was not filled in for both start and end date, 365 days were assumed for every year in the span between start year and end year;
   - If the month was not filled in for one date, June (06) was assumed;

- If the day was not filled in, the 15th of the month was assumed;
- If start and end year were the same and no months were given, then a period of 365 days was assumed.

f. When group size or troop size data were calculated, the following sub-assumptions were made:
   - When a 'group size most likely' is given, that group size was used as group size for the given period
   - When a 'group size most likely' is not given but a 'group size lower' and a 'group size upper' are given, the average of these outer limits was taken as group size
   - When only the upper bound is given, 90% of that number was taken as most likely group size
   - When only the lower bound is given, 110% of that number was taken as most likely group size
   - Troop size: same assumptions; replace 'group' by 'troop'
   - If none of the group size numbers were given, but there was a troop size (same assumptions as for group size), then 110% of the calculated / assumed troop size was taken as being the group size (10% overhead on group size added).

Other assumptions, which did not have the aim of filling in empty values but to achieve a more consistent dataset, were:

g. For armed group and troop size, the weighted average was calculated to obtain one single number for both group size and troop size. The weighted average was based on the durations of the periods that a group had a certain size.

h. When there was more than one value for the outcome of a conflict, the outcome variable was reduced to one outcome. The decision rule was: when 'Victory' or ‘Defeat’ were available, they were chosen as they seem the most

important outcomes; otherwise 'Peace agreement' was chosen because the only other combination of outcomes in the dataset was Ceasefire + Peace agreement, where the latter is considered to be more of an ultimate outcome than the former.

i. For the number of hierarchical levels, the weighted average was calculated per group, weighted for the durations of the periods that a group had a certain number of hierarchical levels.

j. There were four possible types of leadership as answer options. There may be more than one type during the lifespan of a group. Per group, the type of leadership could vary over time (there may be different periods discerned per group and per period the type of leadership can change). Moreover, per period, there may be more than one type of leadership, e.g. both decentralized leaders and a ruling council. All period data were neglected (or condensed as if they were one period, depending on how one wants to see it). The four types of leadership were laid out horizontally as 'dummy variables', whit the values of 1 (=present) or 0 (=absent).

k. For the calculation of the growth rate per group, the group sizes and their respective periods were used as a starting point. Growth rates could only be calculated when there was more than one period with a group size. The middle of each period was taken as the date that a group had a certain size. For each extra period, the growth rate was calculated in percentage, and the geometric mean was calculated to reach one growth rate per group in percentage per year.

With empty values filled where possible by existing expert answers (4) and assumptions (5), the *processed data file* was in place.

Multiple Imputations

(6) As a last step, the process of 'Multiple Imputations' (MI) was used to fill the remaining gaps. MI has the advantage over the classical method of using listwise deletions or using only complete observations, that no data is thrown away, which often also has been collected at considerable cost. Instead, all statistical analyses can be done on all cases, and thereby the same number of cases, which makes the analyses more comparable; and the number of cases is (much) larger, which increases the chance to detect patterns. Summarized, the idea of MI is to treat each variable with missing data as a dependent variable, construct a statistical model based on all other variables with sufficient correlation with that dependent variable to predict it, and then impute the missing values based on that model multiple times to represent the uncertainty that comes along with statistical models. In doing so, the original dataset (here: the *processed data file*) with missing values is 'filled' multiple times with imputed values. As a result, multiple *imputed data files* are created. During the actual analyses, the relevant statistical models are calculated per *imputed data file* (e.g. correlation between group size and nr. of hierarchical levels, etc.). The parameters of these statistical models are thereafter 'pooled': generally, the mean per parameter of interest (e.g. slope, intercept, correlation coefficient, etc.) of all *imputed data file*s is calculated, and for the inferential properties (p-value, standard deviation etc.) standardly "Rubin's rules" (Rubin 1976, 1987) are used that not only reflect the sampling uncertainty, but also the uncertainty caused by the imputation process.

There is one notable practical disadvantage to using MI: it is a relatively new technique, and not all statistical modelling techniques are already implemented in software in a way that they can deal with MI datasets. In fact, only a standard regression (and thereby its derivatives like ANOVA) is implemented in a neat, parsimonious way (Van Buuren and Groothuis-Oudshoorn 2011), though some other tests like correlations and the Chi-square can be calculated with additional helper functions available in supplementary packages (Robitzsch, Grund, and Henke 2016).

Many other relevant statistical techniques, even relatively basic ones, are not yet available. That drawback did affect this project; an estimated 4000 lines of code in R were programmed for this study specifically to deal with analysis on MI datasets other than linear regression. Several statistical tests had to be programmed for this study: cross tables, Fisher exact test, partial correlations, test for normality, robust ANOVAs, post-hoc ANOVAs (standard and robust), p-value poolings, modality-tests, PCA based on individuals, and MDS. The software that was created for this project can be used in subsequent increments of this research, and the code can also be used in other research because it implements general methods that deal with pooling MI dataset analysis results.

The imputations were done with the R package `mice` (Buuren and Groothuis-Oudshoorn 2011). First, from the *processed data file* of 50 armed groups with potentially multiple experts per group, a random sample was drawn such that it contained all these 50 armed groups but with one expert per group. Effectively, the random draw was per armed group. With that temporary data file, an *imputed data file* was constructed. This was done 100 times, so that the multiple experts per group were over-sampled 100 times and the number of *imputed data files* was 100 as well — constituting the *imputed dataset*. Visual checks were done to make sure the `mice` algorithm that generated the imputations had converged (Van Buuren and Groothuis-Oudshoorn 2011, 37–41). The recommendation in the `mice` manual (p. 22) to have between 15-25 predictor variables per imputed variable was followed. That also meant that for the different imputed variables, different minimum correlations were used in their prediction models.

Processing the data

Data were processed with scripts developed in the software package R (R Core Team 2015). References to the packages used for specific analyses are given where applicable.

Chapter 3 — Modes and armed groups

This chapter will consider the extent to which the Modes theory, described in chapter 1, is supported by patterns of variation in the sample of armed groups, detailed in chapter 2. This chapter revolves around three research (sub)questions regarding the Modes theory:

1. Is there an inverse relationship between ritual frequency and the emotional intensity of rituals?
2. Are the modes properties mutually reinforcing?
3. Are there two attractor states, representing the two Modes?

Further details regarding these three questions will be explained in the next section, followed by a discussion of the variables used here and how one of the main analyses —a Principal Component Analysis (PCA)— is calculated when based on imputed datasets. The bulk of the chapter presents the analyses of the data. In the last part, the results will be interpreted, leading back to one of the main questions of this thesis: to what extent can the Modes be found amongst armed groups?

Testing the Modes theory

1. Is there an inverse relationship between emotional intensity and ritual frequency?

One of the main hypotheses of the Modes theory is that the emotional intensity and performance frequency of collective rituals tend to be inversely related (see the Theory chapter, category 'Ritual frequency and arousal' in table 1.1 and 1.2 on page 25 and 36, and tenet 3.10 in Appendix 2 on page 418). In addition, low-arousal high-frequency rituals should spread standardized beliefs and practices (via proselytizing dynamic leaders, explicit ideology, etc.). The Modes theory predicts that low-arousal, ideology-spreading rituals are more frequently performed per participant than rituals with high emotional intensity. In this research, data on performance frequencies of ideology-spreading rituals were collected, as well as data

on frequencies of rituals that were assumed to be positively and negatively arousing, like feasting and humiliation. This enables an interrogation of the database with the question: *Is there an inverse relationship between ritual frequency and the emotional intensity of rituals?*

2. Is there a mutual reinforcement of Modes properties?

One of the hallmarks of the Modes theory is that the diagnostic features of the two modes are mutually reinforcing (Whitehouse 2004, 75; and see Appendix 2, tenet 3.8). This hypothesis will be investigated in three ways. First, the Doctrinal Mode has various properties that jointly are 'more', 'larger', etc. than in the Imagistic Mode, and conversely, in the Imagistic Mode these properties are 'less', 'smaller', etc. (Whitehouse 2004 pg. 74, table 4.1; and Whitehouse and McQuinn 2012; both reproduced in the Theory chapter, table 1.1 and 1.2). For instance, in the Doctrinal Mode, a large(r) group size *and* a higher number of hierarchical levels are expected, whereas in the Imagistic Mode a small(er) group size *and* a small number of hierarchical levels is expected. That basically means that both the Imagistic Mode and the Doctrinal Mode can be captured in the same correlation, in this example a positive correlation between group size and the number of hierarchical levels. For all group property combinations -or when operationalized, for all variable combinations- these predictions can be tested. *Are Modes variables correlated as predicted?* That will be split up into sub-questions: *Do we find that those Modes variables correlate at all? How big are these correlations? Are they significantly different from zero?*

Secondly, although most Modes variables (group properties) are supposed to have a positive correlation between each other, there are a few exceptions. A few observable properties of the Imagistic Mode —most notably, high-arousal low-frequency rituals, and to a lesser extent also non-centralized (i.e. distributed) leadership— are hypothesized to correlate negatively with many other Modes categories, like the group size and the number of hierarchical levels. All in all, most

correlations are expected to be positive, but some are expected to be negative. As a result, the second question being asked about the relationship between individual Modes variables is: *Is the direction of the correlations between all individual variables as predicted?*

Third, according to the Modes theory, it would not make sense to try to single out any one of the categories (see tables 1.1 and 1.2 on page 25 and 36, left columns) as somehow prior to any of the others (Whitehouse 2004, 75; and see Appendix 2, tenet 3.5), but that they should be seen as grouped together. Here, the Modes theory does not clearly predict to what extent the clustering (reinforcement) should occur, but broadly speaking, one could theorize that because all variables interrelate and are not independent, they are all correlated to each other. Hence, when a Principal Component Analysis (PCA) or a Multi-Dimensional Scaling (MDS) is applied to the data, then one big factor, or one dimension, should be found; at most two, if the Imagistic Mode cannot be captured by the same variables into the same component as the Doctrinal Mode. Hence, the question is: *Can evidence for one factor or one dimension of variables be found, or at most two?*

3. Are there two attractor states?

If one thing is of essence for the theory of the two Modes, then it is that there are two distinctly, even 'divergent' ways of organizing religion/group structure (Whitehouse 2000, 2004) and armed groups (Whitehouse and McQuinn 2012). Focusing on armed groups here, Whitehouse & McQuinn (2012) write that armed groups "tend to cluster around two sociopolitical 'attractor positions': the one large scale and hierarchical (doctrinal) and the other highly cohesive but localized or regionally fragmented (imagistic)" (p. 598), and that "rebels, whether or not they are religious, typically utilize either doctrinal or imagistic dynamics rather than exploiting both modes at the same time", and that "rebel groups […] cluster around one or other of these respective modes, but not both" (p. 605).

In addition, as described in the theory chapter, the Modes theory states that Modes are attractor positions, with little overlap in between. That is implemented in this study in four ways. First, despite the wariness of the Modes theory to assign hard criteria to how big, large or small the Modes properties should be to be categorized as either Imagistic or Doctrinal, and despite the wariness of the Modes theory to describe hard cut-off points between the two Modes, it can still be a good mental exercise to make the criteria as concrete as possible, and then see how well the groups separate into either having most or all properties categorized as Imagistic, or having most or all properties categorized as Doctrinal.

Second, certain variables should show a bi-modal[1] distribution. If Modes are indeed attractor states, then intermediate values will be rare. These effects will be clearer for (more or less) continuous numerical variables, so to remain on the charitable side and to do the most valid tests, only four variables that are (semi)continuous are interrogated in this way: group size, growth rate, group size divided by troop size, and the number of hierarchies. Following from this, the question is: *Is there a bi-modal distribution for (semi)continuous Modes variables?*

Third, if the two Modes are attractor states and overlapping group types hardly exist, then groups should predominantly have either Doctrinal (high-frequency, ideology-spreading) rituals, or Imagistic (low-frequency, high-arousal) rituals. If that is the case, then one would expect to see two -and only two- clusters of dots when all low arousal/high frequency (LA/HF) and all high arousal/low frequency (HA/LF) rituals are plotted against each other on a graph: several groups will have LA/HF rituals but no or hardly any HA/LF rituals, and several groups will have hardly any LA/FH but predominantly HA/LF rituals. The question is whether we can find such

[1] Note that the term 'Mode' with a capital refers to the Modes theory, and 'mode' and 'modal' without capital refer to concepts from statistics.

patterns in the dataset: *Do the majority of the groups either have 'Doctrinal' rituals only, or 'Imagistic' rituals only?*

Fourth, given that the values of most Modes properties are mutually reinforcing yet that two attractor states are expected, one should be able to see that when individual groups are plotted on a Principal Component plane (in the PCA) or an MDS, that there are two distinctive types of groups; one would expect two -and only two- clusters of dots, with very few dots in the middle part of these axes. So: *Can two clusters of groups be found in condensed multi-variate data?*

Explorations

All of the above questions explicitly deal with testing the existence of the Modes amongst armed groups. However, there are three extra topics in this chapter that do not directly deal with testing hypotheses from the Modes theory, but are related. They can be considered 'exploratory' and are presented here because they were either easy to include in analyses already done here or because they were a straightforward extension of these analyses.

- Binary vs. scale. From a theoretical perspective, it is possible to argue in two directions about the effects of the number of rituals of a certain type. On the one hand, there is an argument to be made that one high-frequency collective group-defining ritual should be enough to generate Doctrinal Mode characteristics and one highly dysphoric collective group-defining ritual should be enough to generate Imagistic Mode characteristics. This is because these types of rituals are thought to be linked to distinct sets of psychological processes, the Imagistic one leading to fusion with relational groups and the Doctrinal one leading to identification with large imagined communities (see Theory chapter, and Whitehouse and Lanman 2014). On the other hand, there is an argument to be made that more rituals of a certain type create more of these effects. Again, a psychological explanation can

be used for this, because the Imagistic rituals are thought to tap into evolved kinship recognition systems, or as Whitehouse and Lanman (2014) describe: "Essential components of one's autobiographical self, resulting from significant life events stored in episodic memory and ranging from the formative experiences of childhood to sharing the traumas of front-line warfare, can be perceived as shared with others in a group" (p. 677). There is a case to be made that more shared dysphoria rituals generally mimic the protracted kinship experiences from youth better than just a one-off experience, hence, one could argue that more types of rituals give a stronger effect than just one. As for the Doctrinal mode, it requires a high frequency of repetition of the doctrine (semantic worldview), so more types of Doctrinal ritual can increase the frequency even more; and indeed, this is what is often seen in e.g. Doctrinal religious communities (prayer, as well as religious greetings, religious ceremonies, religious readings and teachings at other ceremonies like weddings, etc.). Or as Whitehouse and Lanman state it, "The [Doctrinal] package, based on so-called doctrinal practices, involves frequently repeated causally opaque conventional actions with low levels of dysphoric arousal but heavily emphasizing credibility-enhancing displays for beliefs, ideologies, and values." (p. 679). All in all, it is unknown to what extent it matters whether the mere presence of one or more rituals ('true') or absence ('false') of either the Imagistic or the Doctrinal Mode is a better predictor for the presence of other Modes properties, OR whether the actual number of rituals of either the Imagistic or the Doctrinal Mode is a better predictor for the size of the correlations with other Modes properties. The first situation, no ritual vs. one or more (at least one ritual present), is called 'binary' here (false or true, 0 or 1), and the second situation, where every extra ritual gives a higher number in the variable, is called 'scale'. Is there any effect of adding more rituals if there is already one present, or not? Is at least one ritual of a certain Mode enough, or is more = more?

- Outcome of the conflict. One of the explanations why Modes exist as they do, is that they are shaped by ecological factors, or more specifically, that they are

adaptations to Collective Action Problems. One of those problems is group competition, or in this context: inter-group conflict. Whilst the analysis done here will be too preliminary to make strong conclusions about mechanisms, this thesis asks: Do some of the Modes properties relate to a certain outcome of a conflict? Are there preliminary indications that some elements of the Modes are helpful in achieving a certain outcome?

- Religiosity of the explicit ideology. There are a few reasons to have a look at the religiosity of the explicit ideology. First, the Modes theory originated in the context of religion, to the extent that the term 'Modes of Religiosity' was used to describe the theory in earlier stages (Whitehouse 2004). Second, the 21st century is said to have started at September 11, 2001. The WTC terrorist attacks appeared to have been plotted by an explicitly Doctrinal religious armed group, Al-Qaeda, which is until this date an inspiration for other religious -currently mostly Islamic- groups around the world. More broadly, religiosity of armed groups seems to play a role in violent conflicts, also for the duration and perhaps outcome of the conflict (e.g. Svensson 2007; Sheikh et al. 2012), and it has been suggested that religion is an adaptation for war, and that religion in fact is gaining importance again in conflict during the last decades (D. D. P. Johnson and Reeve 2013). Moreover, moralizing gods from ancestral belief systems of individual ethnic groups prior to European contact are found to significantly increase prevalence of contemporary conflicts and casualties at the local level in Africa (Skali 2017). As there is data on the religiosity of the explicit ideology in this dataset, it is possible to investigate the relationship of that factor with Modes properties and with the outcome of the conflict. And finally, if there really is a link between Modes and religiosity, then it may be useful in future research, as a step towards solving Galton's problem, to use religious relatedness as covariate or correcting factor. These three religious topics will conclude the results section.

Methodology for this chapter

Analyses in this chapter use the imputed dataset as described in the previous chapter. The variables that are specific for this chapter are discussed in what follows. Specific statistical analyses are not discussed here but briefly indicated in the results section in footnotes, with one exception: the technique of creating a PCA based on an imputed dataset will be discussed at the end of this section.

Introducing the variables

One of the central features of the Modes theory is the subdivision of group properties into operationalizable categories like 'ritual frequency', 'type of leadership', 'scale', etc. There is no established way of operationalizing these categories. However, some indications exist in the literature, for instance in Atkinson and Whitehouse (2011) the group size is an operationalization for 'Scale', and they also describe ordinal categorical variables to capture ritual frequencies and emotional intensities. The database Seshat (Turchin et al. 2012) uses somewhat similar operationalizations for these two ritual categories. The category 'leadership', which is present in the 'religious' version of the Modes theory (Whitehouse 2000, and most notably 2004) was not present in the publication that first applied the Modes theory to NSAGs (Whitehouse and McQuinn 2012). Given the suspected importance of leadership in armed groups (see e.g. Clapham 1998; Tamm 2016), the category 'Leadership' was included in this research as well. It was operationalized like the 'type of leadership' data from the MAROB database (Asal, Pate, and Wilkenfeld 2008). All other variables were newly designed for this study. An overview of the conversion from Modes categories stemming from the theory into variables is given in table 3.1.

In the overview table (3.1) of the variables below, the three left most columns ('Mode property', 'Imagistic' and 'Doctrinal') are as given by the Modes theory (see chapter 1, table 1.2, page 36). Different definitions for each Mode category were given in different publications, so where applicable both the Whitehouse (2004) and

the Whitehouse and McQuinn (2012) definitions are given in the second ('Imagistic') and third ('Doctrinal') column.

For the Ritual frequency and arousal, a few pre-defined rituals were chosen per Mode. The frequency of every pre-defined ritual was provided as answer by data sources like experts, and the arousal was assessed with assumptions about how arousing the applicable rituals would be. Imagistic rituals were 'humiliation', 'disgust', 'being subjected to pain', 'being forced to do an action with the risk of wounds', 'having to kill a family member', 'having to kill a friend', 'ritual punishment', 'ritual killing', and 'sexual violence'. These were assumed to be highly negatively arousing. Doctrinal rituals were 'ideological teaching', 'indoctrination', 'military training / drills', and '[doing] Religious, spiritual or ideological gatherings'. They were assumed to spread ideology and social structure, to create a homogenized semantic framework and to be relatively non-arousing (perhaps with the exception of military training and drills).

Mode category	**Imagistic**	**Doctrinal**	**Operationalization in this research**	
			Imagistic	**Doctrinal**
Ritual frequency and arousal	Rarely performed dysphoric ritual ordeals (with little or no doctrinal transmission) Low transmissive frequency, high arousal	Daily collective rituals (including doctrinal repetition) High transmissive frequency, low arousal	Emotionally negatively arousing "Imagistic" rituals (see text) with frequency 'rarely'	Ideology spreading "Doctrinal" rituals (see text) with frequency 'often'
Ritual meaning	Meaning of rituals inferred independently Internally generated	Transmission of exegesis to all members Learned/acquired	Explicit ideology - 'based on historic key books' - [is it a] 'written and published ideology' - [are there] 'prescribed values' - [is there a] 'theory of history' - [are] 'influential ideologues' [present] - ([is a] 'rationale for existence' [explicitly given])	
			all: no	all: yes
Social cohesion	Intense, based on relational ties	Diffuse based on categorical ties	-	-
Leadership	- Passive/absent	- Dynamic	'factionalized/competing leaders' or 'weak or decentralized leadership'	'strong ruling council' or 'strong single leader'
Spread	Slow or fragmentary Slow, inefficient	Fast, efficient, homogenous Rapid, efficient	Growth rate 'slow'	'fast'
Scale	Small, face-to-face communities Small scale	Large "imagined communities" Large scale	Group size 'small'	'large'
Degree of uniformity	No standardized ideology / dogma Low	Standardized body of ideology / dogma High	see category 'Ritual meaning' above	
Structure	Authority exercised personally rather than institutionalized Non-centralized	Highly elaborated hierarchy with designated ranking of offices Centralized	Number of hierarchical levels Low	High
			Group size divided by troop size 1	> 1
			Provision of social services none	one or more
			And see category 'leadership' above	

Table 3.1 - The conversion from the Modes theory to variables as used in this research

The Mode properties 'Ritual meaning' and 'Degree of uniformity' were taken together in this research. A phenomenon like 'meaning of rituals inferred independently' for 'Imagistic ritual meaning' was not included, to keep the question list to a manageable length. Its Doctrinal counterpart, 'transmission of exegesis to all group members', was close to the 'standardized body of ideology/dogma' that was defined for the Doctrinal category 'Degree of uniformity', hence, these two Modes properties were taken together in their operationalization. The 'Explicit ideology' was measured by six binary variables: 'based on historic key books' [y/n], [is it a] 'written and published ideology' [y/n], [are there] 'prescribed values' [y/n], [is there a] 'theory of history' [y/n], [are] 'influential ideologues' [present] [y/n], and ([is a] 'rationale for existence' [explicitly given] [y/n]). The latter binary variable is between brackets, because it appeared that for all groups in the sample the answer was 'yes', hence, there was no variability and this question was left out of the rest of the analyses.

Social cohesion was not directly measured in this research. Instead and partially as a proxy, the type of leadership was measured; the thought is that 'factionalized/competing leaders' and 'weak or decentralized leadership' are thought to indicate localized groups, and therefore could be a proxy for Imagistic practices, whereas 'strong ruling council' can indicate a formalized ruling social structure (i.e. Doctrinalness) and 'strong single leader' the dynamic leadership that the Modes theory ascribes to the Doctrinal Mode. The expectation was that data could be found relatively easily for the type of leadership, and moreover, by measuring the type of leadership a link could be made to the existing civil war literature and research, because the same variable had already been collected before for armed groups (Asal, Pate, and Wilkenfeld 2008).

Spread was operationalized as the growth rate of the group size in percentage per year (geometric growth rate). As with all Modes properties, there was no clear predicted number for both the Imagistic and the Doctrinal Mode, only that for the

former it should be 'slow' or zero, and for the Doctrinal 'faster' than for the Imagistic Mode.

Finally, the 'Structure' property was operationalized in more than one way. As for the property 'Ritual meaning', the theory seemed to give definitions that were different in nature for the Imagistic versus the Doctrinal Mode. The Doctrinal definition was the basis for measuring the number of hierarchical levels, and the provision of social services. The 'Group size divided by troop size' variable is explorative; the thought is that the more an armed group provides social services, the more designated bodies it has to provide these, making the ratio of group size divided by troop size higher (relatively less dedicated military and more other functions in the group). Provision of social services consisted of eight binary variables: 'has a political wing' [y/n], 'has a social organization' [y/n], 'installs law' [y/n], 'builds hospitals' [y/n], 'builds roads' [y/n], 'creates public buildings' [y/n], 'builds schools' [y/n], 'other [services]' [y/n]. The 'Group size divided by troop size' and 'Provision of social services' were also inspired by the PPM (Beardsley and McQuinn 2009), which stated that the high-Return On Investment groups would have a high degree of militarization (hence, a high proportion of troops) and not much provision of social services, whereas low-ROI groups would have the opposite characteristics.

Combining variables

In this research, there are a few variables that purport to measure the same construct and have the same question structure. For instance, several ritual questions aim to capture the construct 'Imagistic rituals', and several variables aim to measure 'Explicit ideology'. Within those Modes properties, the question structure is the same. Such sub-variables per property might be combined into one compound variable, e.g. all individual Imagistic rituals ('humiliation', 'being subjected to pain', etc.) into one indicator for Imagistic rituals, all detailed questions on explicit ideology into one

indicator for 'Explicit ideology', etc. This would have four benefits: (i) it matches more closely the original Modes categories, (ii) it gives a quicker and more easily interpretable overview of the variables, (iii) it reduces the number of variables compared to the number of cases, which has various statistical benefits, and (iv) it may give insight to what extent the constituting variables measure the same construct. A standard way to investigate whether variables can be combined and whether they measure the same underlying construct is via Cronbach's alpha (Field, Miles, and Field 2012, 799). Cronbach's alpha is not without its critics (Sijtsma 2009; Field, Miles, and Field 2012, 799–800), but given the wide use of Cronbach's alpha as a method to measure unidimensionality of combined variables, it is calculated here. Normally, Cronbach's alpha is based on a Pearson's correlation. That requires continuous variables, preferably with residuals that are normally distributed. That is not the case for the variables in this research. Here, variables are of the type 'ordered discrete', and even 'non-ordered categorical'. For binary and ordinal variables, a polychoric correlation has been found to be a better basis for Cronbach's alpha (Gadermann, Guhn, and Zumbo 2012). Because Spearman's rho can also deal with ordered non-continuous data, and Spearman's rho will be used later in this chapter for some tests, a Spearman's rho based Cronbach's alpha is included here as well. Finally, as noted, Cronbach's alpha is not without its critics and there have been suggestions that the maximum Greatest lower bound (Glb_{max}) would be a more accurate number and should replace Cronbach's alpha (Sijtsma 2009). Following that suggestion, the Glb_{max} is given here as well:

	Cronbach's alpha		Glb_{max}
	polychoric	Spearman's	
Imagistic rituals	.89	.85	.94
Doctrinal rituals	.84	.79	.87
Explicit ideology	.88	.76	.84
Social services	.88	.78	.88
Shared neg. experiences	.81	.86	.95

Table 3.2 — Cronbach's alpha and Glb_{max} of compound variables

In the psychological literature, a value between .7 and .8 is considered to be acceptable (Field, Miles, and Field 2012, 798). All alphas are at least of that size, if not higher. That confirms that using the variables as compound/combined variables is warranted. In this research, the five variables concerned will be used as compound variables only.

'Imagistic rituals' is a variable that describes the number of Imagistic rituals per group with the frequency 'rarely'. For instance, if a group had the score 'rarely' for 'humiliation' and 'having to kill a friend' but not the frequency 'rarely' for other Imagistic rituals, then the score on Imagistic rituals was 2 — even if some of the other Imagistic rituals were performed more frequently than 'rarely'. Counting only the 'rarely' performed Imagistic rituals per group was done -also in consultation with the originator of the Modes theory, Whitehouse- because the Modes theory predicts that rituals with a high emotional impact only remain meaningful if they are performed rarely. This converted the many individual variables of 'Imagistic rituals', 'Doctrinal rituals', 'Explicit ideology', 'Social services' and 'Shared negative experiences' into numerical variables with count data.

In table 3.3, an overview is given of all Modes variables; a brief description and their value space and type. Three extra variables are described in that table as

well (The number of Shared negative experiences, the Religiosity of the explicit ideology, and the Outcome of the conflict). Thereafter, in table 3.4, a snippet of the dataset for most of the variables is presented to give a feel for the actual raw data.

Modes variable	abbrev.	description	type	theoretical value space
Group size	grpsz	The total number of group members, including support staff, though not family members when not very active for the group's cause	integer	0 ⇔ +∞
Ratio group size ÷ troop size	gsdts	The group size divided by the troop size (i.e. the number of fighting group members)	integer	0 ⇔ +∞
Growth rate	grwt	The percentage per year of the in- or decrease of the group size	real	-∞ ⇔ +∞
Nr. of hierarchical levels	hrchL	The number of hierarchical levels	integer	1 ⇔ ∞
Doc ideological props.	Dideo	The number of Doctrinal ideological properties when present (see value space)	integer	0 ⇔ 5 'based on historic key books' [y/n], [is it a] 'written and published ideology' [y/n], [are there] 'prescribed values' [y/n], [is there a] 'theory of history' [y/n], [are] 'influential ideologues' [present] [y/n]
Doc rituals (scale)	Drits	The number / sum / count of ideology-spreading rituals (see value space) that also had the frequency 'often'	integer	0 ⇔ 4 'ideological teaching', 'indoctrination', 'military training / drills', and '[doing] Religious, spiritual or ideological gatherings'
Doc rituals (binary)	Dritb	Whether the group has one or more Doctrinal rituals (1) or not (0); for the rituals, see previous row	boolean	0 or 1

Doctrinal leadership	Dlead	Centralized and top-of-the-hierarchy type of leadership of a group	categorical	'strong ruling council', 'strong single leader'
Nr of social services	socsv	The number / sum / count of specific types (see value space) of social services	integer	0 ⇔ 8 Does the armed group have a political wing? Is a social or charitable organization linked to the group? Does the armed group create: - schools - public buildings - roads - hospitals - some other public good? Does the group install a judicial or legal system?
Installs law (y/n)	law	Whether the group installs a law (1) or not (0)	boolean	0 or 1
Social org (y/n)	socor	Whether the group has a social organization (1) or not (0)	boolean	0 or 1
Imagistic rituals (scale)	Irits	The number / sum / count of dysphoric rituals (see value space) that had the frequency 'rarely'	integer	0 ⇔ 8 'humiliation', 'disgust', 'being subjected to pain', 'being forced to do an action with the risk of wounds', 'having to kill a family member', 'having to kill a friend', 'ritual punishment', 'ritual killing', and 'sexual violence'
Imagistic rituals (binary)	Iritb	One or more rarely performed dysphoric rituals (see previous row) present (=1) or not (=0)	boolean	0 or 1

Imagistic leadership	Ilead	Leadership of a group that suggests localized leaders	categorical	'factionalized/competing leaders', 'weak or decentralized leadership'
Shared neg. experiences	Snegx	A count / sum / total of pre-specified shared negative experiences (see value space)	integer	0 ⇔ 12 'fighting with chance of dying', 'witnessing a family member killed', 'witnessing a friend killed', 'witnessing own community member killed', 'having to kill own community member', 'house destroyed', 'property looted', 'being forced to migrate', 'being subjected to sexual violence', 'witness the rape of significant other', 'being physically mutilated', 'being forced to do an action with risk of death'
Religiosity of ideology	RelSec	Indication of the religiosity of the explicit ideology of the group	(ordered) categorical	'n.a. / no ideology', 'fully or predominantly religious', 'mainly religious, but with clear influences of a secular ideology', 'both religious and secular', 'mainly secular, but with clear religious elements', 'fully or predominantly secular'
Outcome of conflict	outcm	The type of outcome of the conflict if it has terminated	categorical	'unknown', 'no or low activity', 'ceasefire', 'peace agreement', 'victory', 'defeated', 'merged with another group', 'other, please specify …'

Table 3.3 — Overview of all Modes variables

#	group_name	grpsz	gsdts	grwt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	Ilead	Snegx	RelSec
1	KNU	19609	2.2552	-0.4	4	1	4	1	0	7	1	1	1	1	0	2	1
2	NMSP	2223	1.4360	4.6	3	NA	0	0	NA	4	1	0	0	0	NA	1	3
3	Hamas	71499	19.7784	43.7	4	4	0	0	0	7	0	1	0	0	0	1	4
4	FNL	4352	1.1001	6.9	6	4	3	1	0	3	1	1	2	1	0	0	2
5	CPN-M	17958	3.1600	30	NA	3	4	1	NA	5	1	1	0	0	NA	2	1
6	PIRA	686	2.0851	-2.5	4	3	0	0	1	2	1	0	1	1	0	1	2
7	ETA	324	1.1530	9.6	NA	NA	0	0	0	NA	0	NA	0	0	0	1	1
8	GAM	5619	1.6859	9.7	NA	2	1	1	NA	2	1	0	0	0	NA	1	2
9	UCK	4452	1.1111	104.5	2	NA	1	1	0	3	1	0	0	0	0	1	1
10	Hezbollah	22000	1	0	4	4	3	1	1	8	1	1	1	1	0	1	4
11	Forces of the Caucasus Emirate	1000	1.1111	0	3	3	0	0	0	NA	NA	0	0	0	1	0	4
12	Jemaah Islamiya	1100	6.3953	-16.2	6	4	4	1	0	3	0	1	2	1	0	1	5
13	Ranvir Sena	3000	1	0	4	2	0	0	1	NA	0	NA	0	0	0	0	3
14	EPLF	NA	NA	NA	NA	NA	2	1	NA	NA	NA	NA	2	1	NA	1	1
15	CNDD-FDD	22500	1.125	18.9	4	3	4	1	0	3	1	0	0	0	0	0	2
16	SPLM/A	23435	1.1111	23.3	NA	2	2	1	NA	7	1	1	0	0	NA	1	1
17	LRA	2972	1.5544	-1.2	3	4	2	1	1	0	0	0	2	1	0	0	4
18	ADF	1375	4.8246	-25.8	4	3	4	1	1	NA	1	NA	0	0	0	1	5
19	NPFL	20000	1.1111	0	NA	1	3	1	NA	6	1	1	3	1	NA	0	1
20	LURD	NA	NA	NA	NA	0	0	0	NA	NA	1	0	0	0	NA	2	3
21	MODEL	1000	1	0	2	0	1	1	0	0	0	0	3	1	1	0	1
22	RPF	14550	1.4195	-1.2	7	3	3	1	1	4	0	1	0	0	0	1	1
23	FDLR	80667	1.8906	-11.5	14	3	4	1	0	6	1	1	0	0	0	0	3
24	MFDC	3000	1	-2.9	3	2	0	0	0	2	0	0	2	1	1	0	1
25	RUF	13971	1.5157	56.6	10	3	1	1	0	7	1	1	2	1	0	1	1
26	Kamajors	15536	1.0260	34.5	3	0	0	0	0	1	1	0	0	0	0	2	0
27	FNCI	29138	1.1992	161.1	3	0	1	1	0	4	0	0	0	0	0	1	1
28	UNITA	109106	2.1568	12.3	3	2	3	1	0	NA	NA	0	2	1	0	0	1
29	Arrow Boys	7500	1.1111	0	2	2	1	1	1	1	0	0	0	0	0	0	2
30	NDV	1876	1.0097	0	NA	NA	1	1	0	0	0	0	2	1	0	2	0

Table 3.4 — Snippet of the actual raw data for the first 30 groups. Shown are the 'numericalized' Modes variables.

In table 3.5 below, a summary of all numerical variables as used in this chapter is given, other than 0/1 variables. The minimum, the maximum, the mean, the standard error, the median, a test for a normal distribution (the smaller the p-value the less likely), a test for skew (the opposite: a small p-value indicates a significant skew) and a test for kurtosis (id.) are provided. None of the variables in this table has a normal distribution. In principle, one can apply standard transformations (most importantly the square root, logarithm, and inverse (1/x)) to see whether normal distributions can be obtained through that method (Field, Miles, and Field 2012, 191–3; Pornprasertmanit, Jorgensen, and Jia 2003). Such transformations yielded a normal distribution for none of the variables in table 3.3, except for one variable with one transformation: the logarithm of group size. All in all, that seemed to be too specific and particular to warrant using a log transformation for subsequent analysis of the data; the more because such transformations can give results that are harder to interpret (Field, Miles, and Field 2012, 193). Hence, in the section that deals with the predicted relation between all Modes variables (the 'prediction matrix'), non-transformed numerical data will be used, and given its non-normality and given the qualitative nature of the predictions ("the larger X, the larger Y"), Spearman's correlations instead of Pearson's will be used.

Variable	min	max	mean	se	median	norm	skew	kurt
Group size	27	80951	13685	3288	4975	***	***	***
Group size div. by troop size	0.56	13.6	4.64	10.1	1.11	***	***	***
Growth rate / yr (%)[‡]	-26	161	16.9	5.3	0.64	***	***	***
Nr of hierarchical levels	2	11.3	4.64	0.45	3.90	***	***	***
Nr of Doctrinal ideological props	0	4	2.2	0.21	2.39	***	-	-
Nr of Doctrinal rituals, often	0	4	1.9	0.23	2	***	-	*
Nr of social services, incl. law	0	8	3.2	0.34	2.31	***	-	-
Nr of dysphoric rare rituals	0	4	0.84	0.16	0	***	***	-
Nr of shared negative experiences	1	12	8.84	0.36	4	**	*	-
Religiosity of the explicit ideology	0	5	2.2	0.23	2	***	*	*

* = p ≤ 0.05; ** = p ≤ 0.01; *** = p ≤ 0.001

Table 3.5 - Summary of numerical variables

For the growth rate, one exceptionally high value was not used; it was more than six SDs removed from the mean. This concerned a group that existed for about half a year, which made the per annum rate extra high.

R packages used for analyses in this chapter

The following R packages were used for data preparations as described above, for all correlation-based analyses (correlation matrices, PCA, etc.), for ANOVA-related analyses and for association-based analyses (Chi-square, Fisher exact test): `boot` (Canty and Ripley 2015), `car` (Fox and Weisberg 2011), `compute.es` (Del Re 2013), `corrplot` (Wei and Simko 2016), `fifer` (Fife 2014), `ggmap` (Kahle and Wickham 2013), `ggplot2` (Wickham 2009), `gmodels` (Warnes et al. 2015), `matrixcalc` (Novomestky 2012), `miceadds` (Robitzsch, Grund, and Henke 2016), `multcomp` (Hothorn, Bretz, and Westfall 2008), `pastecs` (Grosjean and Ibanez 2014), `plyr` (Wickham 2011, -), `psych` (Revelle 2016), `rgdal` (Bivand, Keitt, and Rowlingson 2015), `sos` (Graves, Dorai-Raj, and Francois 2016) and `WRS2` (Mair, Schoenbrodt, and Wilcox 2015, 2). The packages that are used for unusual or specific analyses on one place only are mentioned in the footnotes.

1. Is there an inverse relationship between ritual frequency and emotional arousal of rituals?

Central to the Modes theory is the prediction that the ritual frequency and emotional arousal are inversely related. Can that be found?

Methods

Although emotional intensity was not measured in this research, the low-arousal rituals were taken to mean the rituals that spread ideology and hierarchical social structure, and which are close to rituals described in accounts of the Modes theory, *viz*. weekly church services, etc. (Whitehouse 1995, 2000, 2004). Here, the rituals 'Ideological teaching', 'Indoctrination', 'Military training / drills', and [doing] 'Religious, spiritual or ideological gatherings' were taken to be low-arousal / ideology spreading rituals. For brevity, these four are labelled 'Doctrinal' rituals. The high-arousal rituals were taken to be those that can be inferred to be (very) emotionally intense such as humiliation, committing ritual killing, etc. For brevity, they are labelled 'Imagistic' rituals. (For a list of Imagistic rituals, see table 3.7 and 3.8 below).

The number of groups was counted per Doctrinal and per Imagistic ritual that performed the ritual with a specific frequency in the order of 'rarely', 'sporadic' and 'often'.

The frequency 'never' was not used as count data in the distribution tests to give most credit to the Modes theory and to avoid the effects of any potential skew in the dataset: if it is true that the two Modes are non-overlapping, and if it is true that most groups in the sample tend to be Doctrinal, then one would expect that the majority of the groups get a score of 0 for 'never', both for Imagistic and for Doctrinal rituals. This would make the test spurious if 0-values were included, because what one wants to know here is: when there is a ritual of a certain type, what is the

frequency, and what is the distribution of those frequencies? And not, implicitly: what is the proportion of groups being Doctrinal?

The Chi-square and Fisher-exact tests were used as tests for goodness-of-fit for the uniform distribution. When the tests were significant, it would mean that there was a significant deviation from a uniform distribution. The assumption was that if the distribution was not uniform, *and* if, for the Doctrinal rituals, if the count data for 'rarely', 'sporadically' and 'often' had a monotonic increase, or for the Imagistic rituals, the count data had a monotonic decrease, it was corroborated that there was a tendency for Doctrinal rituals to be performed at high frequencies and/or for Imagistic at low frequencies. Given the sample size, the Fisher exact test is more accurate here, but as potential reference point for future research, the Chi-square probabilities are given as well.

Results

'Doctrinal' rituals

The Modes theory predicts that ideology spreading rituals tend to be performed with a high frequency instead of low(er) frequencies. As can be seen in table 3.6, for each of the four 'Doctrinal' rituals as operationalized here, the frequency 'often' could be found far more frequently than the other two (lower) frequencies ('sporadically' and 'rarely').

ritual	never	rarely	sporadically	often	# groups	Chi-sq	Fisher test
ideological teaching	12	4	9	25	38	***	.011 *
indoctrination	15	3	10	22	35	***	.013 *
military training	8	6	11	25	42	.001 **	.043 *
religious […] gatherings	15	3	9	23	35	***	.009 **

* = p ≤ 0.05; ** = p ≤ 0.01; *** = p ≤ 0.001

Table 3.6 — Frequency distributions of low-arousal / ideology spreading rituals; *the numbers in columns 2-6 ('never'…'# groups') represent the number of groups.*

All four 'Doctrinal' rituals had an increasing number of groups per increasing frequency (first four columns with numbers give group counts). That means that the higher the frequency, the more groups could be found that performed the ritual with that frequency. In addition, the distribution deviated significantly from uniform (see the two most right columns — as said, the Fisher exact test is more accurate here; Fisher exact test also significant after Holm adjustments).

'Imagistic' rituals

Rituals with high emotional intensity are hypothesized to be performed with a low frequency instead of a high(er) frequency. Hence, as operationalized in this research, they are expected to be performed more 'rarely' than 'sporadically', and more 'sporadically' than 'often' — at least for negatively arousing rituals. However, as can be seen in table 3.7 below, none of the rituals with a strongly negative arousal had a distribution that differed significantly from uniform.

Highly arousing dysphoric rituals

variable	never	rarely	sporadically	often	# groups	Chi-sq	Fisher test
humiliation	35	5	6	4	15	.82	1
disgust	45	3	1	1	5	.45	1
subjected to pain	32	6	7	5	18	.85	1
action w/risk of wounds	29	3	7	11	21	.11	.31
kill family member	43	4	2	1	7	.37	.79
kill friend	39	7	3	1	11	.078	.32
ritual punishment	43	2	5	0	7	.066	.21
ritual killing	44	3	2	1	6	.61	1
sexual violence	30	9	7	4	20	.39	.67

* = p ≤ 0.05; ** = p ≤ 0.01; *** = p ≤ 0.001

Table 3.7 — Frequency distributions of high-arousal dysphoric rituals

The 'classical' Modes theory would predict that also highly euphoric rituals are performed more with frequency 'rarely' than 'sporadically', and more with frequency 'sporadically' than 'often'. That said, findings of Atkinson and Whitehouse (2011, 54–55) suggest that there might be a peak for the intermediate frequency 'sporadically'. As can be seen in table 3.8 below, for most euphoric rituals the distribution did not significantly differ from uniform, but for the rituals 'celebrations' and 'festivals' —and perhaps 'dancing'— there was indeed a significant peak at intermediate frequencies.

Highly arousing euphoric rituals

variable	never	rarely	sporadically	often	# groups	Chi-sq	Fisher test
taking drugs	28	6	11	6	22	.24	.55
drinking alcohol	23	8	10	9	27	.89	1
feasting	30	5	11	4	20	.12	.41
orgiastic sex	48	1	1	0	2	.61	1
dancing	29	2	13	6	21	.012 *	.11
celebrations	19	2	25	4	31	***	.001 ***
festivals	23	6	18	3	27	.001 **	.046 *
weddings	30	7	10	3	20	.16	.38

Table 3.8 — Frequency distributions of high-arousal euphoric rituals

Conclusions

In conclusion, on the 'Doctrinal' side the ritual frequency fully corroborated the Modes theory: all low-arousal/ideology spreading rituals were performed significantly more 'often' than 'sporadically' or 'rarely'. On the 'Imagistic' side, the opposite was the case: the Modes theory was not corroborated for the negatively highly arousing rituals, as the number of groups that performed these rituals with frequency 'rarely' was not higher than the number of groups found for 'sporadically' or even 'often'. Nearly the same was found for positively highly arousing rituals: the Modes theory was not corroborated there either, as most of the positively arousing rituals were not performed more 'rarely' than 'sporadically' or 'often'. After Holm adjustment, only 'celebrations' was significant for the Fisher exact test, p=.008. An interesting find is that one (after Holm), two (non-adjusted Fisher exact test), maybe three (if Chi-square is seen as meaningful, and non-adjusted) positively arousing rituals were performed significantly more frequently at intermediate frequencies, in line with earlier findings of Atkinson and Whitehouse (2011). However, these results should be seen with caution, because the question about ritual frequency might have been interpreted differently by the experts than intended (see Methods chapter, pg. 73 and further). Hence, these results should get less weight as evidence against the Modes theory and less weight as evidence in support of the earlier findings of Atkinson and Whitehouse (2011).

2. Do Modes variables relate to each other as predicted?

The Modes theory states that within each Mode, the properties relate to each other in a certain way (generally: when one property like group size becomes larger, then another property like having prescribed values also becomes larger, i.e., goes from 0 to 1; etc.). Yet, the Modes theory has a few salient points that have bearing

on the testability. The first is that there is asymmetric 'positive' evidence for the two Modes. That is to say, the Imagistic Mode is partially characterized by *absence* of group properties, like centralized leadership, an explicit ideology, prescribed values for daily life (installing a law), and providing social services. The Doctrinal Mode is less characterized by absence of properties; one could perhaps say the archetypical Doctrinal Mode does not have, for instance, highly-arousing low-frequency rituals, but that is in exchange for the presence of low-arousing high-frequency rituals — which keeps the symmetry there. The second salient point of the Modes theory is that there are hardly precise criteria on what constitutes a Mode. As described above (page 25):

- There is no independent variable driving the rest, only a set of conditions that some patterns of human activity manage to satisfy, thus accounting for their cultural success.
- A Modes variable on itself with a value as specified in one of the two Modes columns (see table pg. 25) cannot be said to be either Doctrinal or Imagistic.
- The features of both Modes are within a Mode mutually reinforcing.
- In the real world, groups are rarely Imagistic or Doctrinal in terms of all features as specified by the Modes theory. For instance, a tradition that incorporates all the elements of the Doctrinal Mode can also exhibit some of the features of the Imagistic Mode. Or some rituals may be low-frequency low-arousal, other rituals may be frequently performed but lack exegesis. Or the doctrinal corpus is largely confined to elites, etc. Instead, the Modes theory sets out to explain that there is a tendency for religious systems to gravitate towards divergent attractor positions.

In other words, there is no independent variable (IV) or dependent variable (DV) to look for when assessing the presence of Modes; only correlational tendencies. There are no clear-cut borders or limitations; only tendencies. Hence, one needs to look for associations, correlations, significant deviations from uniformity, and outer ends of the spectrum; not a null-hypothesis that discerns Imagistic from Doctrinal

groups. That hypothesized structure of the Modes also means that a lot of 'noise' can be expected. The approach in this thesis is to look for correlations of variables, and clustering of variables and groups.

Methods

Prediction matrix

The expected relationship between Modes properties (caught in variables) will be presented in table 3.9 below (pg. 117) in the 'prediction matrix'. This matrix will guide several of the analyses in this and the next two chapters. Spelled out as individual hypotheses, the predictions are as follows:

Non-state armed groups vary in their (i) group size; (ii) ratio of group size divided by troop size; (iii) growth rate; (iv) number of hierarchical levels; (v) amount of 'Doctrinal' ideological properties; (vi) amount and frequency of 'Doctrinal' rituals; (vii) number of provided social services; (viii) amount of rarely performed highly arousing rituals; and (ix) type of leadership. These differences are not randomly or uniformly distributed and uncorrelated, but clustered into two groups as predicted by the Modes theory. More precisely,

a. Group size, ratio of group size divided by troop size, growth rate, the number of hierarchical levels, the amount of Doctrinal ideological properties, the amount (or presence) of (one or more) Doctrinal rituals, the number of provided social services and the presence of centralized leadership (single leader or council) are all positively correlated.

b. Group size, ratio of group size divided by troop size, growth rate, the number of hierarchical levels, the amount of Doctrinal ideological properties, the amount (or presence) of (one or more) Doctrinal rituals, the number of provided social services and the presence of centralized leadership (single leader or council) on the one hand, and the amount (or presence) of (one or more) rare dysphoric

rituals and distributed or contested leadership on the other are negatively correlated.

A quick overview of all relevant relations between relevant variables for the Modes is given in the following matrix, whereby '+' denotes a positive relation, '-' indicates a negative relation, a dot '·' indicates a trivial or tautological combination (often the diagonal, but sometimes a derivation or a rule-based exclusion), and a question mark '?' indicates no specific prediction, but these variables are included for exploratory research. The provision of social services is split out in the 'Number of social services', 'Installing a law' and '[having a] Social organization'.

	"General"				"Doctrinal"							"Imagistic"			"Explor."		
	Group size	Ratio group/troop size	Growth rate	Nr hierarchical levels	Doc ideological props	Doc rituals (scale)	Doc rituals (binary)	Doc type leadership	Nr of social services	Installs law (y/n)	Social org (y/n)	Rare dysph. rit. (scale)	Rare dysph. rit. (binary)	Distributed / contested / splintering leadership	Shared neg. experiences	Religiosity of ideology	Outcome of conflict
Group size	·	+	+	+	+	+	+	+	+	+	+	-	-	-	?	?	?
Ratio group/troop size		·	+	+	+	+	+	+	+	+	+	-	-	-	?	?	?
Growth rate			·	+	+	+	+	+	+	+	+	-	-	-	?	?	?
Nr hierarchical levels				·	+	+	+	+	+	+	+	-	-	-	?	?	?
Doc ideological props.					·	+	+	+	+	+	+	-	-	-	?	?	?
Doc rituals (scale)						·	·	+	+	+	+	-	-	-	?	?	?
Doc rituals (binary)							·	+	+	+	+	-	-	-	?	?	?
Doc type leadership								·	+	+	+	-	-	·	?	?	?
Nr of social services									·	+	+	-	-	-	?	?	?
Installs law (y/n)										·	+	-	-	-	?	?	?
Social org (y/n)											·	-	-	-	?	?	?
Rare dysph. rit. (scale)												·	·	+	?	?	?
Rare dysph rit. (binary)													·	+	?	?	?
Distributed / contested /splintering leadership														·	?	?	?
Shared neg. experiences															·	?	?
Religiosity of ideology																·	?
Outcome of conflict																	·

Table 3.9 — The prediction matrix

In the first horizontal row, the labels "General", "Doctrinal", "Imagistic" and "Explor[ative]" are given. They are conceptual divisions regarding the type of variables and the direction of the hypotheses. The General variables are neither specifically part of Imagistic or Doctrinal groups: all groups have a size, a growth rate, etc. Yet, as can be seen on the horizontal rows, a positive relation of, for instance, group size with "Doctrinal" variables like having Doctrinal ideological properties (such as an explicit and written ideology) is expected. The "Doctrinal" variables are, when present (either 1 or more, or 'yes') an indicator of the Doctrinal Mode, or at least, should all positively correlate with each other and with the General variables. The "Imagistic" variables are distinct and 'positive' indicators of Imagisticness, negatively correlating with General and Doctrinal variables or associated with an absence of some Doctrinal properties (variables). They are first and foremost the presence of rare and negatively arousing rituals, and secondly the type of leadership as operationalized here, which is expected to be non-centralized, contested, or splintering for 'Imagistic' groups (i.e. groups scoring low values on all variables).

Some remarks about variables and expected correlations:

- The variable 'Nr of social services' includes installing a law, except for when it is compared with the separate variable 'installing a law (y/n)'.
- As stated before, two variables come in a '…(scale)' and a '…(binary)' version: the 'Doctrinal rituals' and the 'Imagistic rituals'. The 'binary' version has values 0 or 1, i.e. at least one (Doctrinal or Imagistic) ritual present or not. The 'scale' version is based on count data: 0, 1, 2, 3, … Imagistic or Doctrinal rituals present in a group as counted per group. Because the binary version is derived from the scale version, their correlation will probably be high yet trivial.
    - Calculating the correlation between Doctrinal type of leadership and Imagistic type of leadership was done, although partially, one comes at the exclusion of the other, suggesting that a trivial negative correlation could have been found. Yet, there was also the option 'both' so in principle the values were not

100% to the exclusion of each other. It is best to interpret that correlation with caution.

Finally, there are variables labelled "Explor[ative]". They represent the following:

- Rituals with a negative arousal can be seen as an artificial means of creating group cohesion, mimicking real negative experiences. Data was also collected on those real negative experiences, like 'being forced to migrate', 'witnessing a family member killed', etc. There is no specific prediction regarding the relationship between the number of shared negative experiences one the one hand and Modes properties of groups on the other. Indeed, there might be a relationship between shared negative experiences on the one hand and group cohesion (as operationalized by some form of cooperation or even altruism) or willingness to fight on the other, but these properties were not measured in this research. Hence, all analyses in this research regarding shared negative experiences will be explorative.
- Data were collected for two variables that are not necessarily part of Modes per se but at least linked to the Modes theory: the 'Religiosity of the explicit ideology' (after all, the theory was originally formulated as the 'Modes of Religiosity' theory) and the 'Outcome of the conflict'. Although analyses of the relationships between religiosity of explicit ideology or the outcome of the conflict are mainly explorative, one could surmise that groups tend to gain more victories when they are more ritualized, or have more sacred values.

As indicated in the previous section, findings of Atkinson and Whitehouse (2011) indicated that the relationship between ritual arousal and frequency is much stronger and monotonic for negatively arousing rituals than for positively arousing rituals, and in more recent formulations of the Modes theory (Whitehouse and Lanman 2014) especially the negatively arousing version of the low-frequency rituals

is emphasized. Hence, to give the Modes theory the maximum charitability, the positively arousing rituals were left out of the correlation matrix, as they could obscure the correlations given their non-monotonic nature.

With the exception of the 'Outcome of the conflict' (which is not ordinal), all of these predictions were tested with Spearman's rank correlation coefficient.

The abbreviations for the columns are given in table 3.3 (see page 104).

Results

The first cluster of questions addressed here, is: *Do we find that those Modes variables correlate at all? How big are these correlations? Are they significantly different from zero?*

When all these variables were analysed with the Spearman's rank correlation and were placed in a correlation matrix matching the 'prediction matrix' above, the results are as follows:

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	lrits	lritb	llead	Snegx	RelSec
grpsz		0.19	0.18	0.13	0.1	0.23	0.11	-0.02	0.58	0.37	0.27	0.05	0	-0.21	0.16	-0.05
gsdts	0.19		-0.05	0.22	0.22	0.15	0.08	-0.24	0.31	0.15	0.17	0.05	0.09	-0.1	0.09	0.18
grwrt	0.18	-0.05		-0.1	-0.15	-0.12	-0.03	-0.17	0.05	0.13	-0.11	-0.2	-0.19	-0.13	0.2	-0.18
hrchL	0.13	0.22	-0.1		0.23	0.28	0.12	0.06	0.39	0.14	0.5	0.15	0.16	-0.23	0.18	0.14
Dideo	0.1	0.22	-0.15	0.23		0.39	0.19	0.24	0.35	0.21	0.32	0.07	0.06	-0.36	-0.06	0.72
Drits	0.23	0.15	-0.12	0.28	0.39			0.11	0.42	0.28	0.41	0.13	0.1	-0.18	-0.07	0.36
Dritb	0.11	0.08	-0.03	0.12	0.19			0.05	0.26	0.12	0.33	0.19	0.14	-0.15	-0.1	0.16
Dlead	-0.02	-0.24	-0.17	0.06	0.24	0.11	0.05		-0.06	-0.09	0.01	-0.18	-0.17	-0.34	0.03	0.28
socsv	0.58	0.31	0.05	0.39	0.35	0.42	0.26	-0.06		0.57	0.66	0.11	0.09	-0.28	0.18	0.25
law	0.37	0.15	0.13	0.14	0.21	0.28	0.12	-0.09	0.57		0.15	0.1	0.14	-0.2	0.08	0.15
socor	0.27	0.17	-0.11	0.5	0.32	0.41	0.33	0.01	0.66	0.15		0.13	0.06	-0.26	0.07	0.14
lrits	0.05	0.05	-0.2	0.15	0.07	0.13	0.19	-0.18	0.11	0.1	0.13			0.13	0.01	-0.1
lritb	0	0.09	-0.19	0.16	0.06	0.1	0.14	-0.17	0.09	0.14	0.06			0.16	0.02	-0.06
llead	-0.21	-0.1	-0.13	-0.23	-0.36	-0.18	-0.15	-0.34	-0.28	-0.2	-0.26	0.13	0.16		-0.23	-0.14
Snegx	0.16	0.09	0.2	0.18	-0.06	-0.07	-0.1	0.03	0.18	0.08	0.07	0.01	0.02	-0.23		-0.15
RelSec	-0.05	0.18	-0.18	0.14	0.72	0.36	0.16	0.28	0.25	0.15	0.14	-0.1	-0.06	-0.14	-0.15	

Figure 3.1 — Correlations between all Modes variables in this study (except 'outcome of the conflict') and their significance, uncorrected for multiple comparisons. Grey cells: correlation not significant (p≥.05). White cells: correlation significant (p<.05).

In figure 3.1, all correlations between all variables are given. White cells indicate a significant difference from 0 (p<.05, uncorrected for multiple comparisons), grey cells indicate a non-significant difference[1]. The upper right and lower left of this figure

[1] Throughout this thesis, two-tailed instead of one-tailed tests were used for various reasons. First, the question is whether something meaningful can be found, and one way of doing that is by using significance tests in the form of p-values. The use of p-values is not without its critics (e.g. Goodman 1999; Thompson 2001; Wagenmakers 2007; Burnham and Anderson 2014). A one-tailed tests is intrinsically a less severe test than a two-tailed test, and it would be (even) less convincing to critics of

are each other's mirror image. The black cells represent correlations that are not very meaningful, namely when the 'binary' variable (0 vs. 1, 2, 3, …) is derived from a scale variable (0, 1, 2, 3, …) — for instance, when absence (0) or presence (1) of one or more Imagistic rituals is derived from the count of Imagistic rituals.

Especially the variables in the social domain (the 'number of social services' (socsv), 'installing a law' (law), having a 'social organization' (socor)) have significant correlations, and 'Imagistic leadership' (Ilead) significantly correlates negatively with 'Doctrinal ideology' (Dideo) and 'Doctrinal leadership' (Dlead).

However, adjusted with the Bonferroni or Holm adjustments for multiple comparisons, far fewer variable pairs had a significant correlation (there was no difference between the Bonferroni and the Holm adjustment here):

p-values and significance tests. Second and related to that, p-values are used regularly in this thesis. Most of them are, internally for the analysis, adjusted for multiple comparisons with Holm adjustments. However, throughout the thesis there is no meta-correction. It is probably sensible to use the more conservative 'two-tailed' tests, to at least slightly compensate for the repeated use of p-values. Third, two-tailed tests are used when the opposite direction of the hypothesis can also exist and is meaningful. For the Modes theory, this is the case for theoretical reasons, but also post-hoc it appeared that opposite directions can indeed exist; e.g. the two 'positive' Imagistic variables (rituals and leadership) generally related to other variables in the other direction than the expected one (see figure 3.3). Indeed, those correlations were not significant, but at least they could have been. One-tailed tests are blind for that possibility.

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	lrits	lritb	llead	Snegx	RelSec
grpsz		0.19	0.18	0.13	0.1	0.23	0.11	-0.02	0.58	0.37	0.27	0.05	0	-0.21	0.16	-0.05
gsdts	0.19		-0.05	0.22	0.22	0.15	0.08	-0.24	0.31	0.15	0.17	0.05	0.09	-0.1	0.09	0.18
grwrt	0.18	-0.05		-0.1	-0.15	-0.12	-0.03	-0.17	0.05	0.13	-0.11	-0.2	-0.19	-0.13	0.2	-0.18
hrchL	0.13	0.22	-0.1		0.23	0.28	0.12	0.06	0.39	0.14	0.5	0.15	0.16	-0.23	0.18	0.14
Dideo	0.1	0.22	-0.15	0.23		0.39	0.19	0.24	0.35	0.21	0.32	0.07	0.06	-0.36	-0.06	0.72
Drits	0.23	0.15	-0.12	0.28	0.39			0.11	0.42	0.28	0.41	0.13	0.1	-0.18	-0.07	0.36
Dritb	0.11	0.08	-0.03	0.12	0.19			0.05	0.26	0.12	0.33	0.19	0.14	-0.15	-0.1	0.16
Dlead	-0.02	-0.24	-0.17	0.06	0.24	0.11	0.05		-0.06	-0.09	0.01	-0.18	-0.17	-0.34	0.03	0.28
socsv	0.58	0.31	0.05	0.39	0.35	0.42	0.26	-0.06		0.57	0.66	0.11	0.09	-0.28	0.18	0.25
law	0.37	0.15	0.13	0.14	0.21	0.28	0.12	-0.09	0.57		0.15	0.1	0.14	-0.2	0.08	0.15
socor	0.27	0.17	-0.11	0.5	0.32	0.41	0.33	0.01	0.66	0.15		0.13	0.06	-0.26	0.07	0.14
lrits	0.05	0.05	-0.2	0.15	0.07	0.13	0.19	-0.18	0.11	0.1	0.13			0.13	0.01	-0.1
lritb	0	0.09	-0.19	0.16	0.06	0.1	0.14	-0.17	0.09	0.14	0.06			0.16	0.02	-0.06
llead	-0.21	-0.1	-0.13	-0.23	-0.36	-0.18	-0.15	-0.34	-0.28	-0.2	-0.26	0.13	0.16		-0.23	-0.14
Snegx	0.16	0.09	0.2	0.18	-0.06	-0.07	-0.1	0.03	0.18	0.08	0.07	0.01	0.02	-0.23		-0.15
RelSec	-0.05	0.18	-0.18	0.14	0.72	0.36	0.16	0.28	0.25	0.15	0.14	-0.1	-0.06	-0.14	-0.15	

Figure 3.2 — Holm adjusted correlations between all Modes variables (except 'outcome of the conflict') and their significance. Grey: not significant. White: significant.

One could argue that of the Modes variables, only 'the number of social services' (socsv) has significant correlations, namely with 'group size' (grpsz), 'installing a law' (law) and 'having a social organization' (socor). Of course, the reciprocal correlations are significant too. Of the non-Modes variables, the 'religiosity of the explicit ideology' strongly and significantly correlates with 'the number of Doctrinal ideological properties' (Dideo).

The number of variables was reduced to a set of core Modes variables to investigate the robustness of the findings after Holm adjustments, because p-value adjustment techniques are sensitive to the number of adjusted values. In addition, this reduction to core Modes variables is useful to obtain a more valid ratio of variables versus cases when a PCA is done. The reduction steps are as follows. First, there is no indication that 'binary' versions of the variable that represents the number of Doctrinal and Imagistic rituals have higher or more significant correlations with other variables than the 'scale' version. The 'scale' version correlates slightly stronger for the 'Doctrinal' side of the variables. Hence, one can tentatively conclude that it *does* matter how many Doctrinal rituals are present in a group ('more is more'), though it does not seem to matter how many Imagistic rituals are present in a group, as long as there is at least one. Given that the binary versions of the variables do not provide stronger correlations, they are left out in further analyses. Indeed, the Holm and Bonferroni corrections were not affected by leaving the binary versions out. Second, one could argue that also the variables 'Shared negative experiences' (Snegx) and the 'Religiosity of the explicit ideology' (RelSec) are strictly speaking not part of the Modes. When these variables are left out of the matrix when Holm and Bonferroni corrections are done, again, there was no effect on the significance of the other variables. Third, one could also argue that the 'Group size divided by troop size' variable is based on somewhat debatable assumptions: in several cases the troop size was estimated based on the total group size, and vice versa. Leaving out all of these variables, and with Holm or Bonferroni corrections in place, again, there was no effect on the significance of the other variables.

That leaves only three substantive correlations significant (corrected for multiple comparisons), all related to Social services: 'group size' (grpsz), 'installing a law' (law) and having a 'social organization' (socor). For the rest, none of the Modes variables has a significant correlation with any of the other variables.

Is the direction of relations between Modes properties as predicted?

The Modes theory predicts that all Modes categories —which are translated here to variables, see table 3.1— are correlated, either positively or negatively. As can be seen in the prediction matrix (pg. 117), most variable combinations have a predicted direction; by far the most are positive correlations, and some are negative. For instance, it is predicted that the Doctrinal Mode has a high(er) number of hierarchical levels and a high(er) group size ("large 'imagined community'"), whereas the Imagistic Mode is predicted to have a low(er) number of hierarchical levels and a small group size ("small face-to-face community"). Taken together, that entails a positive correlation between the number of hierarchical levels and group size. All Modes variables can in such a way be related to one another, creating a correlation matrix as given above, with either positive or negative correlations. That raises the question whether those directions of correlations can be found in the sample, be it positive or negative.

For 'Shared negative experiences' (Snegx) and the 'Religiosity of the explicit ideology' (RelSec), there were no predictions for the direction of the correlations, so they are left out of the result matrix.

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	lrits	lritb	llead
grpsz		0.19	0.18	0.13	0.1	0.23	0.11	-0.02	0.58	0.37	0.27	0.05	0	-0.21
gsdts	0.19		-0.05	0.22	0.22	0.15	0.08	-0.24	0.31	0.15	0.17	0.05	0.09	-0.1
grwrt	0.18	-0.05		-0.1	-0.15	-0.12	-0.03	-0.17	0.05	0.13	-0.11	-0.2	-0.19	-0.13
hrchL	0.13	0.22	-0.1		0.23	0.28	0.12	0.06	0.39	0.14	0.5	0.15	0.16	-0.23
Dideo	0.1	0.22	-0.15	0.23		0.39	0.19	0.24	0.35	0.21	0.32	0.07	0.06	-0.36
Drits	0.23	0.15	-0.12	0.28	0.39			0.11	0.42	0.28	0.41	0.13	0.1	-0.18
Dritb	0.11	0.08	-0.03	0.12	0.19			0.05	0.26	0.12	0.33	0.19	0.14	-0.15
Dlead	-0.02	-0.24	-0.17	0.06	0.24	0.11	0.05		-0.06	-0.09	0.01	-0.18	-0.17	-0.34
socsv	0.58	0.31	0.05	0.39	0.35	0.42	0.26	-0.06		0.57	0.66	0.11	0.09	-0.28
law	0.37	0.15	0.13	0.14	0.21	0.28	0.12	-0.09	0.57		0.15	0.1	0.14	-0.2
socor	0.27	0.17	-0.11	0.5	0.32	0.41	0.33	0.01	0.66	0.15		0.13	0.06	-0.26
lrits	0.05	0.05	-0.2	0.15	0.07	0.13	0.19	-0.18	0.11	0.1	0.13			0.13
lritb	0	0.09	-0.19	0.16	0.06	0.1	0.14	-0.17	0.09	0.14	0.06			0.16
llead	-0.21	-0.1	-0.13	-0.23	-0.36	-0.18	-0.15	-0.34	-0.28	-0.2	-0.26	0.13	0.16	

Figure 3.3 — Correlations that match the direction of prediction. Grey: no match. White: match. The numbers are the Spearman's correlation coefficients.

As can be seen in figure 3.3, most directions of the correlations match the predicted directions. That is to say, when positive relations were predicted, they were generally found as such, and vice versa. The numbers are the same correlations as given before, but here the white cells indicate a match with the direction of the prediction, grey cells indicate a mismatch with the direction of prediction. The upper right and lower left of this figure are each other's mirror image. The probability that so many correlations match the prediction purely by chance is $3.62*10^{-4}$. The uniform patterns found for the match with the direction, mainly aligned along variables rather

than randomly dispersed, make the probability even lower that the findings are generated purely by chance.

The 'growth rate' (grwrt) did generally relate to other variables in the direction opposite from what was predicted. The correlation coefficients for this variable were not very far from zero, though; and indeed, none of them was found to be significantly different from zero, so one could argue that they do not have a direction at all. Perhaps more importantly, the number of rarely performed Imagistic rituals (either binary, 'Iritb', or in the scale version, 'Irits') generally did not relate to other variables in the predicted direction. The only two properties that correlated as predicted (negatively, in these cases) with the number of Imagistic rituals were the 'growth rate' (grwrt) and having a 'Doctrinal leadership' (Dlead), although again not significantly different from zero. In fact, one could argue that Imagistic rituals were predicted to be related to no growth, not to negative growth, reducing the match to only one variable.

Are there two clusters of variables?

Individual variable combinations have been explored above, but many Modes properties are supposed to become larger or smaller together — hence, they can be thought to form clusters. For instance, group size, the number of hierarchies, having a proselytizing leader, having a social organization etc. are all variables that are theorized to become larger or smaller at the same time. Yet, there is a second, smaller group of variables that positively indicate the Imagistic Mode: Imagistic rituals and -to a lesser extent- Imagistic leadership that become smaller (or zero) when the other variables become larger.

Clustering of variables can be investigated by techniques such as Principal Component Analysis (PCA) and Multi-Dimensional Scaling (MDS), which will be used here. These two techniques were initially developed as explorative techniques and in

first instance do not have testing criteria such as 'significance values' etc. Hence, this section has a more explorative character.

PCA

For the PCA, in first instance one big component is expected, that represents all positively correlated variables, and also includes the Imagistic variables that correlate negatively with the rest because these variables are not independent from the other variables. In preparation, the variable matrix was trimmed down to the core Modes variables. As described above (pg. 123), several variables were left out of the prediction matrix ('Religiosity of the explicit ideology' (RelSec), 'Shared negative experiences' (Snegx), binary version of the Imagistic and Doctrinal rituals (Iritb and Dritb), and 'group size divided by troop size' (gsdts)). This reduction was partially to get a reasonable variable-to-case ratio for the PCA. In addition to the earlier reduction in variables, the 'growth rate' (grwrt) and 'installing a law (y/n)' (law) were left out for the PCA as well. Growth rate because it was a derived variable (from group size -sometimes derived from troop size- per period) and because there may be limits to growth later on in the life of groups, reducing the precision of this variable as operationalized here; 'installing a law' because this variable (~group property) is not central to the Modes theory but rather a proxy for enforcing morality and creating homogeneity within a group.

All in all, 9 variables remained. A principal component analysis was conducted on those remaining 9 variables. The Kaiser-Meyer-Olkin measure verified the sampling adequacy of the remaining correlation matrix for the analysis (KMO=.72, which is "middling" according to Kaiser 1974), and all KMO scores for individual variables were above the acceptable limit of .5. Bartlett's test of sphericity, $\chi^2(36) = 104.6$, $p<<0.001$, indicating that correlations between the variables were sufficiently large for a PCA. An initial analysis was run to obtain eigenvalues for each variable.

The scree plot indicated at least 5 components, possibly 8 (which is close to the total of 9 variables). In addition, when model fit was taken into account, based upon off diagonal values and the general model fit, the fit was above the desirable value of .9 only with 5 or more components (off-diag=.92, general=.94). On the other hand, when Kaiser's criterion of retaining components with an eigenvalue > 1 was used, only three components remained. In addition, some sources (e.g. Child 2006, 64) mention that at least three variables per component are required, which is easier realized with 3 than with 5 components when there are only 9 variables, as in this case. Hence, both a version with 3 and with 5 components was calculated, representing 62% and 80% of the variance respectively (without rotation). Indeed, the solution with 4 components appeared to have none of the advantages of 3 or 5 components: neither sufficient variables per component, nor a good separation of variables. An oblique rotation (oblimin) was applied on the PCAs for theoretical reasons: if there are not one or two but more components, the components are expected to be correlated, as Modes properties are expected to be correlated. Table 3.10 and 3.11 show the standardized factor loadings (pattern matrix) after oblimin rotation for 3 and 5 components, representing 59% and 75% of the variance respectively. All loadings below .4 are grey, all loadings between .4 and <.6 are black, all loadings >=.6 are black and have a bold font. The variables are ordered to juxtapose the most correlated variables per component; however, the components are different between the two solutions, and therefore the clustering, which results in a different order of variables in the two tables.

	C3	C2	C1
Cuml. var →	21%	41%	59%
grpsz	**.90**	-.09	-.20
socsv	**.81**	.03	.26
Dlead	-.23	**.81**	-.08
Ilead	-.26	**-.69**	.05
Dideo	.01	.56	.47
Irits	-.15	-.39	**.71**
hrchl	.18	.16	.58
Drits	.22	.25	.52
socor	.49	.12	.50

Table 3.10 — Summary of the 3-components PCA for the reduced Modes variable set (n=50), rotation=oblimin.

	C4	C3	C1	C2	C5
Cuml. var →	17%	33%	49%	64%	75%
hrchL	**.94**	-.11	-.08	.08	.08
socor	**.67**	.17	.28	-.11	-.07
grpsz	-.11	**.98**	-.05	.05	.05
socsv	.35	**.62**	.27	-.10	-.04
Drits	.01	.04	**.86**	-.09	0
Dideo	-.01	-.07	**.73**	.32	.08
Dlead	-.09	-.12	.11	**.82**	-.04
Ilead	-.22	-.28	.04	**-.73**	.07
Irits	.03	.03	.02	-.03	**.98**

Table 3.11 — Summary of the 5-component PCA for the reduced Modes variable set (n=50), rotation=oblimin.

Clearly, the separation between variables is much higher in the 5-component situation. Perhaps for the 5-component solution, the interpretation for C1 could be 'spreading of formal semantic worldview', for C2 'leadership' and C5 already consists

of 'Imagistic rituals' only[1]. Components C4 and C3 are harder to interpret. Despite the weaker separation in the 3-component solution, interpretations could still be made; perhaps 'social specialization' for C3, and -again- 'leadership' for C2; C1 seems to be an amalgam of variables without evident interpretation.

In the 5-component situation, the components C1, C3 and C4 have the strongest correlation. Looking at the variables, they all seem to be 'positive' indicators of Doctrinalness, i.e. when those components score high, a Doctrinal Mode is expected; and similarly, when they score low or are even absent, an Imagistic Mode is expected. In the 3-component situation, it is hard to say what the highest correlation between C1 and C3 could mean given the unclear interpretation of C1.

	C2	C1
C3	.16	.24
C2		.08

Table 3.12 — Correlations between the components in the 3-component solution.

	C3	C1	C2	C5
C4	.28	.35	.09	.11
C3		.27	.01	.02
C1			.16	.09
C2				-.15

Table 3.13 — Correlations between the components in the 5-component solution.

[1] The situation where a component represents one variable more or less defeats the purpose of PCA. It is the consequence of having a 5-component solution for 9 variables; even -or especially- with ideal separation, one variable is left over for the last component.

MDS

Another way to summarize multiple variables into one graph is via Multi-Dimensional Scaling (MDS). The distance or proximity between variables is calculated, preferably for two or three dimensions, and plotted on those dimensions.

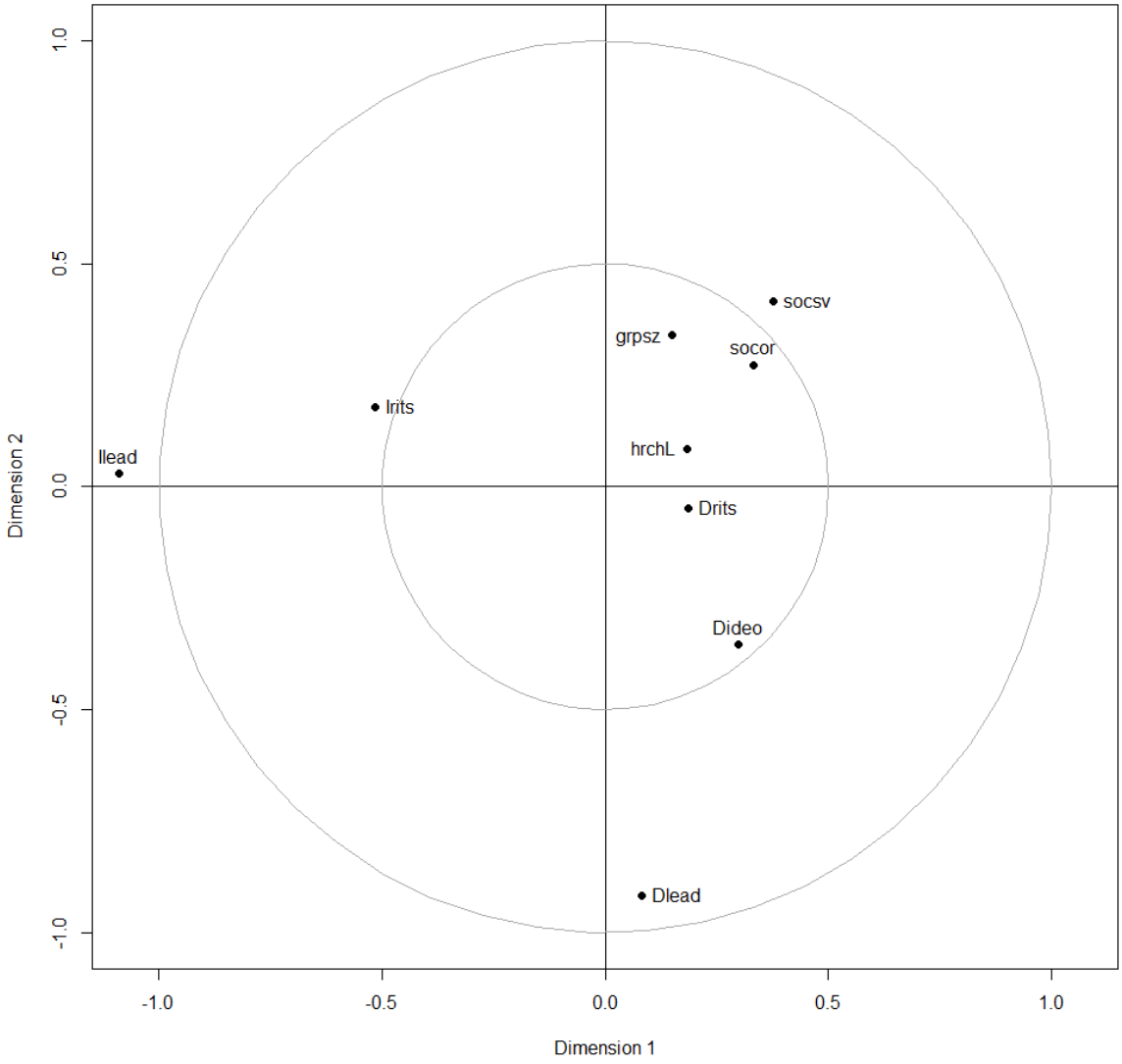


Figure 3.4 — MDS based on the Spearman correlation matrix of the core Modes variables.

In the MDS of core Modes variables, it appears that the positive 'Imagistic' variables (Ilead, Irits) are quite separate from the other variables and hence that they -somewhat- seem to form their own cluster, which would support the Modes theory. Similarly and relatedly, all variables that indicate the Doctrinal Mode when

they score high have more or less the same positive value on Dimension 1. Again, that supports the Modes theory.

Last but not least, variables that are quite similar in nature are relatively close to each other (the 'cultural' variables Drits and Dideo, the 'social' variables socsv and socor, and the group structure variables grpsz, hrchL and socor).

It is unclear what meaning should be attached to the fact that on both Dimension 1 and 2, the leadership variables (Dlead and Ilead) are standing apart from the rest. However, much of the patterns found in the MDS regarding grouping are similar to the distribution over various components in the 5-component PCA given above.

Conclusions

Generally, most correlations were not significant, suggesting that the Modes properties do not relate to each other as predicted by the Modes theory. However, if one neglects the significance of the correlations, then the direction of correlations was as predicted, except for the Imagistic rituals. In the PCA, the 1-or perhaps 2-component solution was not found, suggesting that the Modes variables do not cluster together as predicted. However, there are disagreements about how to determine the number of relevant components via a PCA, and whether a PCA is more than an explorative technique, so caution is required when making conclusions based on a technique like this form of PCA. Hence, an MDS was added, and the MDS lent some support that the structure of the Modes theory in terms of variables can be found amongst armed groups. All in all, for armed groups, the evidence was mixed regarding how well the Modes properties relate in the way the theory would predict.

3. Are there two attractor states?

As described in the theory chapter, it is hypothesized that armed groups are organized along the two Modes, with little overlap in between. Hence, one should be able to find two main type of armed groups when Modes variables are considered; either individual Modes variables should be bi-modal, or clustering techniques of several Modes variables should show two clusters of groups. Can that be found?

Methods

a. Is there a bi-modal distribution for continuous Modes variables?

Of all variables used in this chapter, four variables had a more or less continuous value space: 'group size', 'group size divided by troop size', 'growth rate per annum' and the 'number of hierarchical levels'. For these four variables, it was meaningful to test whether they had a bi-modal distribution. The statistical modes do not need to have equal bandwidth when a linear scale is used, and are not even expected to have that. For instance, for the Imagistic Mode the group sizes should tend to be small (the exact range unspecified by the theory, but that what is required for 'shared experiences' and 'knowing each other in person') whereas the Doctrinal group sizes can go up to millions. Similarly, the number of hierarchical levels in Imagistic groups can be expected to be small (unspecified by the theory, but close to absent) whereas Doctrinal hierarchies can have more than a dozen levels without a necessary maximum.

b. Does the majority of the groups have either 'Doctrinal' rituals only, or 'Imagistic' rituals only?

The number of high-arousal low-frequency (HA/LF) rituals were plotted against the number of low-arousal high-frequency (LA/HF) rituals, to see to what

extent clustering could be observed. Point clouds in the LA/HF corner and in the HA/LF corner would corroborate the Modes theory. In addition, six types of cluster analyses were done on the point cloud(s), to put analytical numbers on the number of clusters that could be discerned. *SSE scree* is based on creating a Sum of Squared Error scree plot and looking for an elbow. The location of the elbow in the resulting plot suggests a suitable number of clusters for the k-means method: "The analyst looks for a bend in the plot similar to a scree test in factor analysis" (Kabacoff 2014). *Silhouette optimal* is based on a partitioning around medoids clustering with the number of clusters estimated by optimum average silhouette width (Hennig 2015). *Calinki best* is based on creating several partitions forming a cascade from a small to a large number of groups. The criterion that is used to select the best partition is the Calinski-Harabasz criterion (Oksanen et al. 2016). *BIC max* is based on determining the optimal model and number of clusters according to the Bayesian Information Criterion for expectation-maximization, initialized by hierarchical clustering for parameterized Gaussian mixture models (Fraley et al. 2012). *Affinity propagation* is based on affinity propagation clustering (Bodenhofer, Kothmeier, and Hochreiter 2011). Finally, the *Gap statistic* is based on calculating a goodness of clustering measure, the "gap" statistic. For each number of clusters k, it compares a found number of clusters via bootstrapping with a reference distribution (Maechler et al. 2015). By and large, all these methods should indicate 2 clusters.

c. Do groups themselves cluster into two clusters?

There are various ways to cluster cases based on multi-variate data. Perhaps the best-known version is tree-clustering. However, by default, the highest level in tree-clustering tends to consist of two branches, hence, it would be no surprise to find two main clusters: it is simply an artefact of the technique. Instead, a non-informed, 'blind' graph can be created and cluster tests can be done on the data in these graphs. Given that earlier analyses already used the PCA and MDS, and given

that both techniques not only allow to cluster variables, but also the individual cases (here: armed groups) it makes sense to use these techniques again and to plot the individual cases on the PCA and MDS planes, based on the same variables as used for these multi-variate techniques as in the previous section.

Calculating individuals of a PCA when using imputed datasets

In the statistical software used for this thesis -R-, a software function for conducting PCA that is based on imputed datasets did not exist. One of the contributions of this thesis is that it proposes how to perform a PCA on imputed datasets and that it implemented the procedure in an R function. There are some methodological issues attached to creating a PCA with individual loadings when based on imputed values. Loadings of *variables* can be calculated fairly easily based on a pooled correlation matrix: that matrix can be used in the same way as a single-dataset correlation matrix to create a variable-PCA as presented in the previous section. However, although such a correlation matrix contains data on variables, it no longer contains data on individual groups. Hence, individual loadings cannot be constructed based on the pooled correlation matrix. To get individual loadings, there are two main options: (1) For most statistical techniques, when imputed datasets are used, a parameter of interest and its p-values or standard error (s.e.) are calculated by first calculating the parameter per imputed dataset, and then combining these parameters ('pooling'). Pooling should take the within and between imputed dataset variance into account to calculate e.g. the p-value, s.e., or anything else that reflects frequentist approaches to hypothesis testing. The mean value is calculated for parameters that are approximately normally distributed, e.g. standard deviations, regression coefficients, means, etc.; for non-normally distributed parameters, such as correlation coefficients, odd ratios etc. the pooling is done via a Fisher-z transformation (Van Buuren 2012, 155–160). Following that line of thought, one could first calculate a PCA per imputed dataset -which contains data on individual

armed group loadings on the PCs- and then pool (e.g. calculate the mean of) these loadings. The mean can be used for the loadings because loadings are, in essence, based on coefficients of linear equations. (2) However, this first method -via individual datasets pooled to the final parameter of interest- is used to reflect the increased uncertainty in the imputed values so that the p-values or s.e.'s etc. can be calculated as well, but that does not affect the mean, only the SD and thereby significance values. As it happens, PCAs do in first instance not work with significance values, SDs, p-values, s.e.'s, etc., at least not for the loadings; only with means for these loadings. Hence, reflecting the uncertainty of the imputations is no longer necessary. In addition, there is a mathematical equivalency between {the mean of coordinates based on coefficients based on individual datasets} and {the mean of individual datasets providing coefficients providing coordinates}. This line of thought enables an alternative way of calculating the PCA for imputed datasets: first calculate the averages per row-variable cell of all imputed datasets, and then make one PCA on those averaged data as if it were a non-imputed dataset. Basically, do the PCA on the mean values of the imputed variable data.

The advantage of the first method is that if one were to develop the PCA further in the direction of testing, the variance is still available (in other parts of the result set of the calculation). The disadvantages are twofold: (a) the deviations between the PCs of every imputed datasets become larger as the PC number is higher -e.g. more variance between imputed datasets for PC5 than for PC1- suggesting that only the lowest, very first few PCs are reliable; and (b) when rotations are applied, the components are no longer Principal Components but merely components (Revelle 2016). Their sequence, loading and interpretation may differ per imputed dataset, making pooling very challenging if not impossible.

It appeared that for this study's dataset, the average difference between the two methods concerning the loadings on the first two PCs without rotation was of a magnitude of ~0.15 for both the first and second PC, which is ~4% for both of the

total axis scales. The maximum deviation was 0.8. As an additional check, when group names were used as labels for the points on the plot of the first two PCs, it appeared that groups were by and large at the same place in the plot. Hence, the difference between the two methods may not be that big after all when the main trends are investigated and the first few PCs are considered.

As a result, the easiest -and perhaps only- way to calculate a PCA with rotation and individual loadings on an imputed dataset is based on a single dataset comprised of mean values of all imputations. That method is used in this section (and in the next chapter).

For the MDS, the same core variables were used as above for the PCA. Per imputed dataset, these variables were standardized to $\mu=0$, $\sigma=1$. Thereafter, the distances between armed groups were calculated, and based on those outcomes, a classical multidimensional scaling was calculated with two dimensions, delivering coordinates for two dimensions for every armed group[1]. For every group and dimension combination, the average of all imputed datasets was calculated and plotted as MDS plot.

Results

a. Is there a bi-modal distribution for continuous Modes variables?

Eyeballing the histograms of these four variables, it appears that there is no bi-modal distribution; rather a uni-modal distribution, be it Gaussian skewed (nr of hierarchical levels) or negative binomial (the other three). For all variables, a 'narrow' mode (Bell curve) is expected at the left side of the histogram ('Imagistic' = small

[1] In R, per imputed dataset: `cmdscale(dist(scale(dataframe)), k=2)`

scale), and a wider mode (Bell curve) is expected at the right side, representing the Doctrinal Mode. That is not found:

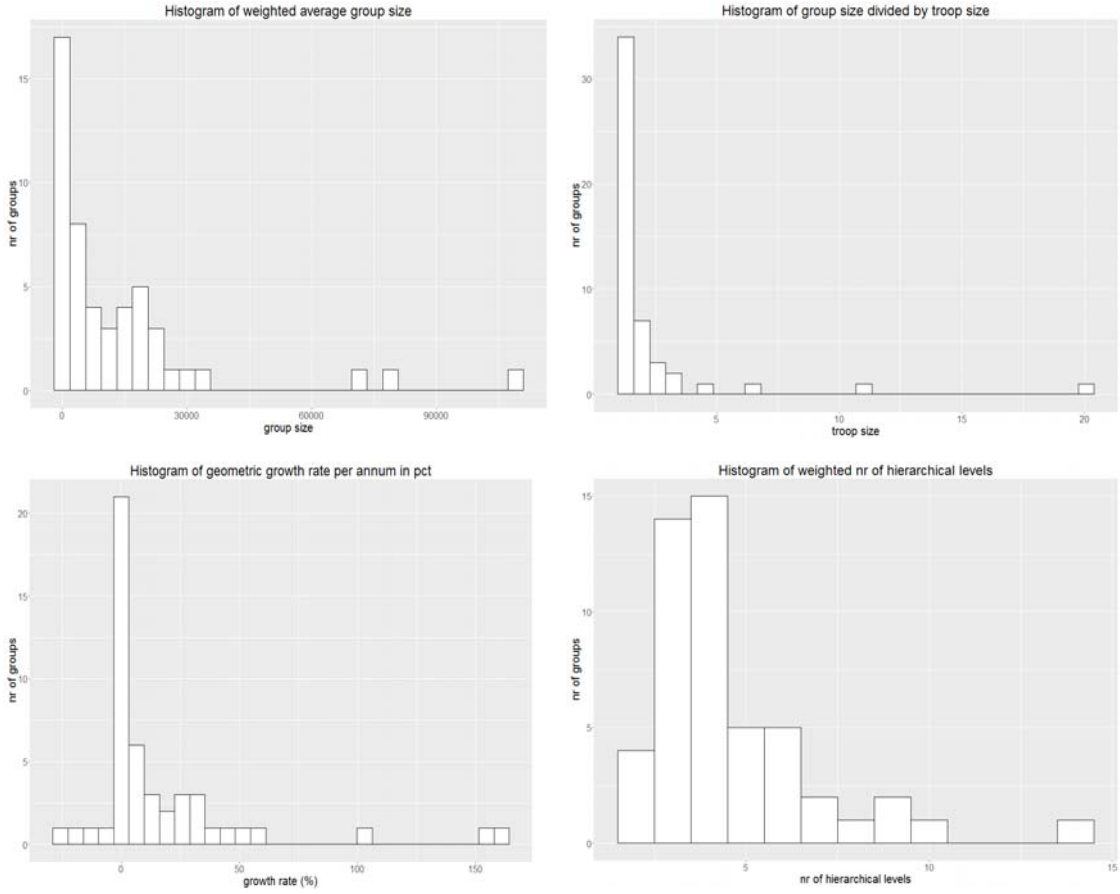


Figure 3.5 — Histograms of the four (semi)continuous Modes variables.

The strong suggestion stemming from the eyeballing, that all variables are uni-modal, is confirmed when numerical modality tests were done[1]: none of the variables appeared to be bi-modal, perhaps with the exception of the 'number of hierarchical levels' if very loose criteria are allowed (see the two tables directly below). All variables are very likely *uni*modal. The numbers in the tables represent the percentage of imputed datasets that indicated TRUE for a particular modality test for the particular variable. Although the first table (with 'min.size=0.1' = minimum

[1] The modality was tested by the modality test functions in the package `LaplacesDemon` (Statisticat 2016).

10% of the x-axis occupied by the Bell-curve of the Mode) seems to suggest that the 'Number of hierarchical levels' is likely to be bi-modal, the criterion is so strict that even small bumps and outliers can trigger a TRUE value. In addition, this 10% seems to lie around the middle of the entire value space (x-axis), namely ±9 levels (see histogram). It is not close to the origin of the x-axis, which could have been interpreted as representing the Imagistic Mode.

variable	% amodal	% unimodal	% bimodal	% multimodal
group size	0	100	0	0
group size ÷ troop size	0	100	0	0
growth rate / yr	0	100	0	0
nr. of hierarchical levels	0	11	71	89

Min.size[1] = 0.1

Table 3.14 — Modality tests with minimum modal width of 10%

Indeed, when the criterion is set to 20% of the distributional area (x-axis) to be occupied by a mode, the effect (bimodality of Nr. of hierarchical levels) is nearly gone:

variable	% amodal	% unimodal	% bimodal	% multimodal
group size	0	100	0	0
group size ÷ troop size	0	100	0	0
growth rate / yr	0	100	0	0
nr. of hierarchical levels	0	78	21	22

Min.size = 0.2

Table 3.15 — Modality tests with minimum modal width of 20%

[1] The min.size refers to "the minimum size that can be considered a mode, where […] the min.size function can be used to reduce the number of modes returned, and defaults to 0.1, eliminating modes that do not have at least 10% of the distributional area." (http://finzi.psych.upenn.edu/R/library/LaplacesDemon/html/Mode.html, Laplaces Demon manual). That means that the larger the min.size, the 'wider' the mode can be before it triggers a TRUE on the test. The smaller the min.size, the more sensitive the test becomes, so that even one outlier can trigger a TRUE for a certain modality, e.g. for bimodality.

All in all, the distribution of the four (more or less) continuous variables does not confirm bi-modality, and thereby does not confirm that there are two divergent Modes amongst armed groups.

b. Does the majority of the groups have either 'Doctrinal' or 'Imagistic' rituals only?

Theory predicts (see Theory chapter; and Appendix 2, tenet 3.8) that groups tend to have / cluster around / evolve towards the attractor positions of having predominantly low-arousal high-frequency (LA/HF) ideology spreading rituals (here called 'Doctrinal rituals'), or high-arousal low-frequency rituals (HA/LF, such as painful initiations, perhaps a euphoric annual feast, etc.). As can be seen in the graphs below (figure 3.6), when the number of high-arousal low-frequency rituals is plotted against the number of low-arousal high-frequency rituals, there is no sign of any clustering. Clustering would have indicated that a section of groups is tilting towards the LA/HF end, and another section towards the HA/LF end. In the plots, dysphoric and euphoric rituals are split out in two graphs, but neither of them shows signs of clustering.

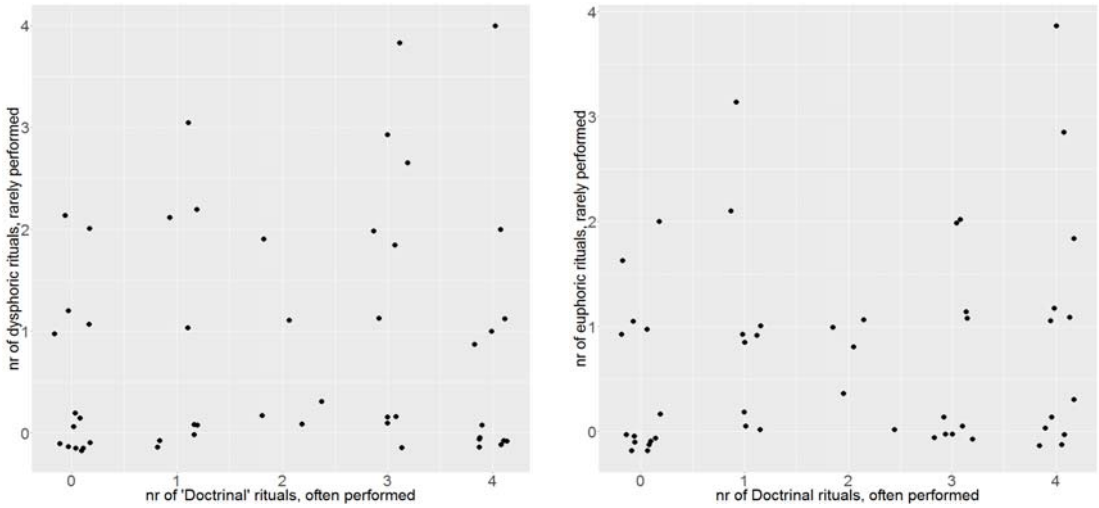


Figure 3.6 — LA/HF ideology spreading ('Doctrinal') rituals plotted against HA/LF rituals. On the left, HA is dysphoric, on the right, HA is euphoric. The points are jittered to show all groups.

The theory explicitly mentions that rituals either evolve towards LA/HF or HA/LF. However, as exploration and as relaxation of the criteria to be charitable towards the theory, the LA and HA rituals were also plotted against each other when all frequencies were taken into account:

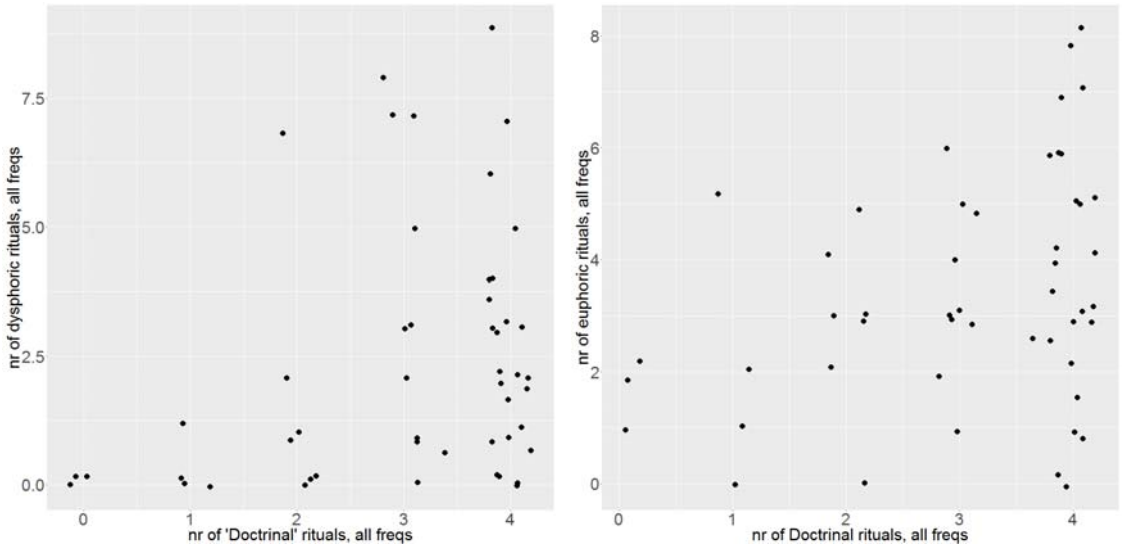


Figure 3.7 — Low-arousal ideology spreading ('Doctrinal') rituals (all frequencies) plotted against high-arousal (HA) rituals (all frequencies). On the left, HA is dysphoric, on the right, HA is euphoric. The points are jittered to show all groups.

Again, there was no clustering into two 'clouds' of points. Because all frequencies were taken into account in these graphs, there was a higher number of groups that had more than one HA or LA ritual, and less groups with zero dysphoric or 'Doctrinal' rituals. As a result, there are not many points close to zero (0,0). These patterns have been analysed with various clustering analyses; as can be seen in table 3.16, the results vary wildly per variable pair and per cluster method. That suggests that there are no clear clusters in the data. The algorithms to determine the number of clusters probably settle on different outcomes by lack of a clear number of clusters. When graphs were made (not shown here) of the cluster distribution when the test indicated two clusters for the Gap statistic (right most column), the point cloud was not only invariably divided in two simple halves, but these were also often different halves when the tests were repeated (e.g. first time: upper and lower half, second

time left and right half). That strengthens the thought that even when the test indicated that there were two clusters, they were not meaningful.

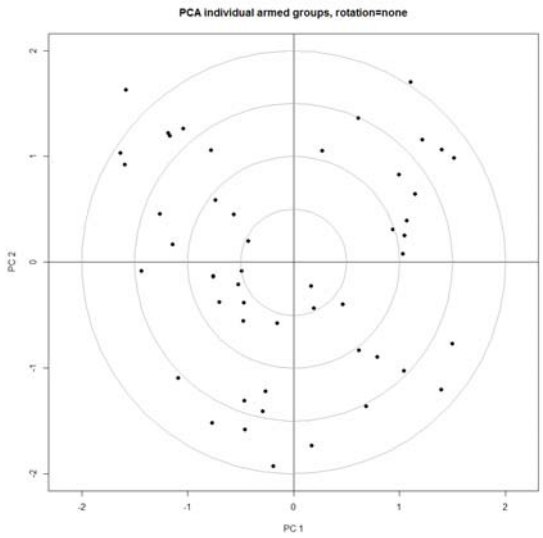
variable 1	variable 2	SSE scree	Silhouette optimal	Calinski best	BIC max	Affinity propg	Gap statistic
'Doctrinal' often	dysphoric rarely	6	19	20	19	5	2
'Doctrinal' often	euphoric rarely	4	19	20	6	3	2
'Doctrinal' all freq's	dysphoric all freq's	7	16	20	4	5	1
'Doctrinal' all freq's	euphoric all freq's	5	20	20	9	6	1

Table 3.16 — the number of clusters per combination of ritual types; six methods were used to determine the number of clusters

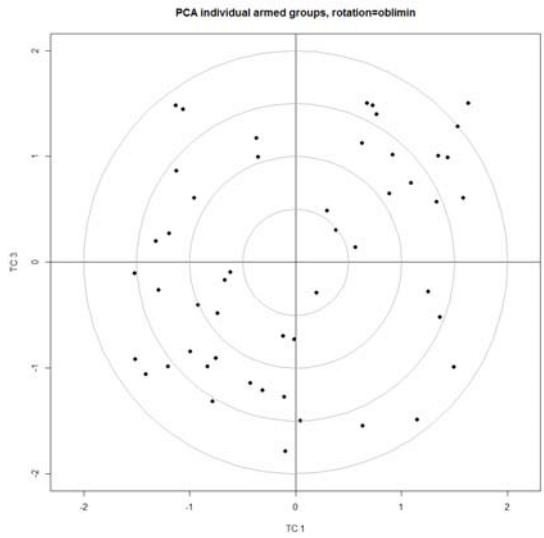
Hence, it is concluded that armed groups do not fall into two different and distinct types of groups concerning their ritual behaviour. Or to put it differently, it is not the case that groups perform predominantly Doctrinal rituals and no or hardly any Imagistic rituals, or predominantly Imagistic rituals and no or hardly any Doctrinal rituals. In that sense, the bi-modality was also not found here.

c. Do groups themselves cluster into two clusters?

Below a PCA based on the mean values of the imputed datasets is presented (see Methodology section). The same core variables were used as for the PCA that investigated the variable loadings (see page 128). In addition, a 5-component PCA is used to stay in line with the PCA presented before. This 5-component PCA captures the maximum amount of variance.



Imputed datasets averaged, then PCA. Rotation=none, 5 components. Shown are individual armed groups on PC1 and PC2.



Imputed datasets averaged, then PCA. Rotation=oblimin, 5 components. Shown are individual armed groups on TC1 and TC3.

Figure 3.8 — Loadings of armed groups on PCAs. The 5-component PCAs were based on mean values of the imputed datasets. The dots represent individual armed groups. On the left: no rotation; on the right: oblimin rotation.

As can be seen from the plot of the individual loadings for the first two PCs, no clear pattern of two clusters of groups emerges. When the number of clusters in this point cloud is determined analytically, a pattern emerges that is similar to what has been described above: there is no agreement or resemblance in the outcomes. The various techniques calculated for both types of PCA either 1 (none) or 2 (oblimin) clusters (Gap statistic), 2 clusters (BIC max), 5 (Affinity propagation), 4, 6 and 8 (none), and 7 (oblimin) (SSE scree), 5 (none) and 16 (oblimin) (Silhouette) and 20 (Calinski) clusters.

MDS

For the MDS, no clear clustering emerges into two 'clouds' — i.e., when the core Modes variables of this research are used as a basis, there is not a clear typology of two types of armed groups:

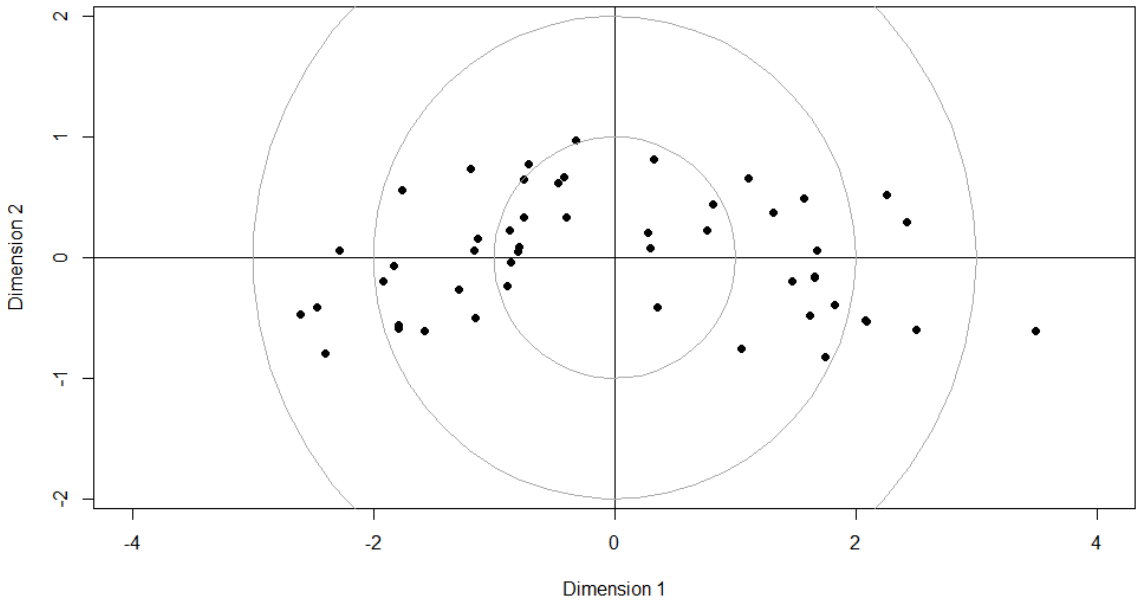


Figure 3.9 — Position of armed groups on an MDS of the core Modes variables.

To check whether any clustering pattern would emerge from numerical analysis, the same cluster analyses as above was applied to the coordinates of the MDS. The number of clusters varied from 1 (Gap statistic), via 2 (Silhouette optimal, and BIC max), via 5 (affinity propagation), via 8 (SSE scree) to 20 (Calinski's); no solid conclusion can be drawn from that but probably similar thoughts as above may apply: the algorithms of the different analyses settle on different outcomes given the lack of clear separation in the entire cloud of points between clusters.

In conclusion, it seems that this method does not support either that there are two attractor states amongst armed groups with regard to the two Modes as operationalized here.

However, in contrast to the PCA, for the MDS the data points do seem to be fairly nicely spread out along the first axis (for the MDS: the first dimension). That makes it worthwhile to investigate what is captured by the two dimensions, especially the first. This is done here in a qualitative way, that is, colouring the data points in the MDS by values of a certain variable, one variable at a time. For all plots, the colour red represents what could be interpreted as 'Imagistic', and the colour blue represent what could be interpreted as 'Doctrinal'. As it turns out, the first dimension is representative of many Doctrinal variables; the more positive the dimension, the more 'Doctrinalness' is captured — and perhaps by extension one could say, the more negative the dimension, the more 'Imagisticness' is captured. Variables 'group size', 'growth rate', the 'number of hierarchical levels' and 'installing a law (y/n)' seemed hardly or not to represent any patterns, and the plots are left out here to save space. This was different for the variables 'Imagistic leadership (y/n)', the 'number of Doctrinal rituals with high frequency', the 'number of Doctrinal ideological properties', 'having a social organization (y/n)', and the 'number of social services', which all showed a clear pattern on Dimension 1, with all 'Doctrinal' values on the positive side of Dimension 1:

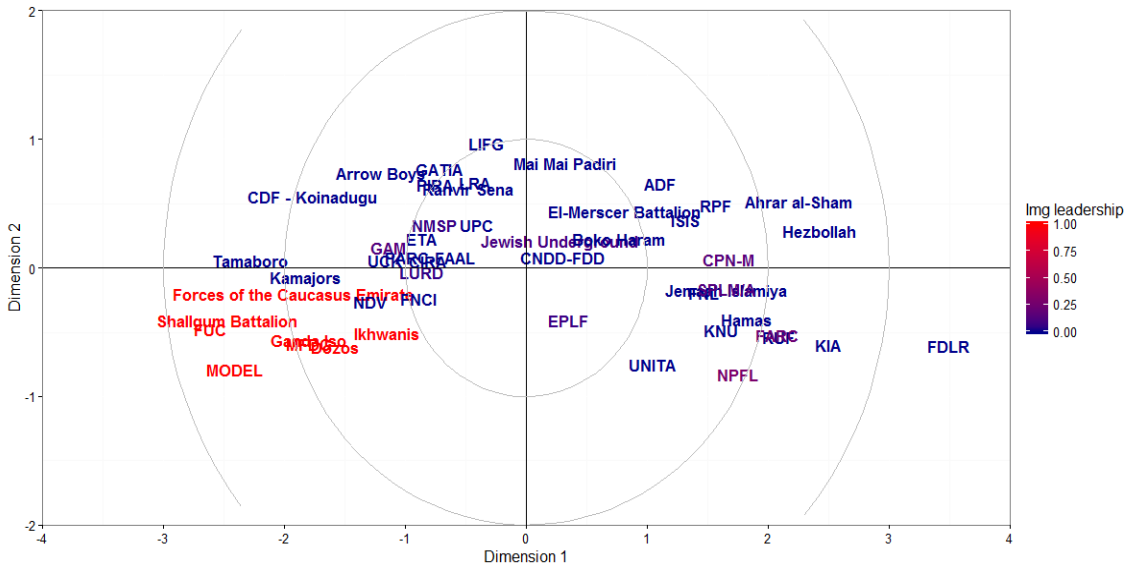


Figure 3.10a — Distribution of Imagistic leadership over armed groups. MDS based on the core Modes variables.

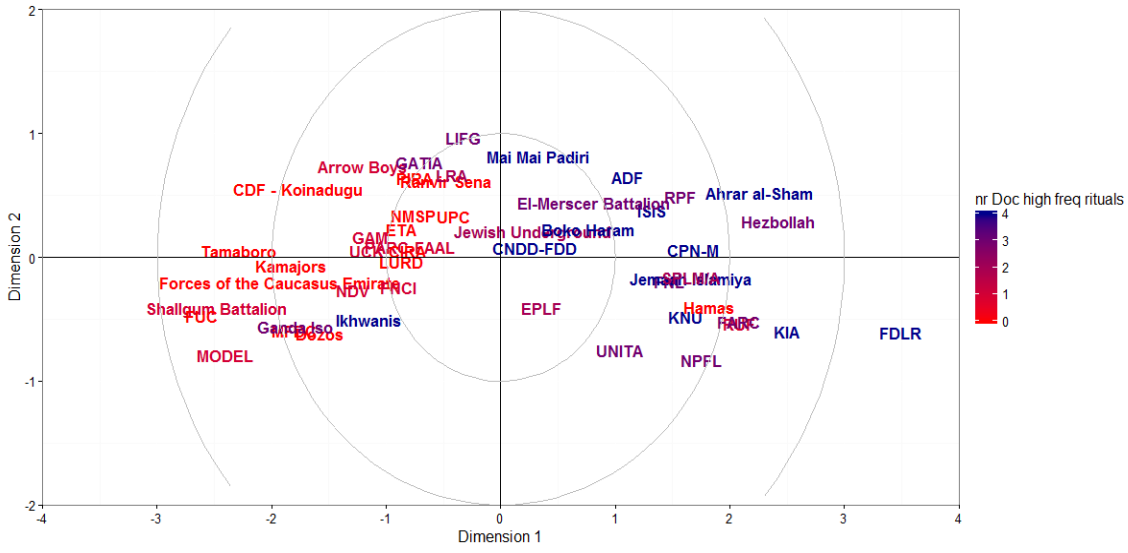


Figure 3.10b — Distribution of the number of Doctrinal rituals over armed groups. MDS based on the core Modes variables.

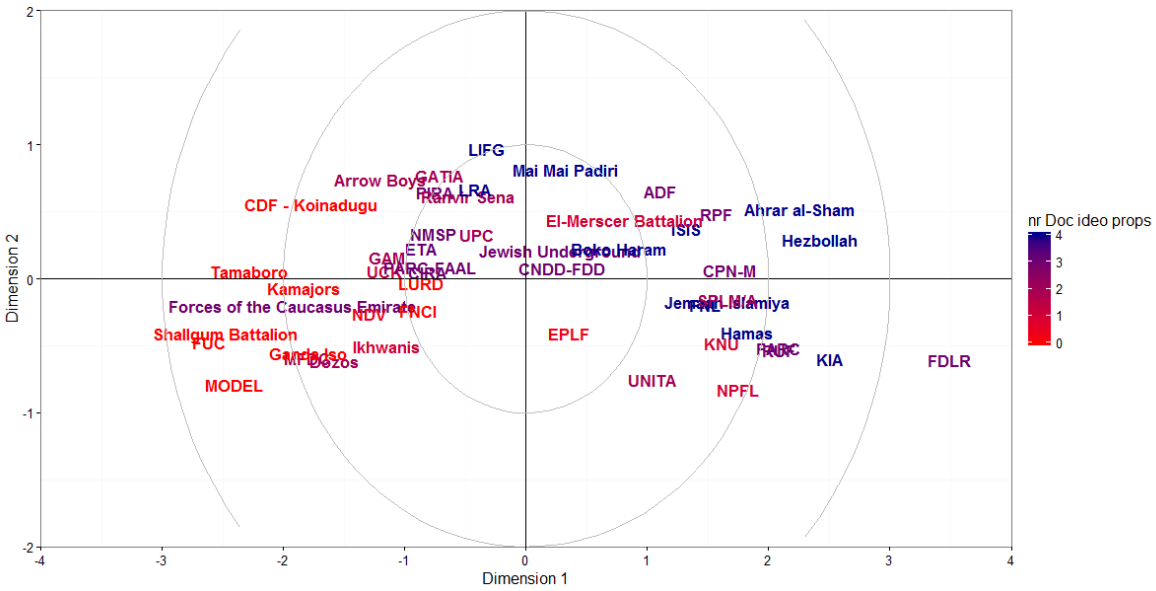


Figure 3.10c — Distribution of the number of Doctrinal ideological properties over armed groups. MDS based on the core Modes variables.

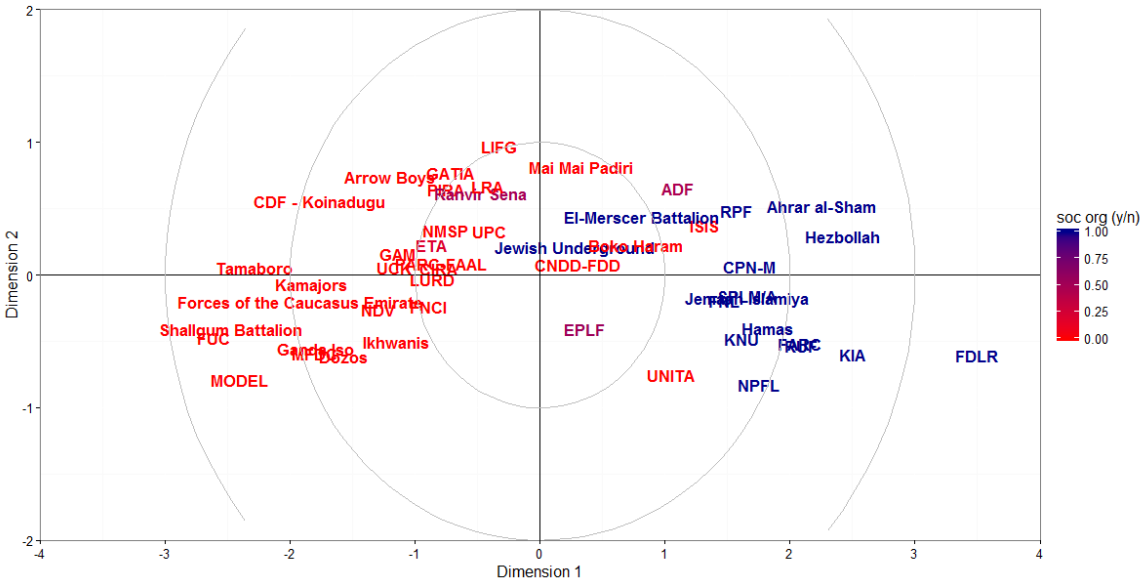


Figure 3.10d — Distribution of having a social organization (y/n) over armed groups. MDS based on the core Modes variables.

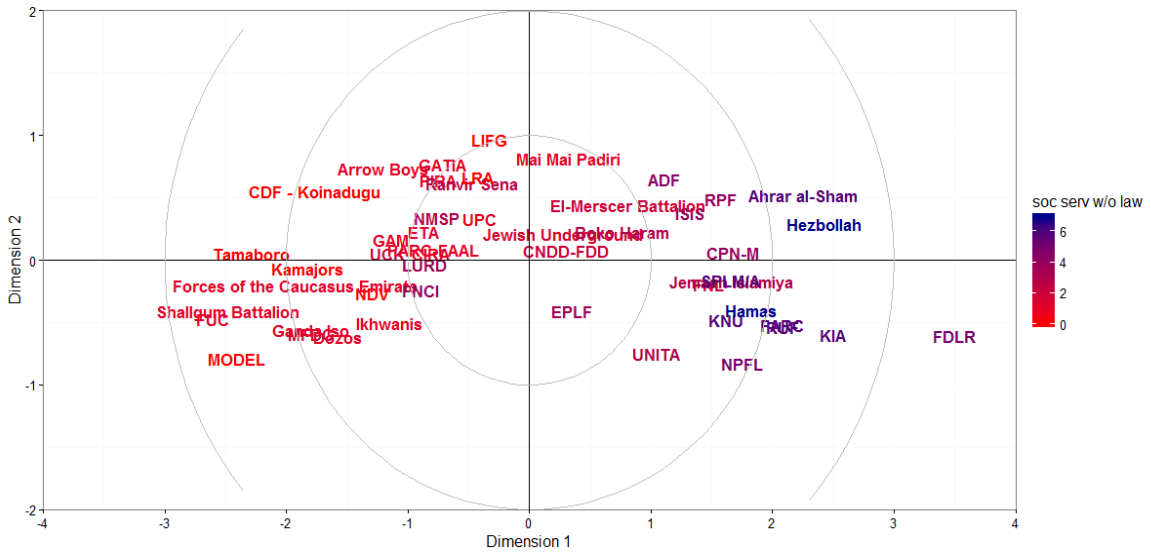


Figure 3.10e — Distribution of the number of social services over armed groups. MDS based on the core Modes variables.

For Dimension 2 and of the remaining variables, the 'number of dysphoric rarely performed rituals' seemed to hint an inversely related gradient on Dimension 2 (not shown here). However, especially the presence (or not) of Doctrinal leadership showed a clear gradient, close to an unmixed dichotomy (the basic variable was true/false) on Dimension 2:

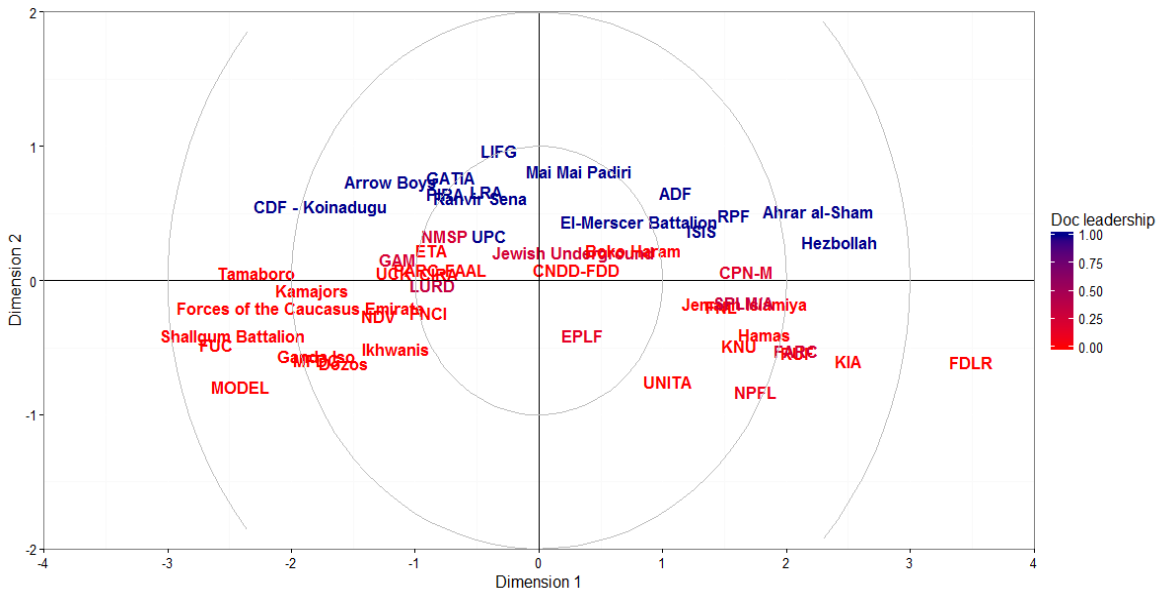


Figure 3.10f — Distribution of Doctrinal leadership (y/n) over armed groups. MDS based on the core Modes variables.

Finding such patterns more or less reconfirms the patterns found in the correlation matrix (see from page 121 onwards). Many of the same variables in the correlation matrix that showed a high correlation in one way or another are clearly patterned on Dimension 1 in the same way: higher on Dimension 1 is more 'Doctrinal'. In addition, the variables that had insignificant correlations and patterns opposite to the predictions there -notably group size, the number of hierarchical levels, and growth rate, which are some of the core properties of Modes- also showed no obvious pattern on the MDS here.

Conclusion

There is basically no evidence that armed groups are organized along the two Modes with little overlap in between. For (semi)continuous variables, a bi-modal distribution was not found. For the rituals, two clusters of rituals —low-arousal high-frequency and high-arousal low-frequency— were also not found. Individual groups did not fall into two clusters on the first two dimensions of a PCA, and also not on the first two dimensions of an MDS.

Explorations

1. Is there a relationship between any of the Modes variables and the outcome of the conflict?

A somewhat separate treatment is reserved for the Outcome of the conflict. The outcome of the conflict is interesting in its own right for policy decisions and predicting change of government in certain areas of the world.

Values for the outcome could be 'conflict still ongoing', 'low activity', 'ceasefire agreement' (two versions), 'peace agreement', 'victory' and 'defeat'. There is not really a natural order in these; perhaps one could try to see how victorious a group has been, and there are values that could be used for such a scale, e.g. from 'defeat' via 'ceasefire' to 'victory'. However, 'conflict ongoing', 'low activity' and 'peace agreement' fall outside of this scale. Peace agreement is not something close to victory; for instance, recently (September 2016) the FARC has made a peace agreement with the government of Colombia, but only after they had suffered heavy losses — close to a defeat. In other instances, for instance in Aceh, there has been a peace agreement where the Free Aceh Movement had gained strategic (but not necessarily tactical) successes closer to a victory. Hence, all in all, an ordered categorical —leave alone a numerical— scale could not be used for Outcome of the conflict. As a result, this variable was not included in the correlation matrix. That said, categorical analyses (ANOVA for relations with numerical variables, Chi-square and Fisher exact test for relations with categorical variables) were certainly possible and the result of such analyses are presented below in a very summarized form. The sequence of variables has been kept the same as in the prediction and correlation matrix.

Variable	ANOVA		Chi-square		Fisher exact	
	all outcomes	condensed	all	cond.	all	cond.
Group size	.62 – .88	.44 - .69				
Ratio group/troop size	(0 –) .07 – .92	.44 - .52				
Growth rate	.74 – .95	.91 - .96				
Nr hierarchical levels	.42 – .64	.35 - .63				
Doc ideological props.	.15	.028 - .056	.30	.25	.27	.29
Doc rituals (scale)	.1	.076 - .16	.45	.24	.31	.16
Doc rituals (binary)	[.18]	[.089]	.18	.09	.13	.086
Doc type leadership	.83 – .99	.80 - .96	.88	.93	.89	.91
Nr of social services	.39 – .71	.45 - .72				
Installs law (y/n)	[.50]	.26	.47	.25	.50	.29
Social org (y/n)	.78	.12 - .63	.36	.27	.32	.28
Rare dysph. rit. (scale)	.88 – .99	.89 - .96				
Rare dysph rit. (binary)	.87 – .99	.79 - .95	.98	.91	.99	.93
Img type leadership	[.69]	[.62]	.66	.60	.80	.70
Shared neg. experiences	.70 – .89	.86 - .99				
Religiosity of ideology	.013 – .14	.0017 - .036	.09	.081	.036	.041

Table 3.17 - Outcome of the conflict as related to other variables. The numbers are p-values found in the respective statistical tests.

Left of the dotted lines in the results columns represent the situation when all outcomes of the conflict are taken into account, the right side of the result columns represent the situation when all 'agreements' ('Ceasefire agreement', 'Peace agreement' and 'Ceasefire agreement with conflict regulation') are lumped together into one 'agreement' category. The Chi-square and Fisher exact test were not applicable when the other variable could not meaningfully be caught in categorical terms; either because the original scale was numerical (e.g. group size) or because the compound count scale had too many counts to divide them up in categories (e.g. the nr. of social services). When the Chi-square and Fisher exact test were not applicable, the cells were left blank. The different p-values per cell in the ANOVA

column stem from the fact that there are different ways to do robust ANOVAs[1]. The p-values between square brackets represent the outcome of a non-robust ANOVA, which was in these instances the only ANOVA that worked because robust ANOVAs gave an error because at least one category contained no variance. The non-robust ANOVAs violate one or more assumptions of ANOVA, hence the outcomes should be taken with a grain of salt. That said, those values are quite comparable to the outcomes of the Fisher-exact test and the Chi-square test of the same variable pair.

On the whole, the 'Outcome of the conflict' relates to none of the Modes properties in a significant way. However, significant relations of some conflict outcomes are suggested with the 'Ratio group/troop size', perhaps for the 'number of Doctrinal ideological properties' and most notably for the 'Religiosity of the explicit ideology' — which brings us to the next question:

How important is the Religiosity of the explicit ideology?

This section will have a look at links between 'Religiosity of the explicit ideology' and three other domains: Modes variables, outcome of the conflict, and spatial distribution.

First, the 'Religiosity of the explicit ideology' is significantly correlated with two Modes variables (see above, pg. 121): with the 'number of Doctrinal ideological properties' (Spearman's ρ=.72, p<<<.001) and with the 'number of Doctrinal rituals' (ρ=.36, p=.0088). Even after a Holm adjustment for multiple comparisons of no less than 120 correlations, the correlation with the 'number of Doctrinal ideological properties' still remained significant. That suggests that 'Religiosity of the explicit ideology' is a meaningful factor when related to Doctrinal categories.

[1] `oneway.test` and `kruskal.test` from the package `stats` (R Core Team 2015), `t1way` and `t1waybt` from the package `WRS2` (Mair, Schoenbrodt, and Wilcox 2015).

In addition, when the multi-variate data of the core Modes variables are condensed in either a PCA or an MDS and individual armed groups are plotted on it, coloured by 'Religiosity of the explicit ideology', then patterns become visible. 'Religiosity of the explicit ideology' was not a variable to constitute either the PCA or MDS, hence, when patterns are found they represent an independent structuring of the data and are not tautological.

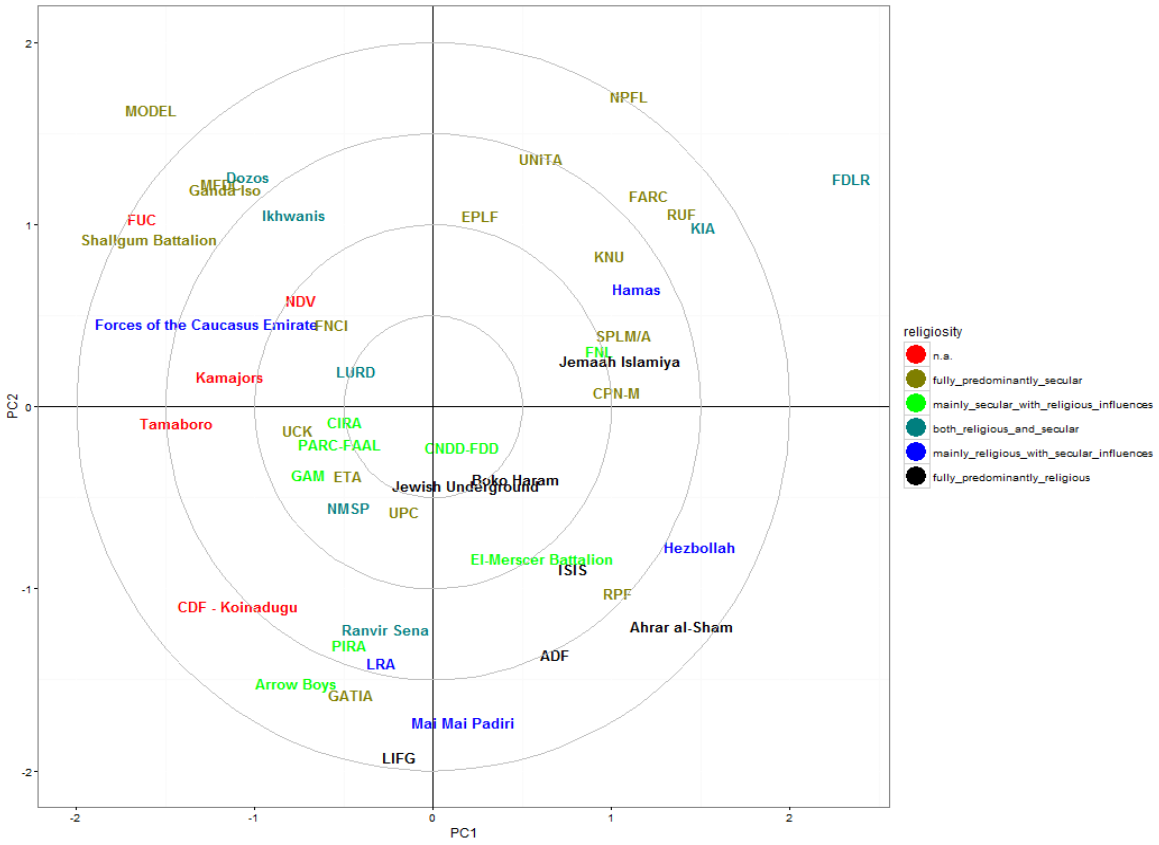


Figure 3.11 - Loadings of armed groups on a PCA, coloured by Religiosity of the explicit ideology. No rotation, loadings on the first two Principal Components of a 5-component PCA based on averaged imputed datasets.

As can be seen in the PCA (fig. 3.11), 'n.a.' is concentrated on the negative side of PC1, 'mainly secular with religious influences' on the negative side of PC2 and 'fully or predominantly religious' in the lower right quadrant. Different from the MDS and in addition here, 'fully or predominantly secular' seems to be concentrated in the positive side of PC2.

When an oblimin rotation is used as above, and the loadings of armed groups are plotted on TC1 against TC3 as above, similar patterns emerge as well:

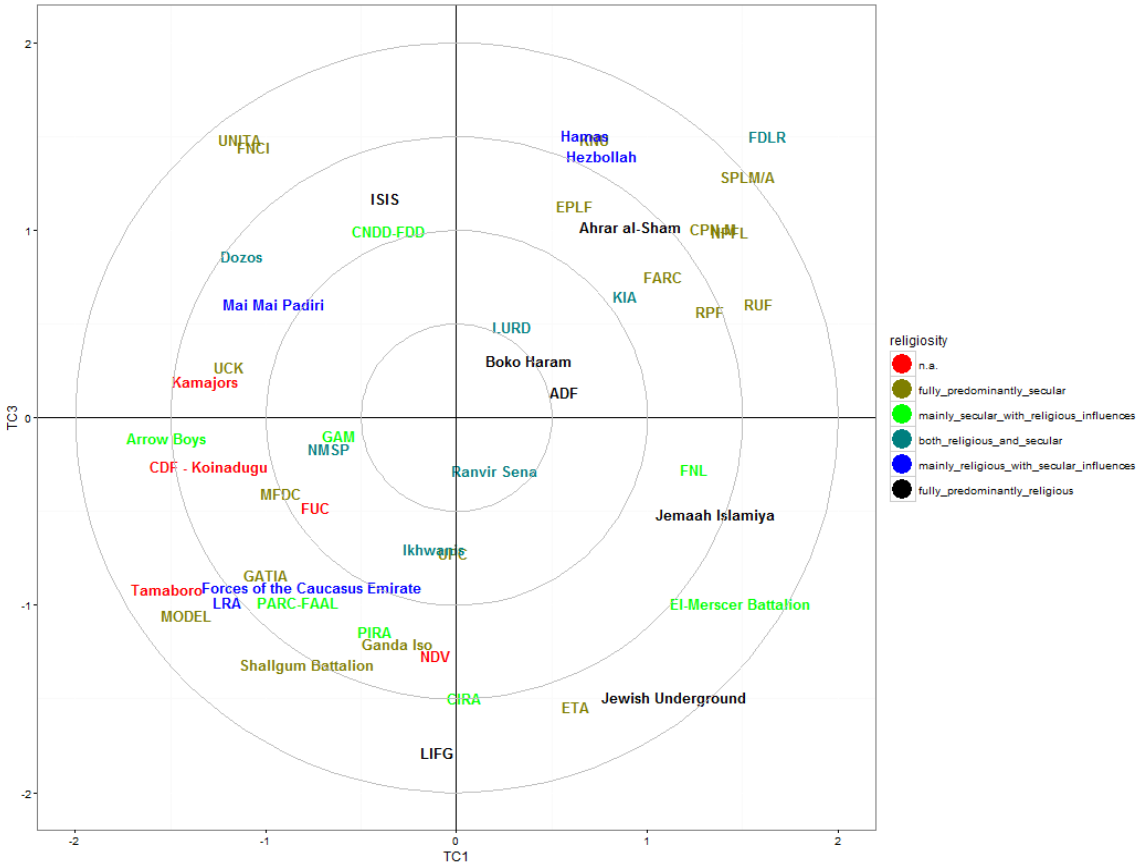


Figure 3.12 - Loadings of armed groups on a PCA, coloured by Religiosity of the explicit ideology. Rotation=oblimin, loadings on the first two Principal Components of a 5-component PCA based on averaged imputed datasets.

Religiosity 'n.a.' is concentrated on the negative side of TC1, and 'fully or predominantly religious' is concentrated on the positive side of TC1. However, all other degrees of religiosity of the explicit ideology seem to be spread out over the plot. Based on these results, it seems that for 'Religiosity of the explicit ideology' there are significant correlations with both the 'number of Doctrinal ideological properties' and with the 'number of Doctrinal rituals', and -probably through that- with the cluster of Modes variables as studied here.

Finally, when an MDS is made of the individuals, similar patterns emerge:

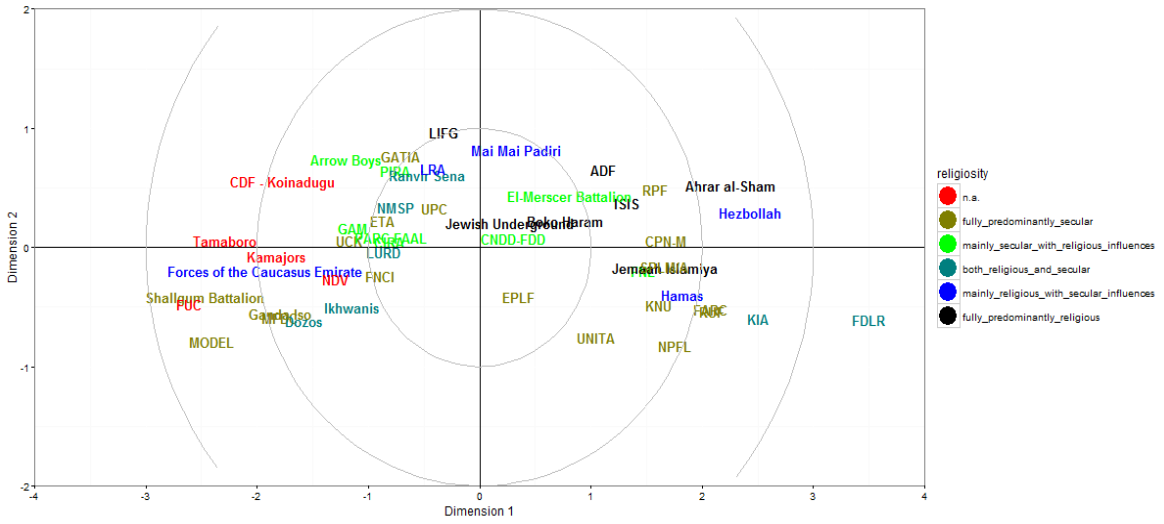


Figure 3.13 — MDS of individual armed groups, coloured by Religiosity of the explicit ideology.

In the MDS (fig. 3.13), the religiosity 'n.a.' (i.e. there is no explicit ideology) is concentrated on the negative side of the first dimension; 'mainly secular with religious influences' is concentrated around the centre of dimension 1 but all positive on dimension 2; and 'fully or predominantly religious' is concentrated on the positive side of dimension 1.

Summarizing whether patterns are found for the MDS and the two PCAs:

Religiosity	MDS	PCA (PC1, PC2) rotation=none	PCA (TC1, TC3) rotation=oblimin
n.a.	yes	yes	yes
fully or predominantly secular	-	yes	-
mainly secular w/religious influences	yes	yes	-
both religious and secular	-	-	-
mainly religious w/secular influences	-	-	-
fully or predominantly religious	yes	yes	yes

Table 3.18 — Patterns for clustering of types of religiosity in MDS and PCA analyses.

The second exploration here is the relationship with the 'Main outcome' of the conflict, from the perspective of the group. It has been suggested in the literature (Svensson 2007; Sheikh et al. 2012) that the duration and perhaps outcome of the conflict may be affected by the religiosity of the participating armed groups. As there is data on the outcome of the conflict and of the religiosity of the explicit ideology in this dataset, it is possible to try to investigate the relationship between the two. The results are mixed, though mainly non-confirming. In table 3.17 (page 152) are relationships given between the 'outcome of the conflict' and various other variables, in the form of various ANOVAs, a Chi-square test and a Fisher-exact test. For 'Religiosity of the explicit ideology', the bootstrapped one-way ANOVA (equal trimmed means using a percentile t-bootstrap method, trim level for mean = 20%, bootstrap samples = 2000), a significant relation with the outcome of the conflict was found (p=0.013). However, none of the other robust ANOVAs revealed a significant relationship between the religiosity of the explicit ideology and the outcome of the conflict. In addition, the ANOVA results are potentially distorted because the 'Religiosity of the explicit ideology' was treated in these ANOVAs as a Likert scale from 0 to 5. Whilst it is not uncommon to treat a Likert scale like a discrete continuous ratio variable, it is technically not valid. More valid are the Fisher exact tests, and they give pooled p-values of .036-.040, which can be considered significant. The post-hoc Fisher exact test of the 'condensed Religiosity of the explicit ideology' showed that the significant differences (uncorrected for multiple comparisons) are between 'agreement' vs. 'defeat' and between 'agreement' vs. 'low activity'. Both 'defeat' and 'low activity' had several empty categories, whereas 'agreement' did not, because this was precisely the condensed category, wherein various types of agreements were lumped. Hence, it might be questioned whether the p-values below the .05 in the Fisher exact tests are that meaningful. All in all,

there is not much confirmation that the 'Religiosity of the explicit ideology' is linked to a particular outcome of the conflict.

Third, there seems to be a geographical pattern in religiosity of the explicit ideology (more on geographical patterns in the next chapter). For simplicity, a condensed form of the religiosity of groups was made; groups with 'n.a.', 'fully or predominantly secular' and 'mainly secular with religious influences' were condensed to the category 'secular'; the category 'both religious and secular' was renamed to 'both', and the remaining groups with categories 'mainly religious with secular influences' and 'fully or predominantly religious' were condensed into the category 'religious'. The resulting map suggested that the majority of the groups from the Middle East were religious, the majority of the groups from West Africa were secular, groups from East Congo were either secular or religious, groups from South Asia were predominantly 'both' secular and religious at the same time (a mix).

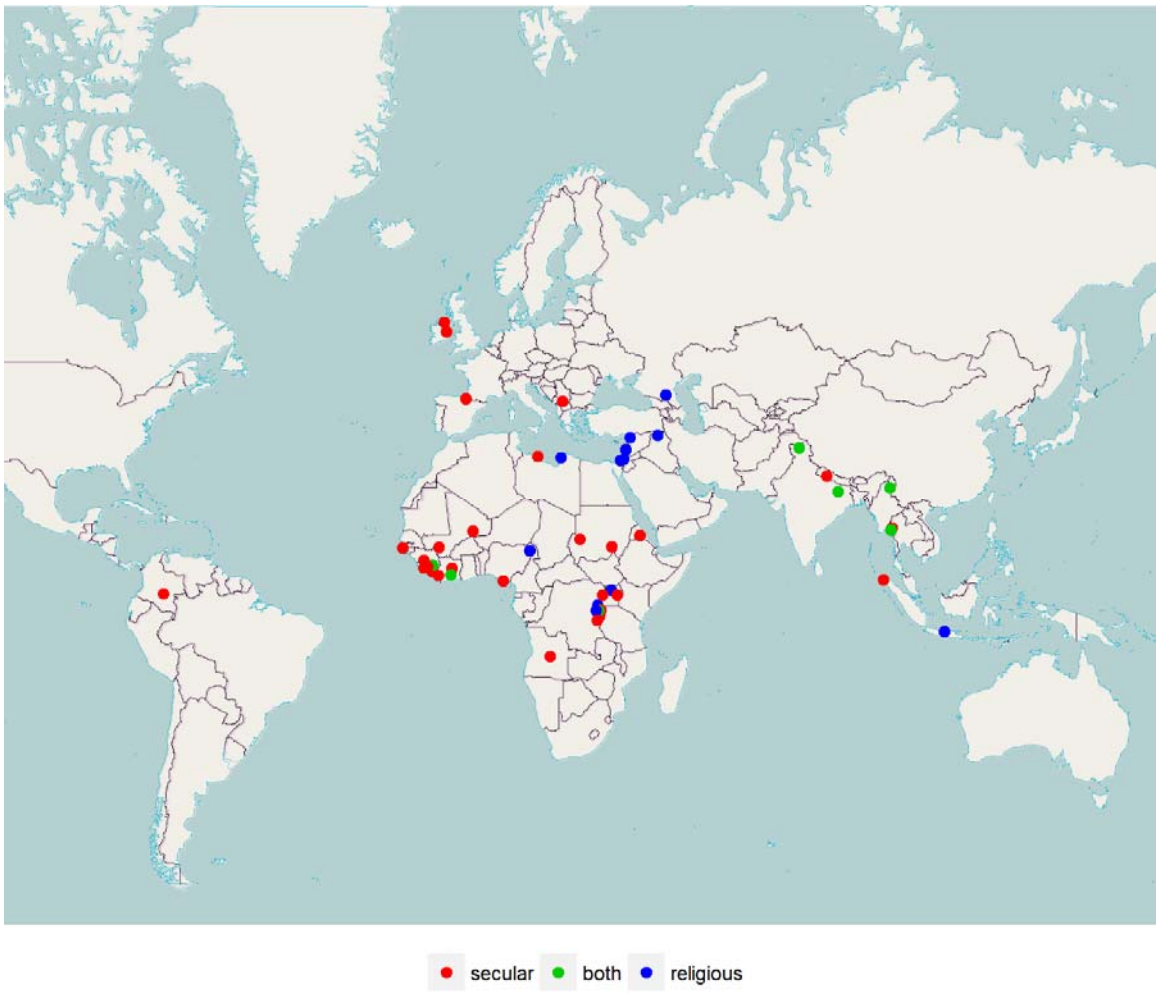


Figure 3.14 — Map of the religiosity of the explicit ideology (condensed) of armed groups

To conclude, the 'Religiosity of the explicit ideology', and probably the religiosity of an armed group on other dimensions, seems to be related to the Modes properties and promises to be a worthwhile dimension to investigate in future studies of armed groups. There also seems to be a geographical non-random distribution of the 'Religiosity…' parameter, which will be further analysed in the next chapter.

Discussion

Can the two Modes be found amongst armed groups?

In this chapter, three main hypotheses of the Modes theory, when applied to armed groups as a whole, were investigated: (i) whether there is an inverse relationship between ritual frequency and emotional arousal, (ii) whether per Mode most properties internally relate by and large positively with the exception of a few Imagistic properties, and (iii) whether armed groups would typically utilize either Doctrinal or Imagistic dynamics rather than exploiting both modes at the same time, to the extent that rebel groups cluster around one or other of these respective Modes, but not both (see also Whitehouse and McQuinn 2012, 605). Was this found?

There were a few findings that supported somewhat confirmative answers to these questions. First, there was a clear tendency for 'Doctrinal' rituals, i.e. relatively low-arousal and/or ideology spreading rituals, to be performed predominantly with high frequencies. Second, most directions of the correlations between the individual variable pairs were as predicted, with the notable exception of the explicitly Imagistic variables. The odds that so many relationships were in the direction as predicted purely by random processes is low — if one does not attach too much value to the non-significance of most correlations. However, if one *does* attach value to the fact that most correlations did not differ significantly from zero, then one could say that the relationships had no direction at all, which would not be in support of the theory. Third, the variables in the domain of 'social services' (the 'number of social services', 'having a law' and 'having a social organization') correlated significantly with Modes group properties from a different nature such as group size, the number of hierarchical levels, Doctrinal ideological properties, and Doctrinal rituals, suggesting a 'Doctrinal cluster'. Patterns found via colouring the individual data points in the MDS according to 'Doctrinalness' per variable yielded comparable results. Fourth, Imagistic leadership correlates negatively with all Doctrinal group properties and with all general variables, all according to predictions and expectations. Similarly,

Imagistic leadership correlates positively with the number of Imagistic rituals that are rarely performed, also according to predictions. However, again a critical remark could be that none of these correlations was significantly different from zero. Fifth, in the MDS the 'positive' Imagistic variables appeared to be relatively separate from the rest, which is according to what can be predicted from the Modes theory.

On the other hand, several findings are not in line with the predictions of the Modes theory. First, there was no tendency of high-arousal rituals to be performed predominantly with low frequencies. Secondly, one could emphasize that most correlations were not significantly different from zero, even in the correlation matrix that was not corrected for multiple comparisons, suggesting that a meaningful internal relationship between the Modes properties was absent, or at least very weak. Third, one of the few 'positive' variables of the Imagistic Mode -highly negatively arousing rituals- was correlated in the opposite direction of the predictions, and also the growth rate was correlating in the opposite direction as predicted — though this may not be an argument if one lends much weight to the fact that none of those correlations was significantly different from zero. Fourth, -although very tentative- the variables did not reduce to one principal component, suggesting that not all variables that should 'go up and down together' actually do so; as a secondary possibility, one could perhaps argue that Imagistic properties should be captured by a second Component and hence one should be able to find two Components (at most), even with these more relaxed criteria, this was not confirmed either. Fifth, none of the (semi-)continuous variables had a bi-modal distribution, effectively not supporting the presumption that there are two attractor states or that groups would centre around two distinctive Modes. Yet, in the MDS the variables appeared to be more in line with the predictions (see previous paragraph), so perhaps the multi-variate condensing techniques should be seen more as explorations than as full arguments. Sixth, the majority of the groups did not have mostly 'Doctrinal' rituals only or 'Imagistic' rituals only, again negating that there are two attractor states or

that groups would centre around two distinctive Modes. Seventh, based on the placement of the individual groups in PCAs or in the MDS, there was no sign that there were two distinct 'point clouds' at outer ends, again negating that there are two attractor states or that groups would centre around two distinctive Modes.

Finding such mixed results can be explained in an endless variety of ways and can lead to various conclusions. Some of the most relevant (but not necessarily correct or mutually exclusive) explanations and interpretations are:

1. The relatively small sample size combined with the uncertainty of imputations may have given effects that were too small to detect. However, this assumption comes at a cost for the theory: if those effects are really that hard to detect, then one can firstly wonder whether it is an *important* effect or a *useful* way to classify armed groups, even if finally found within a larger dataset; and secondly, one can wonder how it is possible that the effect seemed so strongly present for only five (Whitehouse and McQuinn 2012) respectively two (Beardsley and McQuinn 2009) example cases, but not in the 50 cases used in this research. At any rate, more statistical power and thereby more clarity can be gained by collecting more cases (Cohen 1988).
2. Experts may have had significantly different interpretations of the questions, and may therefore have provided noisy data. As already indicated in the Methodology chapter (see pg. 73 and further), there are indications of misunderstanding for the 'ritual frequency' measurements, so one could have concerns about the validity of some of the answers. However, none of the other group properties —like group size, the number of hierarchies, etc.— seem to have been susceptible to misinterpretation, and still these properties did not show significant effects either. Yet, one could say, although there is no evidence of misinterpretation, maybe in some cases there was. For instance, in Imagistic groups, there can certainly be one of the 'elders' who applies Imagistic 'magic' rituals. Perhaps experts saw this as an ideological leader, which counted in this research as a Doctrinal property. It

is uncertain how common such a skew is towards the Doctrinal side of scoring, and by absence of evidence, it was assumed in this research that there was not much of such skew. One could even say that if this skew really plays a big role, it might be hard to use the Modes theory as a general theory for civil war scholars and political scientists, because in that case the misunderstanding could be widespread, also in future use. Regardless, it is not plausible that general misunderstanding or a highly variable understanding by the experts of the question list is the full explanation of not finding strong indications of two divergent Modes. Yet, for a next iteration of this research, at least the questions about frequency must be formulated more clearly, and it is wise to run through all explanations of the questions again (presented as introductory text to the experts, see Appendix 1), perhaps in the form of workshops or more interviews, to be sure the wording is right.

3. The Modes theory is fluid, and finding or refuting something that is fluid is harder than finding or refuting something that is binary or has sharp in/out criteria. Following the Whitehouse and McQuinn (2012) article, the Modes theory was in its entirety applied to armed groups. Yet, in the Modes theory there are many aspects that correlate to many other aspects; they are often described in a qualitative way in the form of tendencies; there are not many criteria in print where a Mode ceases to be a full Mode or to what extent a Mode can be fluid or not; different versions of tables with Modes variables exist in different publications (see e.g. this chapter, table 3.1 and guiding text); and different operationalizations of those variables are used as well. That makes it harder to falsify everything in one go or support everything in one go. In fact, this is why falsification and Popperianism lost its appeal for some philosophers of science: exactly *what* is falsified if something is not found? The whole theory? Parts of it? The methodology? Supporting theories? Etc. (Lakatos and Musgrave 1974; and for a quick intro Rosenberg 1985, 6–8). Testing the Modes theory can be done more successfully if the Modes theory will be formulated sharper. Capturing the Modes theory in a formalized way (see

Appendix 2) could be a first step in this. Yet, more can be done, and various suggestions are made in Chapter 6.

4. One could also conclude that the Modes are not present amongst armed groups in the sense of: both Modes at the level of the entire group. Perhaps the findings that raise the most concerns for whether the Modes theory is applicable in the context of armed groups, is the lack of convincing evidence that there are two attractor states. To come to a more precise understanding what has been found here, the results are compared with the hypotheses and findings of Whitehouse & McQuinn (2012). They suggest that armed groups "tend to cluster around two sociopolitical 'attractor positions': the one large scale and hierarchical (doctrinal) and the other highly cohesive but localized or regionally fragmented (imagistic)" (p. 598), and that "rebels, whether or not they are religious, typically utilize either doctrinal or imagistic dynamics rather than exploiting both modes at the same time", or that "rebel groups […] cluster around one or other of these respective modes, but not both" (p. 605). However, there was no bi-modal distribution in the (semi)continuous variables, no evidence for a tendency for groups to have either Doctrinal or Imagistic rituals, and no evidence that groups plotted in two more or less distinct areas of the variable planes of the PCA and MDS. An additional concern is the fact that most (cor)relations between the Modes variables were weak, and although there was some evidence from the variable-MDS that variables related to each other in a way that could be expected, it was not overwhelming evidence, especially given the fact that other ways to explore that aspect (matrix of direction of correlations, PCA) did not give further support to the expected tendencies.

When a closer look is taken into some of the data there is a suggestion why in Whitehouse & McQuinn (2012) the two Modes emerged more clearly than in the current study. As it happens, some of the groups in that publication are also in the sample of this research: the RUF (categorized as 'Imagistic' in Whitehouse & McQuinn (2012)), the CPN (as "Doctrinal"), the FARC (id.) and Hezbollah (id.). However, for some of those groups, scores for the different variables (group

properties) are different when Whitehouse & McQuinn's study is compared to this research. To give a few examples, for the RUF strong evidence is reported by them against low-arousal high-frequency rituals, whereas this research finds ideological lessons during the morning ritual with frequency 'often' (and indoctrination and general ideological teaching 'sporadically'). They report strong evidence against an elaborate hierarchy and strong evidence supporting a less elaborate hierarchy for the RUF, whereas this research finds that the RUF has one of the highest number of hierarchical levels of all groups in the sample. For the FARC, Whitehouse & McQuinn report strong evidence against high-arousal low frequency rituals, whereas this research finds that the FARC had one of the highest number of rare dysphoric rituals of all groups in the sample. It is not probable that these differences are entirely explained by lack of understanding of experts of the questions or even their non-expertise. Hence, that suggests that if the score for the five groups as given by Whitehouse & McQuinn (2012) would be the same as found in this research, the effects as presented in their article might not have been as clear-cut as they reported.

Where is the Imagistic Mode?

A few group properties were found to be in (fairly good) accordance with the predictions of the Modes theory; most notably the frequency distribution of Doctrinal rituals, and the associations between the 'number of Doctrinal rituals with high frequency', the 'number of Doctrinal ideological properties', 'having a social organization (y/n)', and the 'number of social services', which all seem to represent a positive association between Doctrinal group properties. On the other hand, Imagistic rituals behaved different than expected: the distribution of the ritual frequency of the highly negatively arousing rituals was not in accordance with the prediction, and the number of Imagistic rituals tended to correlate in the opposite direction of what was expected. That suggests that the Doctrinal Mode can be more readily found amongst armed groups than the Imagistic Mode.

However, before jumping to that conclusion too quickly, a few remarks are in place:

a) The fact that Imagistic rituals were not found to have the expected frequency distribution and correlational directions was perhaps the result of the (mis)understanding of experts — see above.

b) In reality, there may be no general lack of Imagistic-ness in the results as presented above. Instead, it could be hidden in the correlations. After all, many of the positive correlations (e.g. between the number of Doctrinal rituals and the nr. of social services etc.) are based on a range of values, including small ones and zeroes — which typically are associated with the Imagistic Mode.

c) One of the peculiarities of the Modes theory is that at the group level, the group properties are asymmetric: the Doctrinal Mode has much more 'positively observable' evidence than the Imagistic Mode, because, according to the theory, many properties in the Imagistic Mode are just absent (e.g. explicit ideology, prescribed values for daily life, proselyting leadership, social services, installing a law, etc.). That makes it harder to detect the Imagistic Mode, simply because there is less to detect.

d) Finally, there may be *much* Imagistic-ness and Imagistic rituals to be found *within* armed groups, but just not at the level of the entire group — with which this research is concerned. Rather, it may be in the form of small groups within armed groups, individual battalions, camaraderie within a platoon, etc. Some parts of the Modes theory do indeed propose that there are Imagistic sub-groups within larger Doctrinal groups, although the Modes theory then often speaks of splinter groups. Indeed, armed groups were sampled as a whole because that is what the two target articles were doing as well, but still, sometimes experts filled in the question list for groups that had recently split off or were sub-groups of a larger amalgam of similar groups, such as CDF-Koinadugu, CIRA, and Mai Mai Padiri. In that sense,

more clearly Imagistic data could have been present — but that was not the case. Yet, the possibility of Imagistic subgroups is fairly plausible; for instance, platoons, or the original group that started a movement that later became a large armed group, could all be intensely cohesive sub-groups. The question whether such sub-groups indeed comply more to Imagistic dynamics is something that could be investigated in later research.

Explorations

Binary vs. scale

The question was whether it matters if there is more than one ritual of a certain type; e.g. whether there is a difference in effect of having one type of Doctrinal ritual versus more than one type. Evidence suggests that the more Doctrinal rituals there are in a group, the more other Doctrinal effects can be detected. For Imagistic rituals, it does not seem to matter how many Imagistic rituals are present in a group, as long as there is at least one. As for the Imagistic rituals, though, the effect could have been lost given the potentially ambiguous interpretation of the question, and hence the potential extra noise in the data.

The results of this study suggest that for future research, it may be useful to take the number of rituals of a certain type into account and not just focus on whether a certain type of rituals is present or not.

Outcome of the conflict

The Outcome of the conflict is not significantly related to any of the Modes variables. However, one could -understandably- argue that the separate individual variables are not the predictor for the outcome, but rather that certain combinations of variables are a better predictor. This requires its own analysis, e.g. with a multinomial logistic regression, using all variables that could be relevant, perhaps with a certain system to try out different combinations. That would probably need

more cases, given the 6 or 7 types of outcome and about 14 variables. A Bayesian approach would mitigate the problem that many cases are needed. All of these approaches are pursued no further in this thesis, but instead are suggested for future studies. As for now, no indication of a relationship between *Modes* and the outcome of the conflict has been found. However, significant relations of some conflict outcomes have been found with the Ratio group/troop size and for the Religiosity of the explicit ideology.

Religiosity of the explicit ideology

There are two empirical indications that religiosity (of the explicit ideology) is meaningful in the context of the two Modes amongst armed groups. First, there are significant correlations with both the number of Doctrinal ideological properties and with the number of 'Doctrinal' (low-arousal / ideology spreading) rituals. That suggests that Religiosity of the explicit ideology is a meaningful factor when related to Doctrinal categories. And second, both on a PCA and on an MDS plot, various categories of religiosity seemed to cluster in a distinct area, suggesting relationships with (combinations of) Modes variables. The religiosity of the explicit ideology strongly and significantly correlates with the number of Doctrinal rituals with a high frequency in the group, and especially with having Doctrinal ideological properties, which were [is the ideology] 'based on historic key books', [is it a] 'written and published ideology', [are there] 'prescribed values', [is there a] 'theory of history', and [are] 'influential ideologues' [present]. Given the content of these variables, the strong and significant correlations might not be totally surprising. However, one might approach it from the other side and say that it is not surprising that the Modes theory originated in the context of religion, was initially called the theory of the Modes of Religiosity and was formulated largely in religious terms, notably in Whitehouse (2004). Perhaps the Modes are clearest in the religious context, which could be a

further explanation of why their presence is less clear in the context of non-state armed groups.

The road ahead

In this chapter, a first iteration of the study to what extent the theory of the two Modes can be applied to armed groups was conducted, and the first of the limitations of the target publications on Modes amongst armed groups was addressed: a large-N study was used to investigate some of the core hypotheses of the Modes theory, and in doing so, the sample size was a tenfold larger than the initial study. This sets a base line for comparison and conceptualization to research potential solutions to the second limitation: Galton's problem. That will be the topic of the next chapter. Above (page 46), reasons were given why the results were not directly presented with corrections for that problem, but instead are given a dedicated chapter (the next).

Moving on to the chapter on Resources, it will be hard, if not impossible, to link ROI and Risk to a Mode per se (as has been proposed by the Modes and the PPM Theory) because it appeared that it was hard to pinpoint a Mode, let alone two Modes (especially the 'Imagistic' Mode was less pronounced in the sample, both for empirical and theoretical reasons). However, a good alternative is possible: linking ROI and Risk to individual (Modes) variables. In that sense, it is especially promising that variables related to social services appear to be strongly correlated to various other Modes variables: the PPM theory predicts that providing social services is linked to low-ROI low-Risk strategies, because social services are the 'investment' of a group in their human environment. The chapter on resources will give more clarity.

Finally, several recommendations were made in the text above to improve this research and to sharpen the Modes theory. An overview of the most important recommendations will be given in the last chapter, integrated with other recommendations and optimizations.

Chapter 4 - Galton's problem

Galton's problem is "the difficulty in drawing inferences from cross-cultural data, due to the statistical phenomenon of autocorrelation"[1]. In simple words, the problem is how to distinguish between two possible sources of cultural elements for any given group: is the group itself the origin of a cultural element, or did it get the cultural element from another group? Francis Galton was the first to make this problem explicit, and over time, the label "Galton's problem" has become synonymous with it. To give an example, one could wonder whether culture is an adaptation to resource extraction. In Anatolia, the Alevi community has costly annual rituals, whereas the Sunni have weekly prayers in the mosque. The Alevi community consists of small and dispersed groups, the Sunni groups are bigger and more together. Yet, both are dependent on the same type of resource extraction in the same landscape: animal husbandry, subsistence agriculture and very little trade. How to explain this? David Shankland (2014) sees in this a difference between Imagistic and Doctrinal group organization, and explains it by an historical *transfer* process: "an Alevi community would flip and convert to becoming Sunni if it became more proximate to the state […for instance] when the Ottoman Sultan's army passed by on an imperial mission to conquer Iran" (id.). The primary cause, he argues, is cultural transfer from one group to another in the form of a dominance relation, not adaptation to resource extraction or selection of cultural elements in the human mind by means of memory, fusion or any other mechanism. Whether this is right in all cases, or even most cases, is something that remains to be seen, but in general, when many groups are studied via a cross-cultural sample and it is simply assumed that those groups have no cultural exchange, the statistical result might be spurious. For instance, Ember *et al.* (2007) reported that male mortality in warfare and

[1] https://en.wiktionary.org/wiki/Galton%27s_problem

environmental pathogen stress were statistically significant predictors of nonsororal polygyny; however, Dow and Eff (2009) re-analysed their data with a statistical correction for cultural trait transmission and concluded that the only significant predictor of the worldwide distribution of nonsororal polygyny was cultural trait transmission itself — meaning that nonsororal polygyny spread throughout societies by transmission of the idea itself rather than being causally linked to male mortality or pathogen stress. Other examples exist in the literature showing that once relatedness of sample points is taken into account, other conclusions should have been drawn about the presence or absence of the reported effects (see e.g. Dow 1993; Reed 2004).

The problem of interrelatedness of groups might seem to be peculiar to anthropology, but actually, Galton's problem is a common challenge in the statistics of all social sciences and even beyond; the problem arises in any context where there is a potential correlation between subjects with regard to researched parameters and where the researched parameters are treated as independent. The non-independence need not to be via mutual influence. For instance, data points may be related to themselves. As an example of this, one of the best predictors for the occurrence of civil war in a country is a recent previous civil war or previous political contentions in the same country (Lichbach, Davenport, and Armstrong 2004). The more official and modern term for related data points is "autocorrelation", whether data points are (time-lagged) related to themselves, to their peers via network interactions of cultural transmission, or via vertical inheritance from a shared common ancestor.

It depends on the research question and background theory which type of cultural transfer —or autocorrelation— is relevant. As far as anthropology deals with Galton's problem, often two types of autocorrelation are considered: "horizontal" transfer between co-existing groups such as material or ideological exchange, for instance via exchange of marital partners, trade, or other mutual links; and "vertical" transfer, generally because of a common ancestor, be it biologically or culturally, for instance having a religion with the same origin. Both horizontal and vertical transfer

introduce (extra) correlations between groups, which should be taken into account in the analyses if one wants to do statistical analyses of relations between group properties and possibly external factors.

Autocorrelation and the Modes in armed groups

Most armed groups included in the present study probably had cultural transfer both in the horizontal and vertical direction. Examples of 'horizontal' interactions between groups in the sample are: the Mai-Mai Padiri closely worked with the FDLR who closely worked with and did business with the FNL; Ahrar-al-Sham from Syria got leaders from Al-Qaeda and fought against ISIS, Boko Haram from Nigeria copied tactics from Al-Qaeda and ISIS, the Chechen Republic of Ichkeria from the Caucasus copied ideology and tactics from Al-Qaeda; the ETA copied tactics from the PIRA in Ireland, and the ETA did business with the FARC in Colombia. And so on, and so on. Examples of more 'vertical' cultural transfer, with roots in a common ancestor are for instance that the CPN-M from Nepal, the FARC from Colombia, partially the ETA from Spain / Basque land, the first (long) phase of the PKK from Turkey, and the New Mon State Party from Burma all draw their inspiration from the same Marxist 'ancestors' (Marx, Mao); and several groups are drawing (parts of) their ideology on Islam (e.g. Ahrar al-Sham, Boko Haram, Forces of the Caucasus Emirate, Free Aceh Movement, Hamas, Hezbollah, ISIS, Jemaah Islamiya, Libyan Islamic Fighting Group). Examples of mixtures of vertical and horizontal relations are, e.g, that both the El-Merscer Battalion and the Shallgum Battalion originated in Libya, fought in the same civil war (2011), and worked closely together. An example of possible vertical transfer that is not so much ideological but more military is that a few groups were trained in Libya (e.g ETA, Free Aceh Movement) or the Economic Community of West African States Monitoring Group (CDF – Koinadugu, and the Kamajors). Such seemingly non-ideological relations can be meaningful for this research, for instance because one of the rituals was 'military training/drills', which

is also part of the 'Number of Doctrinal rituals' (variable 'Drits' in the previous chapter).

Given that autocorrelation can be so influential on the outcome of statistical analyses, given the relatedness between groups as just discussed, and given the different pathways possible for cultural transfer, the following research questions emerge:

1) *Via which relation types are the individual Modes properties transferred between groups?*

   Before starting to see things as a 'problem', it can in fact be interesting to know in what way cultural elements are transferred between groups, if at all. This flips the coin and sees autocorrelation in terms of "Galton's asset" (Hendrix 1997; Korotayev and De Munck 2003). For instance, in this study, it seems worthwhile to know to what extent e.g. group splits, trade, ideological inspiration etc. each have their own effect on the diffusion of the Modes properties amongst armed groups. Until now, there has hardly been any research on pathways of cultural transfer amongst groups, though a few examples are summarized in Dow and Eff (2008, 149). A limitation of that previous research is that they all focused on one type of relation only, for instance only trade, etc. In addition, although research on relations between nodes in a network has been done before, that was predominantly, if not always, within one community or group (Borgatti et al. 2009), and less so, perhaps never, between groups. Two of the contributions of this thesis are that the effect of various relation types is researched and combined in one and the same study, and that this is not limited to relations within one group but expands to relations between various groups that exist more or less at the same time.

2) *If there is such interrelatedness between groups in the sample, which Modes properties are (most) influenced by it?*

Together with the previous question, this question asks: is there a Galton's problem anyway? And if one wants to see it as Galton's asset, what is the nature of it? Which Modes properties are most affected by relations between groups? This is interesting in its own right, but also useful for the following question:

3) *If one or more of these group properties are influenced, then to what extent would the outcomes of the analyses of the previous chapter change when these influences are taken into account?*

Or in other words, when the analyses are re-done, but now with the relatedness factored in, are the conclusions still the same?

Methodology for this chapter

The general strategy for addressing the three research questions in this chapter will be as follows.

Question 1 asks via which relation type (trade, being inspired by, etc.) a transfer of Modes properties takes place, if at all. For this, data were collected on the types of interactions between the groups in the sample. A list of 17 relation types was devised. Additional variables were: who was the other actor in that particular relation, what was the strength of the relation and what the duration of the relation. This list was given as part of the general question list (see Appendix 1, question 8) to experts. From their answers, per relation type a matrix was created that described which groups interacted with each other and with what intensity of that relation. Those matrices were used to calculate Moran's I —a measure of autocorrelation— per relation type per Modes variable. Significant Moran's I's were taken to indicate that there is cultural transfer via that particular relation type for the particular Modes property. In principle, Moran's I does not measure transfer as such, but simply deviations from randomness. The assumption made here is that because the relation

types as used in this research are directional (e.g. 'split off from'), Moran's I can in this particular case be used as an indicator of transfer. If nothing else, it is a first and straightforward step in disentangling cultural relations between groups.

Question 2 asks which Modes properties are (most) affected by autocorrelation. Although the results of the first question already gave an indication, those results had at least two limitations. First, splitting out the autocorrelation per relation type may have resulted in splitting out a big effect in such small parts that it became undetectable; hence, it makes sense to combine all relation types into one relations matrix and see whether some variables that remained insignificant in first instance now become significant. Second, there is more than one way to research autocorrelation, and a few extra methods are introduced here: more types of relation matrices (also spatial ones) and the simple technique of using region as covariate.

Question 3 asks to what extent the outcomes of the analyses of the previous chapter were influenced by interrelatedness of groups. This will be done via a two-step process: first calculate corrected values ('instrumental variables') with the regional covariate, and subsequently re-do the analyses for most research questions of the previous chapter with those corrected values. The basic reasons to use this two-step process are, first, that the method is usable for all correction methods and for most statistical techniques, second, that the two-step process follows the established technique of partial correlations, and third, that it is, in general terms, a variant of the two-step process that is already in use for corrections for autocorrelation, as outlined in Eff & Dow (2009). However, this method cannot be applied to the relevant analyses with categorical data as done in the previous chapter, especially not the goodness-of-fit Fisher exact test, so the question regarding the frequency distribution of Doctrinal and Imagistic rituals will not be repeated in this chapter.

All in all, the methodology followed here is incremental; not only does this chapter build on what was found in the previous one and not only does this chapter provide a method that also will be used in the next, but also this chapter itself has an incremental methodological approach: For the first question, Moran's I is calculated and per variable is described to what extent it is affected by autocorrelation. That delivers weight matrices per relation type, which are used and combined for the second question. The methodology for the second question provides evidence which Modes variables need corrections anyway, and to what extent there is a match between the corrected 'instrumental' values (lowest AIC) and the various Moran's I's for the weight matrices and correction methods.

Per research question a more detailed Methodology section is given with further specifications of the methods used to address each question.

1. Via which relation types are the individual Modes properties transferred between groups?

This section investigates to what extent every individual Modes property is autocorrelated via a range of relation types between armed groups.

Methods

For investigating the presence of autocorrelation, the statistical technique of Moran's I was used. That technique requires a representation of the links between data points (armed groups) in the form of a weight matrix. Data for these links between groups were collected; an example of such explicitly recorded relations is:

Group	Relation type	Other actor	Strength of relation	Period start date	Period end date
Dozos	got leaders from	FNCI	4 = much/most	2002	2011
Dozos	got supplies from	MJP	3 = medium / several	2002	2011

For 3 of the 50 groups in the sample, relational data were absent; in one case because the expert did nor fill in these data, in two other cases because no relations with other groups in the sample were recorded, not even indirect relations. Those last cases represent genuine zeroes. In what follows, for the group for which no data was filled in, the cells were also set to 0, with as advantage that all data of that group could still be used in the analyses, but with the disadvantage that the estimated statistical parameters deviated slightly from their 'true' value. In total, there was relational data for 49 of the 50 groups in the sample.

There are 18 relation types (17 effectively, see further on), and 5 strengths of relation. For conceptual convenience (but no further bearing on this research), the relations are grouped in categories in the table below (table 4.1). The 'Strength of relation' categories are so straightforward that no further grouping was added.

Relation type		Strength of relation
Fission-fusion		1 = hardly/minor
- split off from	Working relation	2 = some
- got group member(s) from	- closely worked with	3 = medium / several
- gave birth to	- got supplies from	4 = much / most
- got leader(s) from	- did business with	5 = all / intensely
- merged with		
- successor of	Training relation	
- predecessor of	- copied tactics from	
- was a faction of	- trained by	
- encompasses faction of	- was mentor for	
Ideological	Competition	
- copied ideology from	- fought against	
- explicitly inspired by		

Table 4.1 — Relation types and strength of relations used in this research. The relation types are grouped into conceptual relation categories for ease of understanding.

For every Relation type, a Relation type weight matrix was created. The exact method of conversion of the relations data to the 'weight matrices' that are used in the calculation of Moran's I is described in Appendix 3a.

The 'standard' Moran's I was based on function `Moran.I()` from package `ape` version 3.4 (Paradis, Claude, and Strimmer 2004); the 'robust' Moran's I was based on function `moran.mc()` from package `spdep` version 0.5-92 (Bivand, Hauke, and Kossowski, Tomasz 2013; Bivand and Piras 2015) with the number of samples per calculation (`nsim`) of 1000.

The advantage of the non-robust method is that the direction of association (negative or positive) between the relation type and the variable is readily available in the calculation outcomes.

Per relation type matrix and per Modes variable, the p-value was calculated and where possible the direction of association. This was done for all imputed datafiles, the p-values were pooled into one p-value per relation type ⇔ variable combination.

Results

The relation type 'got supplies from' and 'predecessor of' had no records between groups in the sample, hence, had no influence on Modes properties. These two relation types are left out of the rest of the results.

When the p-values (a total of 240) were Holm adjusted, no combination of relation type and variable was significant. In fact, all p-values were 1, except for two relation types where the p-values were indeed smaller than 1 but still not significant: the relation type 'successor of' in combination with variable 'number of Doctrinal ideological properties' had p-values of .25 (standard Moran's I) and .26 (robust) respectively; the relation type 'fought against' in combination with variable 'religiosity of the explicit ideology' had a p-value of .81 for the robust Moran's I (perhaps somewhat saliently). Given that all other ±240 adjusted p-values were 1, these two relation type ⇔ variable combinations stood out and presented themselves as candidates for future research, despite not being significant.

It can be instructive to take a look at the unadjusted values:

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	Ilead	Snegx	RelSec
closely worked with	0.2	0.86	0.51	0.46	0.05	0.41	0.4	0.65	0.04	0.1	0.48	0.31	0.64	0.44	0.16	0.27
copied ideology from	0.11	0.3	0.33	0.6	0.11	0.02	0.06	0.7	0.51	0.21	0.63	0.25	0.07	0.44	0.4	0.33
copied tactics from	0.21	0.88	0.92	0.22	0	0.37	0.59	0.61	0.03	0.47	0.03	0.65	0.88	0.54	0.99	0.04
did business with	0.64	0.26	0.71	0.4	0.16	0.26	0.34	0.24	0.41	0.16	0.48	0.31	0.36	0.45	0.4	0.28
encompasses faction of	0.1	0.83	0.61	0.64	0.22	0.55	0.25	0.47	0.31	0.12	0.68	0.51	0.29	0.59	0.72	0.37
explicitly inspired by	0.13	0.95	0.61	0.53	0.03	0.83	0.96	0.6	0.07	0.75	0.24	0.84	0.94	0.57	0.59	0.36
fought against	0.65	0.09	0.13	0.68	0.15	0.04	0.33	0.01	0.4	0.07	0.81	0.37	0.92	0.21	0.32	0
gave birth to	0.41	0.38	0.53	0.57	0.02	0.29	0.78	0.43	0.8	0.75	0.33	0.93	0.75	0.75	0.92	0.69
got group member(s) from	0.15	0.33	0.44	0.41	0.04	0.09	0.2	0.61	0.34	0.17	0.66	0.5	0.2	0.52	0.77	0.41
got leader(s) from	0.29	0.33	0.02	0.69	0.11	0.18	0.14	0.45	0.39	0.46	0.93	0.95	0.63	0.45	0.75	0.49
split off from	0.25	0.35	0.37	0.57	0.03	0.08	0.15	0.5	0.75	0.67	0.49	0.85	0.38	0.72	0.8	0.6
successor of	0.36	0.33	0.47	0.52	0	0.14	0.59	0.55	0.61	0.88	0.26	0.9	0.67	0.71	0.88	0.34
trained by	0.04	0.91	0.82	0.39	0.11	0.48	0.69	0.62	0.02	0.45	0.18	0.12	0.35	0.45	0.34	0.15
was a faction of	0.41	0.38	0.53	0.58	0.02	0.29	0.78	0.43	0.8	0.75	0.33	0.93	0.75	0.75	0.92	0.69
was mentor for	0.04	0.96	0.4	0.51	0.12	0.47	0.33	0.71	0.06	0.69	0.08	0.4	0.55	0.33	0.33	0.2

Figure 4.1 — Autocorrelation per Relation type per Modes variable. The numbers are p-values of the robust Moran's I, pooled over 100 sampled and imputed datasets. Columns: Modes variables (same abbreviations as previous chapter), rows: Relation type. The p-values are not adjusted for multiple comparisons (but see text). The lighter the grey shade, the lower the p-value.

In figure 4.1, a matrix is presented of unadjusted p-values of the Moran's I test. As can be seen in the matrix, if there is a pattern then it would be at the Modes property side, not the Relation type side: many relation types are positively associated with the 'number of Doctrinal ideological properties' (Dideo). Most other variables do not show much sign of being influenced by many relation types, though the 'number of Doctrinal rituals' (Drits) and the 'number of social services' (socsv) may be good candidates for the shortlist; and 'group size' (grpsz), 'growth rate' (grwrt), 'having a social organization' (socor) and the 'religiosity of the explicit ideology' (RelSec) all have at least one significant relation (way of transfer). There

seems to be a tendency that the Imagistic variables have higher p-values, i.e. for the Imagistic Mode there is a hint of less significant cultural transfer, which is in accordance with the theory. Finally, the 'number of Shared negative experiences' (Snegx) seems to have the highest p-values, that is, is the least related to any type of interaction between groups. The most reasonable explanation seems to be that those experiences are not an element of culture —let alone a desirable one—, so no transfer is to be expected.

It also appears from the non-adjusted graph that no relation type influences many variables — there are no 'white rows', so to speak. Perhaps the effects of every individual relation type are too small, literally and figuratively too insignificant, to stand out, and perhaps another approach is required to see whether there is cultural transfer.

Presented in figure 4.1 are the p-values of the robust unadjusted Moran's I, but the non-robust unadjusted p-matrix was qualitatively the same; that is to say, no single relation type stood out as particularly related to the value of several variables, and the 'number of Doctrinal ideological properties' was also a variable that had overall the lowest p-values. The 'religiosity of the explicit ideology' had somewhat lower p-values than with the robust version. There were 9 relation type ⇔ variable combinations significant in the non-robust version, and 19 in the robust version.

It appeared from the non-robust analyses that all significant (unadjusted) combinations had a positive association, i.e., more of <a certain relation type> also meant <a higher value of the variable> for the significant combinations.

Conclusion

In conclusion, there is no specific pathway via which Modes properties seem to be transferred. There is nonetheless a clear suggestion that the group property

'number of Doctrinal ideological properties' is susceptible to many relation types, and possibly 'religiosity of the explicit ideology'.

Hence, for the next question, the relation types are put together into a combined 'relation' matrix and another broad-spectrum approach of interaction will be used, namely a spatial matrix, which can be interpreted as a proxy of many interactions. By combining relation types into one matrix, it is also easier to focus more on Modes properties, as the individual relation types no longer require full attention.

2. Which Modes properties are (most) influenced by the interrelatedness of groups?

This section investigates which of the Modes properties as used in the previous chapter are autocorrelated. Two extra weight matrix types are used, namely two types of geographical distance. Per Modes variable it is investigated whether Moran's I is significant.

Methods

Moran's I is used, and Moran's I is typically using a matrix that is a model of the strength of the relationship between sample points. There is more than one way to model this matrix. Hence, in this section the net is cast wide: four methods to model autocorrelation are used and reported about: two types of spatial weight matrix, and two types of relations matrix, which will be specified hereunder. Thereafter, Moran's I is calculated.

Spatial (proximity) weight matrices

To construct the spatial weight matrix, first the actual distances between all groups, one by one, to all other groups, one by one, was calculated. The locations of all groups were based on the 'Home base (town, region)' question, which was converted to estimated latitudes and longitudes using Google Maps. The distances were converted to weight matrices that were used in calculating Moran's I. The geographical weight matrices are thought to be a proxy for interaction between groups with the argument that the closer groups are to each other, the more (mutual) influence is assumed to take or have taken place. These weight matrices also enable to see the difference with the geographical cluster correction, which will be used in the next section of this chapter. Two types of proximity weight matrices were used. The first was linear, the second more asymptotic (nearby gets relatively more weight than far away).

a. Linear distance. The functional idea of this weight matrix is that influence of one group on another linearly decreases with distance. Compared to the asymptotic matrix ((b) below), it assigns more weight to long distance relations, and as described in the introduction, modern armed groups do have such long-distance relations. To calculate the matrix, the latitudes and longitudes of the home base of the group were converted to distances via the `distVincentyEllipsoid()` function in the `geosphere` package (Hijmans 2015). The distances were standardized to unity by subtracting all distances from the longest distance thus calculated, and dividing that number by the highest resulting number in the matrix. This type of matrix gave the highest absolute numbers (though still between 0 and 1) in the matrix compared to all other two matrices used in this study. All cells except the diagonal had a value > 0.
b. Asymptotic distance. The functional idea is that the influence of more distant groups exponentially decreases, and that by far the biggest influences on any single group are exerted by their direct neighbours. This might have merit too: whereas long-distance connections are often of one type (either 'trained by' or

'inspired by', etc.), nearby relations can be of several types (all ones just mentioned, but also 'traded with' etc. at the same time) and belong to the most influential ones ('split off from', 'got group members from', etc.). Hence, there is an argument to be made that this type of proximity matrix is a better proxy for interaction between groups than the linear matrix. For this weight matrix, the actual distances between groups were first calculated based on latitude and longitude, as above. Thereafter, to calculate this asymptotic distance weight matrix, the formula was used as specified by Eff (2004, 4): the distances were converted to a weight via $w_{ij} = (1+0.001*d_{ij})^{-2}$ and $w_{ii}=0$, whereby w_{ij} = the weight between group i and j, and d_{ij} = the distance between group i and j in km. Different from the previous method based on linear distance, here the unit *does* matter because it is not linear and not divided by its own unit; the distances used here was kilometres. All cells except the diagonal had a value > 0.

Relations weight matrices

The second general type of weight matrix that will be used to model autocorrelation is based on the actual recorded interactions between groups. Again, this research uses two (sub)types: a relatively straightforward combination of all relation type matrices as used for the previous question, labelled 'direct relations' and a second type which adds indirect relations between groups to these as well, labelled 'all relations'.

a. *Direct relations*. The question here is how to combine different Relation types into one matrix. Specifically, the issue is to what extent different Relation types should make different relative contributions to the overall strength of the relation between each group. For instance, it is plausible that getting leaders from another group is more important for structuring the group —including transfer of Modes properties— than, say, getting supplies from another group. Hence, it is plausible that the first type of relation in this example would make a numerically higher

relative contribution to the overall matrix than the second. Following this line of thought, every Relation type got a number on a five-point Likert-scale, which was interpreted linearly (see table in Appendix 3b; the number right at the start of the 'Relative contribution…' column in the table below). Those weight scores may be debateable, but the least that can be done is that they are made explicit here with a brief rationale (see same table in Appendix 3b, further text after the dash '—' in the 'Relative contribution…' column). Some assumptions were made for situations like when there was more than one period per relation type per group, or when assessments of more than one expert were different, or when a relation type was bi-diretional (trade) versus one-directional (inspired by), etc. (see again Appendix 3b for the details).

With these assumptions in place, the overall 'direct relations' matrix could be established. Summarizing, when calculating the value for a cell in the overall Relations weight matrix, the formula was:

Cell value = sum of (((relation strength between 2 groups) / maximum of relation strength) * (relation type weight / sum of all relation type weights))

b. *All relations*, including indirect relations. A second relations matrix was constructed, that also included the most important *in*direct relations between groups. The idea is roughly this: suppose that group A got leaders from group B, and group B was trained by group C, then an indirect cultural transfer can be suspected from C —via B— to A. That could be very relevant for this research: in the sample data, 440 of the 520 relation records (±85%) did not represent direct links between groups, but the ±85% did contain several indirect links. Given that the direct links were only given in 15% of the records, it seemed desirable to use as much info as possible —and more importantly, it should reflect reality as well—, hence an algorithm was developed in this thesis to incorporate the indirect links into a relations weight matrix as well. With extra assumptions about the influence

of uni- and bi-directional types of relations and about which type of indirect links (actors) to include (see Appendix 3c), the 'All Relations' matrix was created.

Calculating autocorrelation statistics

With the two proximity matrices and two relations matrices in place, Moran's I was calculated; for the methods of Moran's I, see the Methodology section of the previous research (sub)question (page 176).

Results

For all core Modes variables, two or three had a significant value for Moran's I (see table 4.2). As it appears, two variables have a strong autocorrelation (positive, not shown here), namely the 'Number of Doctrinal ideological properties', and the 'Religiosity of the explicit ideology'. The 'Number of Doctrinal rituals (scale)' was significant before Holm adjustment for both geographical proximity ('Geo distance') relations. In general, the strongest autocorrelation seems to occur with geographical proximity, not with actual links between groups (the 'Relations' columns in table 4.2). All four weight matrices had fairly comparable results, suggesting that the autocorrelation found for the two / three indicated variables is real and meaningful. Also the maps that plot the different values per Modes variable for the three indicated variables (see figure 4.2 a-c) suggest there are regional patterns, and illustrate the structure of the non-random distribution over the world.

	Geo distance 1		Geo distance 2		Relations direct		Relations all	
Variable	standard	robust	standard	robust	standard	robust	standard	robust
Group size	1	1	1	1	1	1	1	1
Group size ÷ troop size	1	1	1	1	1	1	1	1
Growth rate	1	1	1	.88	1	1	1	1
Nr. of hierarch. levels	1	1	1	1	1	1	1	1
Nr. Doc. ideol. props.	**.00028**	**0.038**	**~0**	**.0017**	0.054	0.053	**.037**	**.032**
Nr. Doc. rituals (scale)	.17	.30	.51	.13	0.89	1	1	1
Nr. Doc. rituals (binary)	1	1	1	.60	1	1	1	1
Doc. leadership	1	1	1	1	1	1	1	1
Nr. of soc. services	1	1	1	1	1	1	1	1
Installs law (y/n)	1	1	1	1	1	1	1	1
Social organization (y/n)	1	1	1	1	1	1	1	1
Nr. Img. rituals (scale)	1	1	1	1	1	1	1	1
Nr. Img. rituals (binary)	1	1	1	1	1	1	1	1
Img. leadership	1	1	1	1	1	1	1	1
Nr. shared neg. exp.	1	1	1	1	1	1	1	1
Religiosity of ideology	**~0**	**0.033**	**0.00019**	**.025**	0.31	1	**.040**	1

Table 4.2 — P-values for Moran's I for all Modes variables, Holm adjusted for multiple comparisons per column / method. Significant values are in bold.

As can be seen in Figure 4.2a, there is a strong suggestion of a geographic distribution of the number of Doctrinal ideological properties: very few per group in West Africa and the Sahel, relatively many in East Congo and Middle Eastern groups, and mixed in Indochina and the Himalaya.

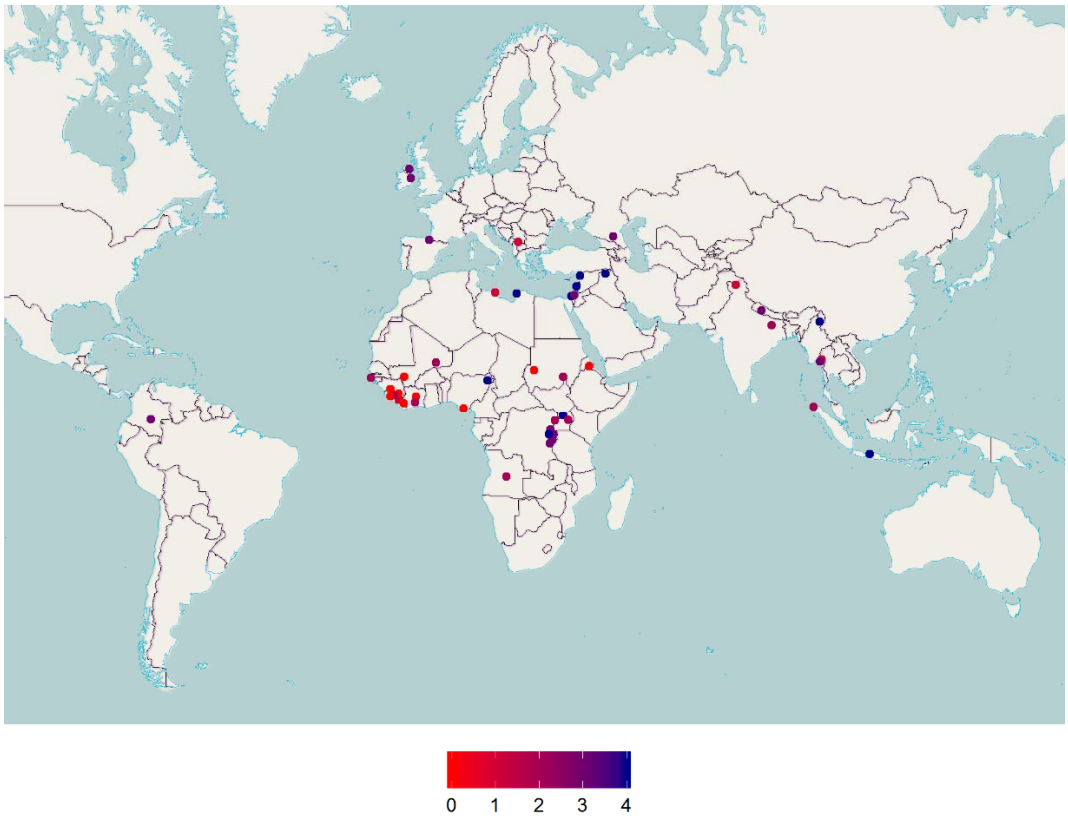


Figure 4.2a — The geographic distribution of the number of Doctrinal ideological properties

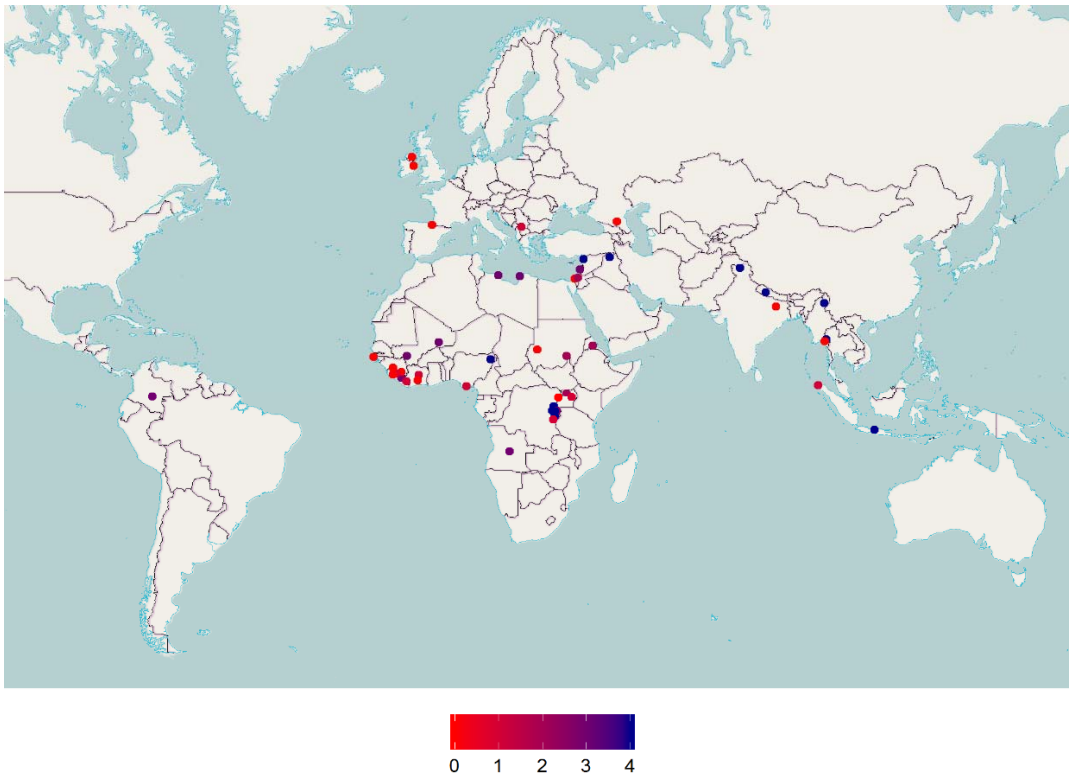


Figure 4.2b — The geographic distribution of the number of Doctrinal rituals per group

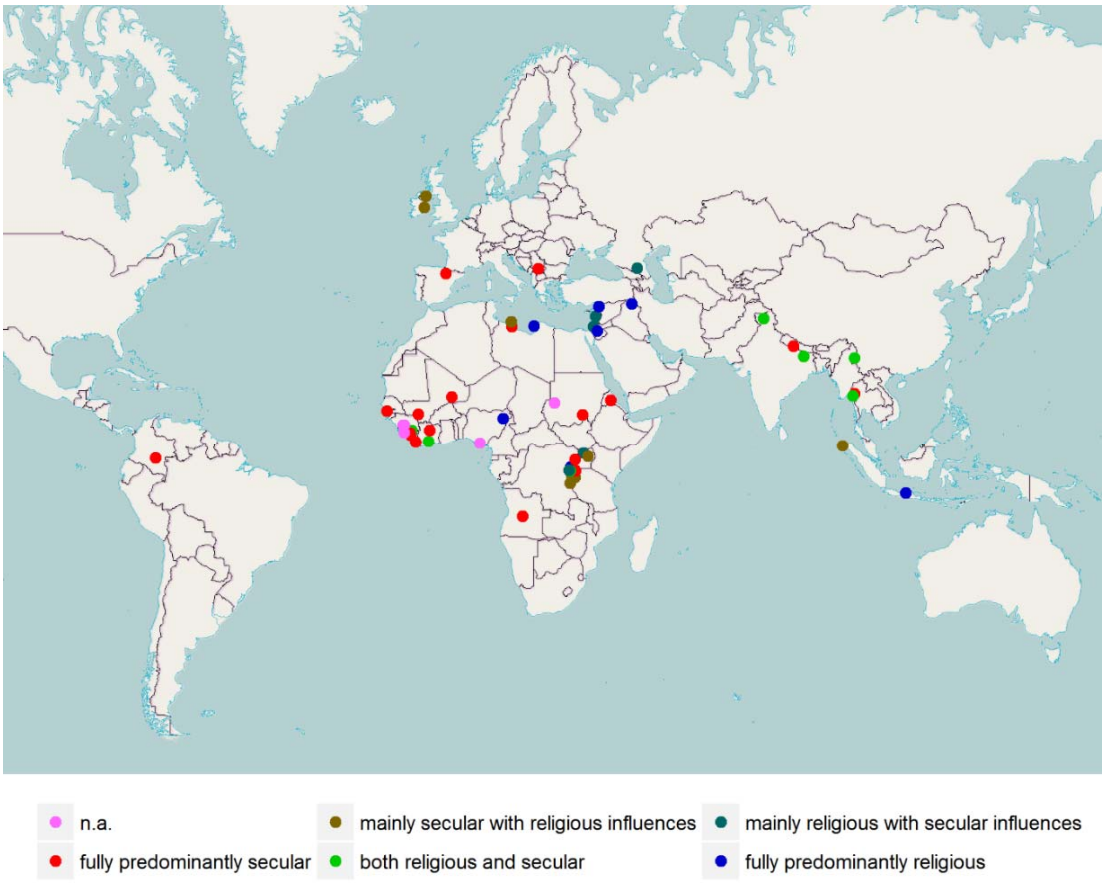


Figure 4.2c — The geographic distribution of the Religiosity of explicit ideology

There also seems to be a geographical distribution of the number of Doctrinal rituals per group (fig. 4.2b); especially in West Africa there is a cluster of groups with very few of these rituals, and much higher numbers of Doctrinal rituals per group in the Middle East. Finally, there is also a suggestion of a geographic distribution of the religiosity of the explicit ideology (fig. 4.2c): most groups in West Africa and the Sahel either have no explicit ideology — a phenomenon not found elsewhere in the world in the sample— or are fully or predominantly secular. Conversely, most groups in the Middle East (with exception of the two groups that fought in the brief 2011 revolution in Libya) are fully or predominantly religious. Most groups in East Congo are mainly secular with religious influences; and many groups in the Himalaya and Indochina are both religious and secular.

Conclusion

All in all, the Modes variables seem by and large not strongly affected by autocorrelation (Galton's problem). Using Moran's I to assess the presence of autocorrelations, the results were rather consistent between the different weight matrices. The 'number of Doctrinal ideological properties' stood out as the most autocorrelated, closely followed by the 'religiosity of the explicit ideology' for most of the weight matrices. Depending on the interpretation of the Holm corrections, there is perhaps a suggestion that the 'number of Doctrinal rituals (scale)' is also autocorrelated. There was a tendency for the distance-based matrices (geography-based matrices) to have more significant Moran's I than the relations-based matrices. Also, plotting the values of the 'number of Doctrinal ideological properties', the 'religiosity of the explicit ideology' and the 'number of Doctrinal rituals (scale)' on the world map, the strong impression emerges that there are regional patterns. This suggests that regions as covariates may be a good approximation to correct for autocorrelation. Hence, in what follows, this will be the approach.

3. To what extent were the outcomes of the analyses in the previous chapter influenced by interrelatedness of groups?

As indicated in the introduction of this chapter, two questions of the previous chapter could be answered taking autocorrelation into account. Using the original question numbers of the previous chapter here, these questions are:

2. Do Modes variables relate to each other as predicted?

a) Is there a significant correlation between all Modes variables?

b) Is the direction of relations between Modes properties as predicted?

c) Are there two clusters of variables?

3. Are there two attractor states?

a. Is there a bi-modal distribution for continuous Modes variables?

c. Do groups themselves cluster into two clusters?

Methods

All questions regarding whether the Modes variables relate to each other as predicted (2a, b and c) are correlation based. Correlations can be corrected for a third variable, a covariate, by creating partial correlations. This covariate will be world region here, labelled 'geographical cluster' or 'geo cluster'. An extension of the technique of creating partial correlations —using the residuals after a regression on the mean— will also be used for the research question whether there are two attractor states as well.

Do Modes variables relate to each other as predicted? Creating the Regional cluster covariate

A standard way to 'correct for' any variable in statistical research is by simply collecting data for that variable and use that variable as a covariate in one or other statistical technique. This can also be applied to correlations. One standard way to calculate a correlation of x and y, corrected for z, is via a partial correlation. Here, the 'z' is the region. The partial correlation -between x and y, corrected for the influence of z- can be calculated by taking the `correlation of (the residuals of (a linear regression of (x on z)) with the residuals of (a linear regression of (y on z)))`.

As shown above, groups within one geographic region are more similar to each other regarding some Modes properties than between geographic regions. It makes sense to use geographical cluster as corrector for autocorrelation. There are advantages and disadvantages to this method. A great benefit of this clustering method is its intuitiveness: groups closer to each other = more contact = more autocorrelation. Another benefit is its simplicity: just assign a group to a category, and much of the specification work is done. Finally, its versatility: the regional cluster is a simple categorical variable that can be used in many types of statistical techniques as covariate. There are also disadvantages. First, this is a bit of a crude method; it is in the modern day and age not realistic to assume that there is no contact between groups from different clusters. A counterargument to this is that it is still plausible to assume that nearby groups have on average more in common with each other than distant groups, so it could be possible that a sufficient degree of autocorrelation is captured with a regional cluster. Second, other categorizations could have been possible, e.g. the type of ideology (e.g. Islam, Marxist, n.a., etc.) but in this study, no data was collected for that, whereas data was collected for the 'home base'. Hence, some form of geographical clustering seemed prudent. Third, borders are arbitrary. Here a geographical clustering was made that tried to balance three to four factors: proximity, the type of landscape, the number of groups per cluster, and perhaps the suspected cultural similarity as well (e.g., one could suspect that many groups in the Middle East are Islamic). The resulting clusters are presented in figure 4.3 and table 4.3. Although the clusters presented here might have a subjective subdivision, in a practical sense they resemble well known regions of the world ('South America', 'Europe', 'Middle East', etc.). Thus, for all practical purposes, it seems reasonable to use the geo-clusters as devised here.

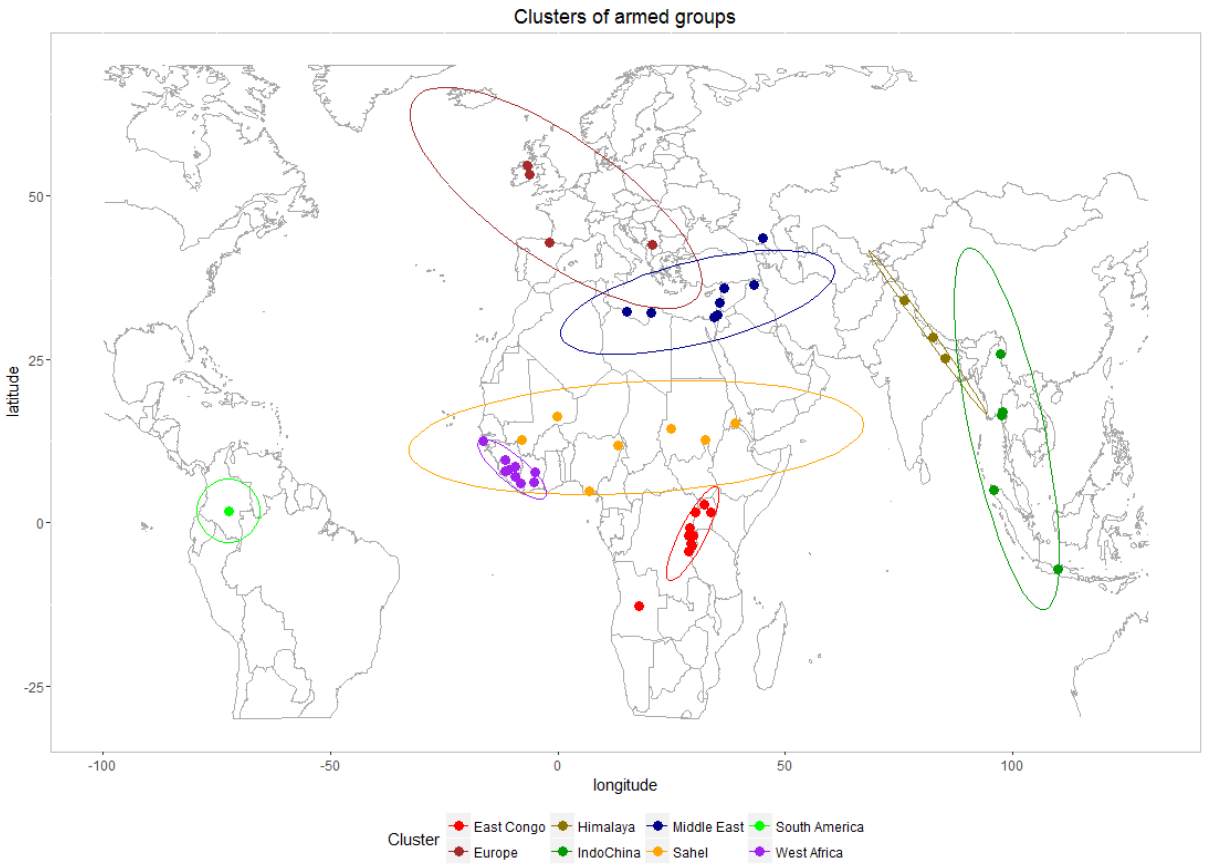


Figure 4.3 — Geo-clusters of groups as used in this study; the circles are 95% confidence intervals as calculated by the package `mclust` (Fraley et al. 2012).

Geo-clusters of groups	# Groups
WA – West Africa	11
EC – East Congo	10
SH – Sahel	7
ER – Europe	4
ME – Middle East	9
IC – IndoChina	5
HI – Himalaya	3
LA – Latin America	1

Table 4.3 — The geo-clusters and cluster size as used in this research

Are there two attractor states? Creating 'instrumental variables'

Dow and Eff have done much work to describe the size of Galton's problem in anthropological fieldwork (e.g. Eff 2004; Dow and Eff 2008; Dow 2008; Dow and Eff 2009), and to find solutions (Eff and Dow 2009). They came up with a two-step model to be able to cope with that problem in statistical tests: First the IV and DV are multiplied by a weight matrix that represent autocorrelations, to create what they call 'instrumental variables'; these instrumental variables can be interpreted as 'corrected' values. In a second step, the instrumental variables are used in the various statistical analyses as required, which need not be regressions only — a clear advantage of this method. This resembles the standard technique for a partial correlation, based on regressing residuals as specified above. This is essentially also a two-step process, because first 'instrumental' variables are created, which are the residuals of the regressions on the mean with the covariate to be corrected for, and second the analysis is done (the correlation). However, the analysis does not *need* to be a correlation; it can also be, say, a modality test. That would overcome a disadvantage of Eff and Dow's (2009) two-step method, namely that a combination of an IV and one or more DVs is always required to do the analyses.

The intuition behind this way of reducing autocorrelation is as follows: suppose that in a certain region groups influence each other or have a common ancestor, such that they all have more high-frequent rituals because of this influence. To model the 'true' values for every group without autocorrelation, one could subtract that extra that is added to the number of high-frequency rituals in that region from the value for each individual group in that particular region. In doing so, all numbers of high-frequency rituals are set to the value they would have had without this 'bonus' caused by mutual relations between groups. The general model is: 'real' variable value = observed variable value – (cluster mean – grand mean). If the cluster mean is higher than the grand mean, there is apparently an extra 'bonus' for a particular armed

group as a result of belonging to that regional cluster. When that difference (cluster mean – grand mean) is subtracted from the observed value, the value is 'corrected' for that; if the group mean is lower than the grand mean, there is apparently a 'suppressor' for belonging to that cluster, after which a constant is added to the observed case value, because the cluster mean is lower than the grand mean, i.e. there will be a double subtraction = addition to the observed value. In this way, the 'real' or '*instrumental*' values can be obtained that can be used in subsequent analyses if desired so; in the example above, a correlation. Because of the usage and availability of residual variance in the first step —the creation of the instrumental variable—, the AIC can be calculated as well. The AIC describes the amount of residual variance after a statistical model (typically a regression) has been fit, with penalty for the number of parameters. The lower the AIC, the better the model; the 'best' model (least wrong) is the model with the lowest AIC (Burnham, Anderson, and Huyvaert 2011). For the current purposes, if the different cluster means capture a lot of total variance, then the AIC is lower. That means that a lower AIC with the corrector (geo-cluster) as covariate instead of a constant indicates that variance has been taken away ('explained') by the mere fact of being in a geo-cluster, hence, after subtraction of that variance, it also means that the models with the lowest AIC are the most 'corrected' for this.

The benefits of the geo-cluster method are its simplicity, intuitiveness, its resemblance with the accepted technique of calculating partial correlations (and for the next research question, the Spearman's correlations exactly *are* these partial correlations when this method is used). Most importantly, and an improvement over the methods hitherto used in the literature, with the corrected 'real' values just about every statistical technique can be used in subsequent analyses, not just linear regressions.

Instrumental variables were created with refitted values for all variables that were used in the previous chapter and that were numerical (i.e., all variables in the

correlation matrix, except 'Outcome of the conflict'). Per Modes variable, new values were calculated as

```
mean(variable) + residuals(glm(mean(variable)~geocluster)).
```

The `glm()` function —the Generalized Linear Model (GLM)— can be used with other distributions than just the Normal distribution, and the requirement of equality or constancy of variances is also relaxed for the GLM. This function also provides the log-likelihood and the number of coefficients, from which the AIC was calculated as: -2*log-likelihood + 2*(nr. of coefficients+1). The AIC of every variable is compared with the uncorrected base version and a lower AIC is interpreted to mean that the model fit of values with correction for autocorrelation is better than without; hence, there is not only an improved model (by including the region as covariate) for analysing the variables, but it is also an indication that there is meaningful autocorrelation in those cases.

For every Modes variable, instrumental variables were calculated. As can be seen in table 4.4 (and compare with table 4.2), there is a great resemblance between which variables are indicated as autocorrelated by Moran's I and the lowest AICs after geo-cluster corrections. Two variables —the 'number of Doctrinal ideological properties' and the 'Religiosity of the explicit ideology'— had a significant Moran's I for most weight matrices and world maps that also suggested patterns (fig. 4.2a and c), and they indeed had a lower AIC after correction with geo-cluster. To a lesser extent but still noteworthy, although the 'number of Doctrinal rituals (scale)' did not have significant Moran's I after Holm corrections, the p-values suggested there might be something going on, and likewise the map (figure 4.2b); also this variable had a lower AIC after geo-cluster correction. Only for the 'number of Imagistic rituals' there was no sign of autocorrelation whereas the AIC was lower, but that was only barely so. All in all, the impression that the geo-cluster correction is, at least in this research, a reasonably good proxy to capture autocorrelation and correct for it is reconfirmed.

variable	base glm	glm geo cluster
Group size	1144.43	1152.52
Group size ÷ troop size	324.93	335.18
Growth rate	503.93	509.47
# hierarch levels	246.08	255.98
# Doc ideo props	182.61	**170.34**
# Doc rituals (scale)	192.3	**187**
# Doc rituals (binary)	67.86	67.88
Doc leadership	70.93	73.62
# soc. services	231.67	238.3
Installs law (y/n)	75.47	83.87
Soc. organization (y/n)	72.04	76
# Img rituals (scale)	157.23	**156.62**
# Img rituals (binary)	75.85	85.81
Img leadership	50.9	54.54
# shared neg. exp.	116.22	122.02
Religiosity of ideology	192.11	**181.1**

Table 4.4 — AIC values of Modes variables regressed on their mean, without ('base glm' column) and with ('glm geo cluster' column) regional covariate. Variable names in bold are the ones that had significant Moran's I, AICs of the 'geo cluster' correction in bold have a lower AIC than without correction.

With the instrumental variables in place, there are two viewpoints regarding how to redo the analyses:

(1) With all variables corrected.

The idea is to apply a correction to all variables, regardless whether they appeared to be autocorrelated or not. In that way, the same arithmetic is applied

to all variables — making them potentially more comparable. In addition, those variables that have no autocorrelation are not affected in an important way by the correction anyway; they were not affected by the geo-cluster in the first place, hence, their variation will not be affected by corrections. Applying corrections to all variables makes sure that Galton's problem is mitigated for all variables, though perhaps at the cost of more statistical noise.

(2) With only the autocorrelated variables corrected.

The idea is to use all variables in the analyses, but to apply corrections for autocorrelation only when the variables appeared to be autocorrelated in the first place. For most variables, the AIC was higher with correction than without (see table 4.4), indicating that the model with correction was a less precise model. However, for four variables the AIC was lower with correction; these variables are the ones when analyses are redone with only the autocorrelated variables corrected: the 'number of Doctrinal ideological properties' (Dideo), the 'number of Doctrinal rituals (scale)' (Drits), the 'number of Imagistic rituals (scale)' (Irits) and the 'religiosity of the explicit ideology' (RelSec). Of course, when corrected values are used for these variables only, one can expect changes in the analyses for these variables only.

Given that for both approaches there is an argument, both will be used in what follows. The first will be labelled 'all [var(iable)s]', and the second 'autocor[related] [var(iable)s]' — depending on space and situation.

Results

2. Do Modes variables relate to each other as predicted?

a) Is there a significant correlation between all Modes variables?

As can be seen in table 4.5, the analyses with the instrumental variables (based on the regional covariate) performed slightly worse than the base situation.

	base	geo-cluster	
vars. refitted →	n.a.	all	autocor.
# corrs. signif.	18	15	14
# signif. w/Holm	4	4	4
# now signif.	-	3	0
# no longer signif.	-	6	4
min. diff in ρ	-	-.26	-.19
max. diff in ρ	-	.20	.19
# match pred.	60:89	58:89	**63:89**
P(match pred.)	$3.05*10^{-4}$	$1.39*10^{-3}$	$\mathbf{2.16*10^{-5}}$

Table 4.5 — The effect of geo-cluster corrections on correlations between Modes variables and the match with predictions. The column with 'base' is the base analysis without corrections, as presented in the previous chapter. All grey values indicate a deterioration compared to the base model. The bold values represent an improvement over the base model. For the total increase in the number of significant correlations, the absolute decrease in significant correlations ('# no longer signif') was subtracted from the increase ('# now signif').

Both for the situation in which all variables were corrected, as for the situation in which only the autocorrelated variables were corrected, there were less significant correlations without Holm corrections (see table 4.5 and figure 4.4; only 'all vars' shown).

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	llead	Snegx	RelSec
grpsz		0.3	0.26	0.3	0.14	0.26	0.11	-0.16	0.64	0.39	0.31	0.01	-0.04	-0.23	0.19	0.01
gsdts	0.3		0.08	0.1	0.09	0.05	-0.18	-0.1	0.2	-0.03	0.18	0.02	0.01	-0.01	-0.09	0.08
grwrt	0.26	0.08		-0.11	-0.05	0.07	0.13	-0.1	0.2	0.11	-0.07	-0.14	-0.1	-0.21	0.28	-0.27
hrchL	0.3	0.1	-0.11		0.18	0.19	0.09	-0.05	0.37	0.16	0.54	0.15	0.08	-0.19	0.26	0
Dideo	0.14	0.09	-0.05	0.18		0.26	-0.02	0.1	0.34	0.25	0.23	0.19	0.13	-0.15	-0.03	0.57
Drits	0.26	0.05	0.07	0.19	0.26			-0.04	0.46	0.37	0.34	0.16	0.13	-0.07	-0.05	0.26
Dritb	0.11	-0.18	0.13	0.09	-0.02			-0.1	0.18	0.15	0.22	0.28	0.22	-0.1	-0.02	0
Dlead	-0.16	-0.1	-0.1	-0.05	0.1	-0.04	-0.1		-0.1	-0.02	-0.07	-0.18	-0.15	-0.31	0.12	0.15
socsv	0.64	0.2	0.2	0.37	0.34	0.46	0.18	-0.1		0.57	0.58	0.07	0.06	-0.24	0.21	0.18
law	0.39	-0.03	0.11	0.16	0.25	0.37	0.15	-0.02	0.57		0.16	-0.02	0.09	-0.22	0.06	0.22
socor	0.31	0.18	-0.07	0.54	0.23	0.34	0.22	-0.07	0.58	0.16		0.16	0.07	-0.29	0.08	-0.03
Irits	0.01	0.02	-0.14	0.15	0.19	0.16	0.28	-0.18	0.07	-0.02	0.16			0.17	-0.02	0.09
Iritb	-0.04	0.01	-0.1	0.08	0.13	0.13	0.22	-0.15	0.06	0.09	0.07			0.2	0	0.09
llead	-0.23	-0.01	-0.21	-0.19	-0.15	-0.07	-0.1	-0.31	-0.24	-0.22	-0.29	0.17	0.2		-0.17	-0.02
Snegx	0.19	-0.09	0.28	0.26	-0.03	-0.05	-0.02	0.12	0.21	0.06	0.08	-0.02	0	-0.17		-0.2
RelSec	0.01	0.08	-0.27	0	0.57	0.26	0	0.15	0.18	0.22	-0.03	0.09	0.09	-0.02	-0.2	

Figure 4.4 — Correlation coefficients when all Modes variables are corrected with the 'geo-cluster' covariate. Upper-right: differences in significance with the base scenario; green cells indicate variable combinations that now have become significant, red cells indicate correlations that are no longer significant. Lower left: white cells indicate significant correlations, grey cells non-significant correlations. P-values are not Holm-adjusted.

Somewhat as a logical consequence, the number of significant correlations after Holm adjustments was not higher in both correction situations (see table 4.5 and figure 4.5).

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	Ilead	Snegx	RelSec
grpsz		0.3	0.26	0.3	0.14	0.26	0.11	-0.16	0.64	0.39	0.31	0.01	-0.04	-0.23	0.19	0.01
gsdts	0.3		0.08	0.1	0.09	0.05	-0.18	-0.1	0.2	-0.03	0.18	0.02	0.01	-0.01	-0.09	0.08
grwrt	0.26	0.08		-0.11	-0.05	0.07	0.13	-0.1	0.2	0.11	-0.07	-0.14	-0.1	-0.21	0.28	-0.27
hrchL	0.3	0.1	-0.11		0.18	0.19	0.09	-0.05	0.37	0.16	0.54	0.15	0.08	-0.19	0.26	0
Dideo	0.14	0.09	-0.05	0.18		0.26	-0.02	0.1	0.34	0.25	0.23	0.19	0.13	-0.15	-0.03	0.57
Drits	0.26	0.05	0.07	0.19	0.26			-0.04	0.46	0.37	0.34	0.16	0.13	-0.07	-0.05	0.26
Dritb	0.11	-0.18	0.13	0.09	-0.02			-0.1	0.18	0.15	0.22	0.28	0.22	-0.1	-0.02	0
Dlead	-0.16	-0.1	-0.1	-0.05	0.1	-0.04	-0.1		-0.1	-0.02	-0.07	-0.18	-0.15	-0.31	0.12	0.15
socsv	0.64	0.2	0.2	0.37	0.34	0.46	0.18	-0.1		0.57	0.58	0.07	0.06	-0.24	0.21	0.18
law	0.39	-0.03	0.11	0.16	0.25	0.37	0.15	-0.02	0.57		0.16	-0.02	0.09	-0.22	0.06	0.22
socor	0.31	0.18	-0.07	0.54	0.23	0.34	0.22	-0.07	0.58	0.16		0.16	0.07	-0.29	0.08	-0.03
Irits	0.01	0.02	-0.14	0.15	0.19	0.16	0.28	-0.18	0.07	-0.02	0.16			0.17	-0.02	0.09
Iritb	-0.04	0.01	-0.1	0.08	0.13	0.13	0.22	-0.15	0.06	0.09	0.07			0.2	0	0.09
Ilead	-0.23	-0.01	-0.21	-0.19	-0.15	-0.07	-0.1	-0.31	-0.24	-0.22	-0.29	0.17	0.2		-0.17	-0.02
Snegx	0.19	-0.09	0.28	0.26	-0.03	-0.05	-0.02	0.12	0.21	0.06	0.08	-0.02	0	-0.17		-0.2
RelSec	0.01	0.08	-0.27	0	0.57	0.26	0	0.15	0.18	0.22	-0.03	0.09	0.09	-0.02	-0.2	

Figure 4.5 — Holm adjusted correlation matrix for all variables corrected with the geo-cluster covariate. Both halves are each other's mirror image.

All in all, corrections for Galton's problem did not alter the conclusions drawn in the previous chapter: most variable pairs do not have significant correlations.

b) Is the direction of relations between Modes properties as predicted?

Three extra correlations were in the direction of the prediction when all variables were corrected, two fewer correlations when only the autocorrelated

variables were corrected (shown in figure 4.6: all vars). There is no major shift in tendencies here.

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	Ilead
grpsz		0.3	0.26	0.3	0.14	0.26	0.11	-0.16	0.64	0.39	0.31	0.01	-0.04	-0.23
gsdts	0.3		0.08	0.1	0.09	0.05	-0.18	-0.1	0.2	-0.03	0.18	0.02	0.01	-0.01
grwrt	0.26	0.08		-0.11	-0.05	0.07	0.13	-0.1	0.2	0.11	-0.07	-0.14	-0.1	-0.21
hrchL	0.3	0.1	-0.11		0.18	0.19	0.09	-0.05	0.37	0.16	0.54	0.15	0.08	-0.19
Dideo	0.14	0.09	-0.05	0.18		0.26	-0.02	0.1	0.34	0.25	0.23	0.19	0.13	-0.15
Drits	0.26	0.05	0.07	0.19	0.26			-0.04	0.46	0.37	0.34	0.16	0.13	-0.07
Dritb	0.11	-0.18	0.13	0.09	-0.02			-0.1	0.18	0.15	0.22	0.28	0.22	-0.1
Dlead	-0.16	-0.1	-0.1	-0.05	0.1	-0.04	-0.1		-0.1	-0.02	-0.07	-0.18	-0.15	-0.31
socsv	0.64	0.2	0.2	0.37	0.34	0.46	0.18	-0.1		0.57	0.58	0.07	0.06	-0.24
law	0.39	-0.03	0.11	0.16	0.25	0.37	0.15	-0.02	0.57		0.16	-0.02	0.09	-0.22
socor	0.31	0.18	-0.07	0.54	0.23	0.34	0.22	-0.07	0.58	0.16		0.16	0.07	-0.29
Irits	0.01	0.02	-0.14	0.15	0.19	0.16	0.28	-0.18	0.07	-0.02	0.16			0.17
Iritb	-0.04	0.01	-0.1	0.08	0.13	0.13	0.22	-0.15	0.06	0.09	0.07			0.2
Ilead	-0.23	-0.01	-0.21	-0.19	-0.15	-0.07	-0.1	-0.31	-0.24	-0.22	-0.29	0.17	0.2	

Figure 4.6 — The match of predicted with found correlation directions after all variables were corrected for autocorrelation. Grey cells indicate no match, white cells indicate a match. The numbers are Spearman's correlation coefficient. Both halves are each other's mirror image.

All in all, the conclusions of the previous chapter regarding the direction of the correlation remain intact: on the whole there was a match, so much so that the odds are very low that this occurred purely by chance. However, the direction of the correlations with the two Imagistic ritual variables tended to mismatch with the prediction, quite like in the uncorrected situation; also the direction of the correlations

with the Doctrinal leadership variable tended to mismatch with the prediction, but now even more so than in the uncorrected situation. Whether this is very meaningful for non-significant correlations close to zero remains to be seen.

c) Are there two clusters of variables?

Whether there was clustering of variables was assessed again both with a PCA and with an MDS. Like in the previous chapter, the Spearman's correlation matrices were used as basis for the PCA and MDS; because these matrices are based on corrected values in this chapter, the PCAs and MDSs are automatically corrected as well.

PCA

As in the previous chapter, PCA statistics were calculated based on the 9 'core' variables: the KMO score (higher is better), Bartlett's test (which is a p-value that indicates the significance value that the correlations are different from 0, which is a requirement), the determinant (which should be > 0.00001, indicating sufficient variability in correlations, hence PCA makes sense), the percentage of large residuals (smaller is better, and if ≥50% then there is probably cause for concern), the square root of the mean of the squared residuals (which should be <=0.08 to indicate that the number of factors is appropriate for a good model fit), the off-diagonal model fit (which should be >= 0.9 to indicate a sufficiently good model fit), and the [general] model fit (id.). Last but not least, the Kaiser criterion is an indication of how many factors to retain; for the best support of the Modes theory this should be 1, although there is a case to be made for 2 at most as well (see previous chapter).

All PCAs had a Kaiser criterion of 3.

correc-tor	**var. type**	**PCA type**	**KMO score**	**Bartlett test**	**determi-nant**	**% large resids**	√(resids^2)	**model fit off diag**	**model fit**
none	all vars	2_none	0.72	1.30E-08	0.099	67	0.11	0.85	0.78
none	all vars	2_oblimin	0.72	1.30E-08	0.099	78	0.12	0.85	0.78
none	all vars	3_none	0.72	1.30E-08	0.099	58	0.1	0.87	0.86
none	all vars	3_oblimin	0.72	1.30E-08	0.099	75	0.13	0.87	0.86
none	all vars	4_none	0.72	1.30E-08	0.099	56	0.095	0.89	0.9
none	all vars	4_oblimin	0.72	1.30E-08	0.099	89	0.16	0.89	0.9
none	all vars	5_none	0.72	1.30E-08	0.099	39	0.081	0.92	0.94
none	all vars	5_oblimin	0.72	1.30E-08	0.099	89	0.17	0.92	0.94
cluster	all vars	2_none	0.68	9.62E-08	0.11	67	0.12	0.82	0.75
cluster	all vars	2_oblimin	0.68	9.62E-08	0.11	67	0.12	0.82	0.75
cluster	all vars	3_none	0.68	9.62E-08	0.11	58	0.11	0.85	0.84
cluster	all vars	3_oblimin	0.68	9.62E-08	0.11	61	0.11	85	0.84
cluster	all vars	4_none	0.68	9.62E-08	0.11	61	0.098	0.87	0.9
cluster	all vars	4_oblimin	0.68	9.62E-08	0.11	72	0.14	0.87	0.9
cluster	all vars	5_none	0.68	9.62E-08	0.11	64	0.086	0.9	0.93
cluster	all vars	5_oblimin	0.68	9.62E-08	0.11	86	0.16	0.9	0.93
cluster	autocor. vars	2_none	0.7	9.87E-08	0.11	75	0.12	0.8	0.74
cluster	autocor. vars	2_oblimin	0.7	9.87E-08	0.11	78	0.13	0.8	0.74
cluster	autocor. vars	3_none	0.7	9.87E-08	0.11	69	0.1	0.86	0.84
cluster	autocor. vars	3_oblimin	0.7	9.87E-08	0.11	53	0.1	0.86	0.84
cluster	autocor. vars	4_none	0.7	9.87E-08	0.11	64	0.091	0.89	0.9
cluster	autocor. vars	4_oblimin	0.7	9.87E-08	0.11	75	0.13	0.89	0.9
cluster	autocor. vars	5_none	0.7	9.87E-08	0.11	53	0.083	0.91	0.93
cluster	autocor. vars	5_oblimin	0.7	9.87E-08	0.11	83	0.16	0.91	0.93

Table 4.6 — PCA statistics for the relations between Modes variables, without and with geo-cluster correction.

The variable PCAs with correction for autocorrelation (both forms) did generally perform worse than the uncorrected variable PCAs for all PCA meta-statistics. Given that outcome, it was not further investigated whether meaningful clusters of variables were formed after corrections. To conclude, a 1- or 2- component solution was not found, like the previous chapter.

MDS

For an MDS of correlations of variables (Modes properties), it is harder to say via which numerical methodology the various correction methods could be assessed. Although there is a 'goodness of fit' metric, this is used for individual cases, not variables. The case is made here that the best indication that there are two clusters

of variables that indicate two Modes, is when the Imagistic variables -which have a negative correlation with the rest- are the furthest removed from the rest of the variables -which all have a positive correlation-. If that is correct, then the highest distance between the center of the two Imagistic variables ('Ilead' and 'Irits') and the center of the rest reflects this (the column 'center distance' in table 4.7 below). Perhaps to a lesser extent indicative for the Modes theory at large, but certainly reflecting the largest separation between variables in general, is the sum of squares of all points on the MDS.

corrector	vars corrected	center distance	Σ squares
n.a.	n.a.	1.06	3.26
geo cluster	all	0.83	3.26
	autocorrelated	0.99	3.16

Table 4.7 — The distance between the center of the Imagistic and the Doctrinal variables, and the sum of squares (SSQ) of the distance between all variables for all corrections. The first row represents the base scenario. All values of corrected scenarios that have a smaller distance or SSQ than the base scenario are grey.

As can be seen in table 4.7, the corrected / instrumental variables gave a smaller distance between Imagistic and Doctrinal variables, and perhaps less important but still, the instrumental variables also gave a smaller or equal sum of squares (SSQ[1]) compared to the base scenario (uncorrected).

One can also see in the plots of the variable MDS that many of the variables that are not specifically Imagistic seem to cluster more. The 'number of Doctrinal

[1] Some caution should be exerted with the SSQ metric. In general, with the same absolute variability in correlation coefficients, higher average correlations in the matrix give a lower SSQ, lower average correlations give a higher SSQ. Yet, higher variability in correlations gives a higher SSQ, which can even be higher when the average correlation is higher — undoing the previous statement. Nonetheless, when the MDS plot is taken on its own, the highest SSQ does reflect the greatest separation between variables.

ideological properties' and 'Doctrinal leadership' have shifted slightly towards the Imagistic side.

Original: All variables corrected:

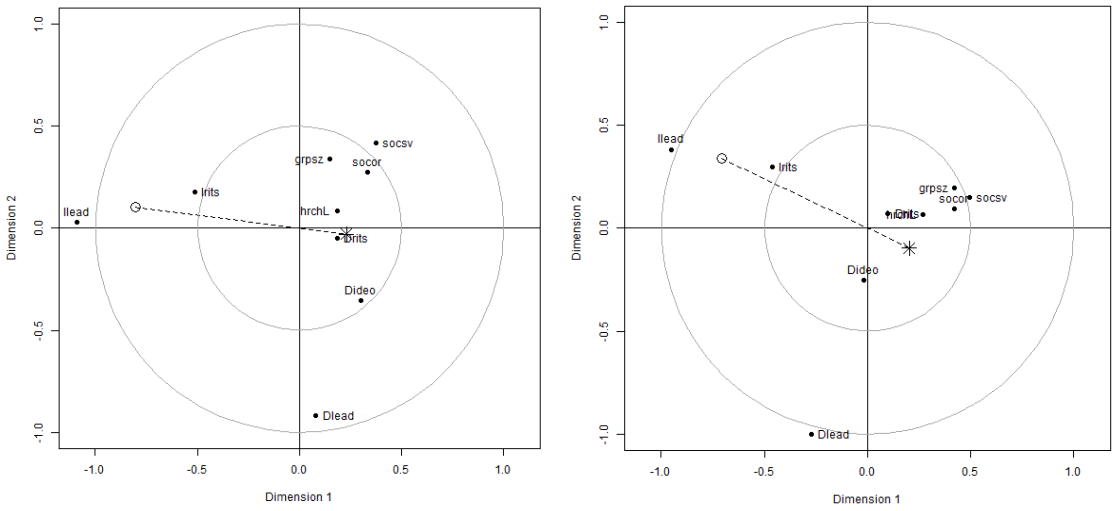


Figure 4.7 — MDS of the core Modes variables, uncorrected and corrected for autocorrelation. To the left in original (uncorrected) form, to the right with all variables corrected via the geo-cluster covariate.

All in all, the conclusion of the previous chapter remains intact, that the MDS lends some support to the Modes theory, but there is no specific improvement for this support.

3. Are there two attractor states?

a. Is there a bi-modal distribution for (semi-)continuous Modes variables?

In the previous chapter, it was investigated for four (semi)continuous variables whether they were bi-modal: 'group size', 'group size divided by troop size', 'growth rate per annum' and the 'number of hierarchical levels'. Most of the time, these four variables gave no indication of autocorrelation (see table 4.2 of Moran's I on page 187 and table 4.4 of AICs per variable for all corrections on page 197), but

regardless, corrections were applied (only 'all variables'), to see whether corrections would make a difference. When done so, it appeared that there was more of a suggestion of bi-modality[1] in the modality tests than without corrections (see table 4.8 and 4.9). Yet, the suggestion of *multi*-modality was equally strong as for bi-modality. When the percentage of multi-modality was subtracted from that of bi-modality to see whether there was unique evidence for bi-modality, none of the corrections showed meaningful improvement over the non-corrected base scenario for any of the variables. In addition, the histograms did not give a clear picture of bi-modality either (not shown here). Moreover, if there were to be bi-modality, one would expect a smaller mode ('bump', 'hilltop') on the left side of the x-axis, and a larger mode ('bump', 'hilltop') on the right side, indicating the constraints on the Imagistic Mode and less constraints on the Doctrinal Mode, but this was not found in the histograms either.

corrector	variable	% amodal	% unimodal	% bimodal	% multimod.
-	group size	0	100	0	0
-	group size div. troop size	0	100	0	0
-	growth rate	0	100	0	0
-	# hierarchical levels	0	11	71	89
geo cluster	group size	0	100	0	0
	group size div. troop size	0	22	78	78
	growth rate	0	13	87	87
	# hierarchical levels	0	48	52	52

Table 4.8 — Modality tests with minimum modal width of 10% for all correction types.

[1] Once more, Mode with a capital M stands for the divergent Modes of the theory, whereas the a-, uni-, bi- or multi-modal with a lowercase 'm' is a statistical term for the value distribution of a variable. To put it simply, uni-modal is the famous Bell curve. Bi-modal can be seen as two bell-curves (indicative of two modes). Multi-modal is yet more 'hilltops' in the distribution of the variable. "A-modal" has none of these hilltops.

corrector	variable	% amodal	% unimodal	% bimodal	% multimod.
-	group size	0	100	0	0
-	group size div. troop size	0	100	0	0
-	growth rate	0	100	0	0
-	# hierarchical levels	0	78	21	22
geo cluster	group size	0	100	0	0
	group size div. troop size	0	48	52	52
	growth rate	0	17	83	83
	# hierarchical levels	0	98	2	2

Table 4.9 — Modality tests with minimum modal width of 20% for all correction types.

All in all, it can be concluded again that there is no clear evidence that these four variables are bi-modal. Hence, this test does not give convincing indications that there are two attractor states.

c. Do groups themselves cluster into two clusters?

In the previous chapter, it was investigated to what extent groups cluster into two clusters via two methods: a PCA for individual groups and an MDS for individual groups. Those analyses are repeated here, now with corrected values.

PCA

The procedure to create PCAs for individuals (armed groups) was similar to the procedure followed to create PCAs in the previous chapter: the same core variables were used, and the point cloud was analyzed by the same cluster analysis methods. The question was whether visual inspection of the plots and cluster analyses indicated two clusters.

Starting with the analyses, for all numerical analyses (i.e. excluding the scree plot, which requires more interpretation) of the individuals of the autocorrelation-corrected PCAs, it appeared that for all "Calinski's best", 20 clusters were found. For

"Affinity propagation", the range was between 5 and 8 clusters. That means that none of these analyses would confirm two clusters of groups. However, "Silhouette optimal # clusters" indicated between 2 and 18 clusters "BIC best expected maximum number" indicated 1 or 2 clusters, and "GAP statistic" also 1 or 2. Hence, if those cluster analyses were to be taken seriously, and if the approach was taken that the PCA(s) that have the most of these cluster analyses indicating 2 clusters are the ones that have the most confirmation for two clusters of groups indeed, then exactly one PCA combination would emerge: only autocorrelated variables corrected, 5 components, and an oblimin rotation. Yet, inspecting the plot of the PCA (see figure 4.8 below), it is hard to see where the boundary of these two clusters would be. It is therefore probably safest to leave the conclusion of the previous chapter in place, that there is no strong evidence in the PCAs of the individuals that there are two clusters (types) of armed groups based on the core Modes variables.

Imputed datasets averaged, then PCA. No corrections, rotation=oblimin, 5 components, as shown in previous chapter.

Imputed datasets averaged, then PCA. Combination all variables corrected x 5 components x rotation=oblimin.

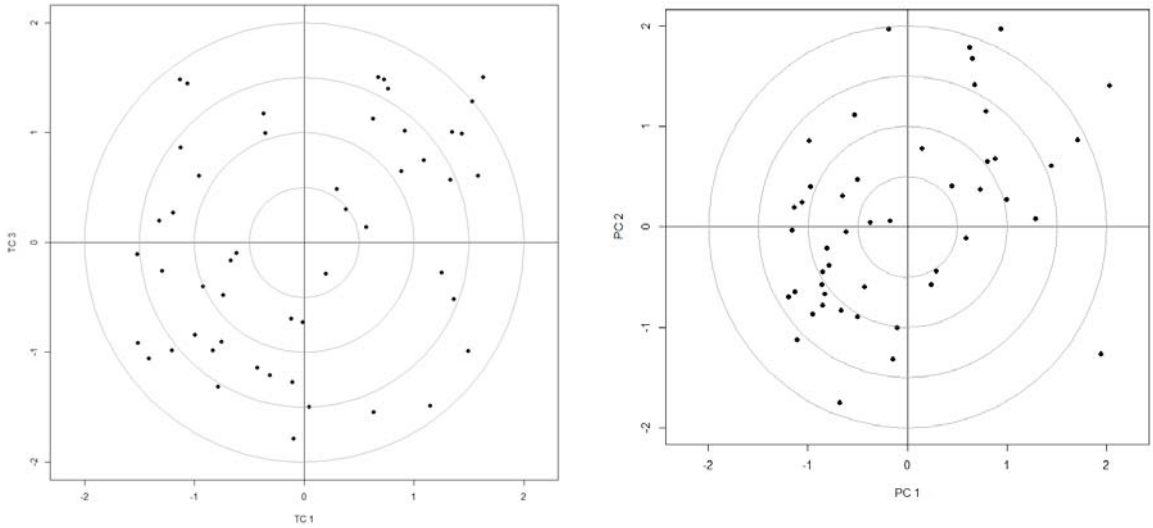


Figure 4.8 — PCAs of individual groups, to the left uncorrected, to the right with the most charitable correction for autocorrelation.

MDS

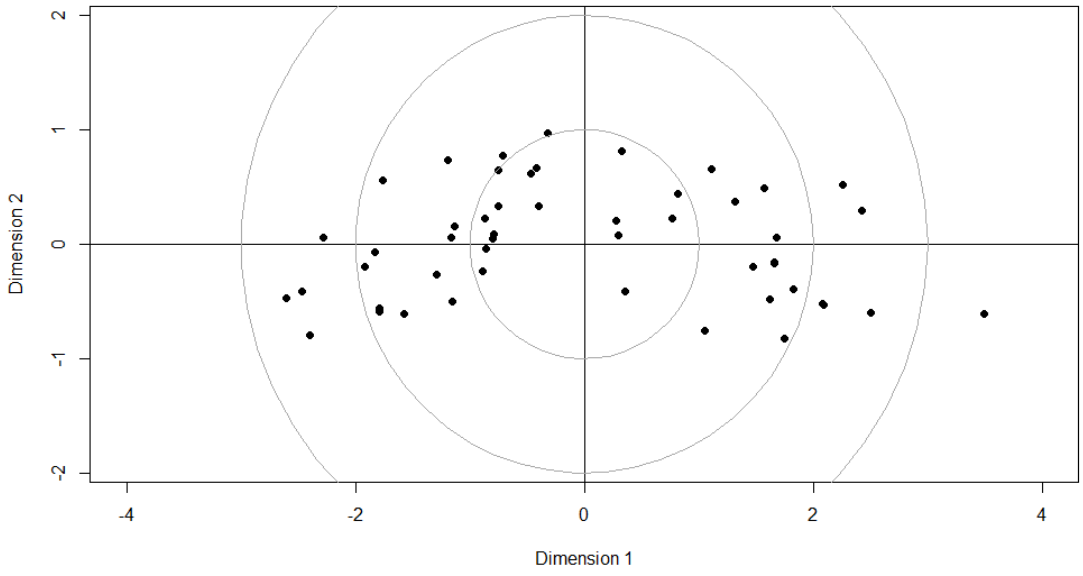
The second way to see to what extent individual armed groups grouped together as used in the previous chapter was via MDS. Again, first cluster analyses are done on the points on the MDS plane per correction combination, and then the plots are presented that had the best results in the analyses.

corrector	corrected vars	Silhouette	Calinski	BIC	Affinity	GAP
-	-	2	20	2	5	1
m_cluster	all_vars	8	20	1	7	1
	autocor_vars	2	20	1	6	1

Table 4.10 — The number of clusters per cluster analyses per correction combination on the point cloud of an MDS of Modes properties of armed groups. The first row (# 0) is the base scenario presented in the previous chapter, all other rows are various combinations to create corrected values. Grey numbers indicate a worse performance than the base scenario, black numbers a similar performance.

Compared to the base scenario, none of the correction combinations had more types of cluster analyses with two clusters than the base scenario, and in fact, the BIC statistic now indicated one cluster instead of two. Consistent with the previous analysis (PCA of individuals), the least bad seemed to be the scenario with only the autocorrelated variables corrected, so the MDS plot of that scenario is given below. (The plot with only the autocorrelated variables corrected gave qualitatively very similar results.) First the original MDS of the previous chapter is given, for easy comparison, then the new plot:

Original, uncorrected MDS of individual armed groups



MDS of armed groups, all variables corrected

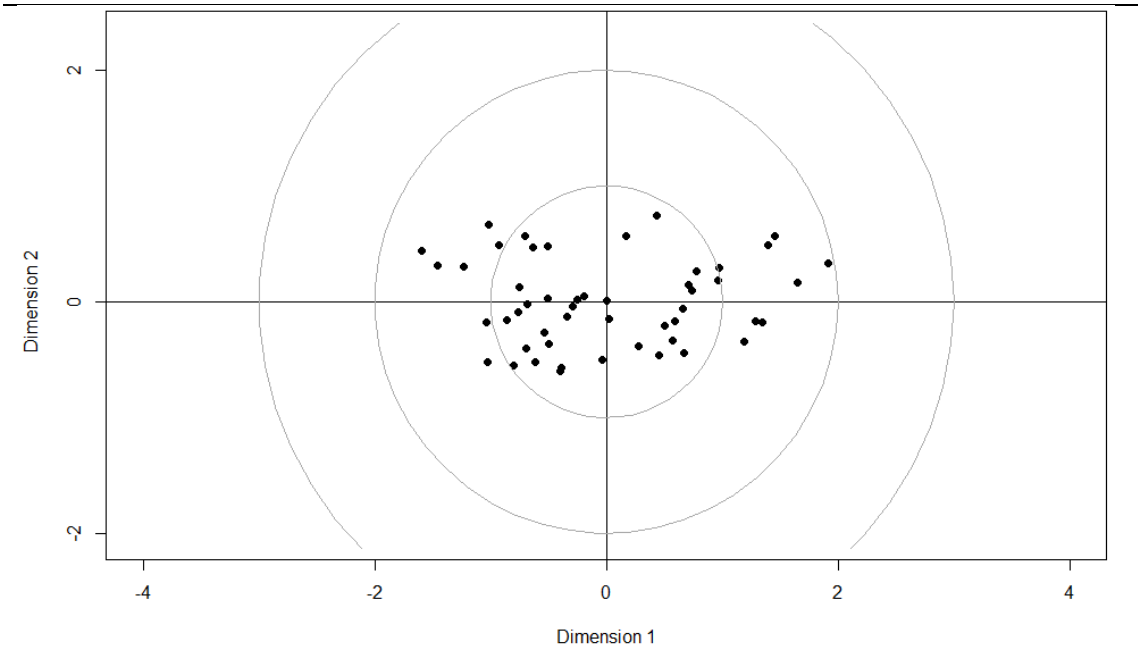


Figure 4.9 — The influence of autocorrelation corrections on the MDS of individual armed groups

In the plot it is hard to see a clear —leave alone meaningful— separation between two point clouds. If anything, the total point cloud seems to be more condensed (same scales are used in both plots), which suggests that after the correction, all groups form in fact one point cloud that is more similar and more condensed, not two point clouds that are more separated. Hence, for the MDS based on individuals, the conclusion of the previous chapter remains in place: there is no evidence for two clusters of groups.

Conclusion

All in all, the conclusion of the previous chapter remained in place, that neither with a modality test of semi-continuous variables, nor with a PCA of individual groups, nor with an MDS of individual groups, there was a clear indication of two clusters of armed groups.

Discussion

This chapter concentrated on three questions: (1) Via which relation types are the individual Modes properties transferred between groups? (2) Which Modes properties are (most) influenced by the interrelatedness of groups? and (3) If one or more of these group properties are influenced, then to what extent would the outcomes of the analyses of the previous chapter change when these influences are taken into account?

Summarized, (1) No relation type in particular stood out as being the source of cultural transfer; yet (2) Certain Modes properties have a high likelihood of being autocorrelated; depending on the strictness of interpretation of significance, these could at least be the 'number of Doctrinal ideological properties' and the 'religiosity of the explicit ideology', and perhaps the 'number of Doctrinal rituals (scale)'. (3) For the *relations between Modes properties within the two Modes*, there not more support for the Modes theory, neither regarding the number of significant correlations, nor the direction of correlations, nor the model fit (or any other meta-statistic) of the variable PCA. In addition, there was no extra support for two *attractor positions*.

All three findings will be discussed in more detail in what follows, and a brief indication of the road ahead will be given.

Recapping results

Via which pathways is the most cultural transfer?

Amongst other things, two of the contributions of this thesis are (i) to be the first research to explore several forms of transfer of culture (ii) between groups. Seventeen types of relation were investigated, namely Fission-fusion (9 types in total), Ideological (2), Working relation (3), Training relation (3) and Competition (1). As it appeared, none of these had a significant p-value for Moran's I when pitted against all individual Modes variables, although that was perhaps too much of an uphill battle given that 240 p-values were Holm adjusted. (The fact that nearly all p-

values were unrealistically 1 instead of a value between 0 and 1 (excl.) suggests artificially high p-values.) Nonetheless, taking those outcomes seriously, it must be concluded that none of the Relation types stood out as particularly conducive to transfer Modes properties. Yet, there was a suggestion that 'successor of' seemed to indicate autocorrelation for the 'number of Doctrinal ideological properties', and that 'fought against' indicated autocorrelation for 'religiosity of the explicit ideology'.

If these two suggestive results are anything to go by, then the interpretation could be that none of these two Relation types are actually 'transferring' anything from one group to the other. Being the successor of a group is not a real transfer between two or more groups, but rather one group ceases to exist, and is perhaps renamed and shuffled a bit into its successor. Critics could remark: no wonder the successor has the same properties. On the other hand, then the question emerges why Modes properties other than the 'number of Doctrinal ideological properties' were not autocorrelated for this Relation type. The hinted autocorrelation for 'fought against' for the Modes property 'religiosity of the explicit ideology' is also best explained when no direct transfer between groups is assumed, but rather a common ancestor. In that case, it is not implausible that groups that fight each other —typically occurring in the same geographical area— may have the same religious properties. Recent events in, say, Syria and Libya illustrate that most fighting can indeed occur within a (religious) culture, not necessarily between broad religious traditions. But importantly, in these examples it is of no relevance if the content of the religion is somewhat different (say, Sunni vs. Shiite) because what is measured here is the religiosity of the ideology, not the content of it.

Another thing that was indicated by the results, is, that instead of solely focusing on the way cultural properties are transferred, one might in addition take the cultural properties themselves into account as well. It seemed that some cultural properties —here: the number of Doctrinal properties, and perhaps the religiosity of the explicit ideology— were (much) more autocorrelated to various Relation types than other Modes properties. If that were to be the case, then the Modes are not

transferred as complete packages, but rather as individual elements. That, on its turn, resonates with the findings of this and the previous chapter, that there are not two distinct Modes, but rather Modes *properties* that can be found to a certain degree, and on a scale. This all the more warrants to focus on individual Modes properties and ask to what extent they are autocorrelated amongst armed groups.

Which Modes properties are (most) influenced by the interrelatedness of groups?

Interrelatedness of groups was tested via Moran's I, using two geographical / proximity matrices, and two relations matrices. The analyses showed that if there was one Modes property that had several significant p-values for Moran's I for various Relation types, it was the 'number of Doctrinal ideological properties'. However, having combined these relation types into one relation's matrix, Moran's I was not significant after Holm adjustments. Yet, for all other weight matrices (e.g. geographical), the 'number of Doctrinal ideological properties' was significant for all Moran's I's. The 'religiosity of the explicit ideology' was significant for both spatial weight matrices in the Moran's I test; perhaps as runner up the 'number of Doctrinal rituals (scale)' could be flagged, though it was not significant after Holm adjustments.

In general, based on Moran's I, only two or three, at most four Modes properties seem to be influenced by the interrelatedness of groups. That already suggested that re-analysis of the findings of the previous chapter may not show much difference when autocorrelation would be taken into account. That appeared to be the case.

Is the relation between Modes variables as predicted?

With the corrected values in place, several of the analyses of the previous chapter were re-done. The same number of correlations were significant after Holm adjustments, namely four; when no Holm adjustments were applied then 15 out of 126 correlations were significant, three less than in the non-corrected scenario of the

previous chapter. In addition, when the match of the directions of the correlations with the prediction were investigated, the picture was similar to the situation without correction for autocorrelation, and perhaps also slightly worse. Also the variable PCA and the variable MDS did not improve, that is, did not give more support than in the previous chapter for the idea that the Modes variables relate to each other as predicted. All in all, the conclusions of the previous chapter were also not changed.

Summarized, when corrections for autocorrelation are applied via the geo-cluster method, then it can be found that *some* Modes variables relate as predicted, that most Modes variables relate to each other as predicted with the exception of the Imagistic variables and perhaps Doctrinal leadership, that the Modes variables do not group into one or two components, yet, that the Imagistic variables indeed stand apart from the rest in the MDS.

Are there two attractor states?

Similar results were obtained for the analyses that tried to establish whether there were two attractor states. On all accounts, this was negative. Neither the analyses of semi-continuous variables that sought to test whether they are bi-modal, nor the PCA of individual groups and the cluster analyses on the PCA point clouds, nor the MDS of individual groups and the cluster analyses on the MDS point clouds gave convincing evidence for two (or in fact any number of) attractor states.

This difference, whereby at least some of the internal (cor)relations between individual variables seem to be reasonably as predicted, but without a sign of two attractor states, could indicate that Modes variables can correlate indeed, but without forming clusters. Perhaps, one could see all Modes properties forming a continuous space or perhaps a gradient whereby all properties combined could form an index. That reinforces the idea that groups and societies in general do not fall into two distinct Modes, but rather and at best can be placed on a continuum. That should be an incentive to rethink, reformulate or refine the 'attractor' thesis in the Modes

theory, and perhaps even to discard it for future versions of the theory in some contexts.

The road ahead

In this chapter, it proved again impossible to discern two distinct Modes amongst armed groups at the level of the entire group. That also means that one of the conclusions of the previous chapter still stands: that it is not possible to link types of resources or a ROI or Risk index to a Mode per se. What is possible, of course, is to link those resource related data to individual Modes properties.

Resource extraction may certainly have a strong geographical component (work with what is available locally), and because the resource data is in first instance categorical as well, it makes sense to use the geographical cluster as covariate again, the more because that can be used with various types of regressions and link functions.

In the final chapter, further suggestions will be made how to expand the research on Galton's problem and Galton's asset. Here, it will be left to the suggestion that techniques such as the Fisher exact test and the goodness-of-fit, etc., should be developed so that they can deal with autocorrelated data, and that it might be interesting -indeed useful- to develop network matrix corrected correlations.

Chapter 5 - The Modes and Resources

One of the standard views in social sciences on how culture is shaped, is the 'Marxist' theory that production relations shape a cultural superstructure that in turn reinforces the production relations. Somewhat similar, but stemming from evolutionary theory, is the idea that culture is an adaptation to the resource environment. That idea poses that those groups that have a culture such that it enables successful resource extraction will -on average- become more successful, will grow, and ultimately survive; those groups that have a culture such that they struggle to extract resources and perhaps have a shrinking resource base will -on average- become less successful, will shrink, and ultimately become extinct. Perhaps there is a loop here as well: once the culture is in place, this existing culture can be built upon to extract different or more resources, perhaps more efficiently. Whitehouse and McQuinn (2012) give two examples of armed groups (CPN-M and the RUF) that could illustrate such a loop:

> "CPN-Maoists are a highly ideological organization spread across an inaccessible country. The group's primary source of revenue is derived from donations and "taxes" extracted from local communities and businesses in one of the poorest countries in the world […]. The Maoists are a highly ideological and disciplined force not simply because its leaders are so inclined but because a doctrinal mode of operation has proved to be highly adaptive to the group's resourcing needs. In contrast, the resourcing strategies of the RUF required little investment in the hearts and minds of a large population. The ease of surface mining for diamonds combined with the geographic concentration of the mines produced high payoffs without the need for a large labor force." (p. 612).

In the same vein, Beardsley and McQuinn (2009) also see a dichotomy in resource extraction and group typology, and also come up with two examples of representative groups: The LTTE in Sri Lanka has been able to depend on relatively lucrative funding from international sources, notably remittances, and paid little attention to the needs of the local population; perhaps even worked to their disadvantage. The GAM in Aceh, Indonesia, relied more significantly on direct taxation that comes with stronger strings attached in the form of providing services

to the local population — which they indeed did. In local elections, they subsequently obtained the most votes and were able to secure a peace deal with wide-ranging autonomy for the region.

Groups, including armed groups, cannot pick out their resource types from an unlimited array of possibilities; some resource types are given in an area, others not. In addition, some resource types can be *created* in an area (one way of saying there might be an interactive loop between resources and culture), others not. In addition, some resource types are more profitable than others, and some resource types are riskier than others. For instance, some armed groups may find profitable surface diamonds or high-value timber in their operational area, other armed groups have not much more than barren highland as their physical environment. Some armed groups may find a willing funder in a (foreign) government or diaspora, other armed groups need to do without such money. Yet, in general, all armed groups can tap into more than one resource type, and can make choices regarding their resource extraction strategy. Will they choose for higher revenues, or for less risk? Will armed groups provide services to the local population in order to win their hearts and minds —which is initially costlier but may pay out in the long run—, or would they rather loot the population and its resources? Will an armed group make itself dependent on a foreign state regime, with the benefit or low investments and high revenues, or not, to avoid the risk of becoming overly dependent on a foreign party that can change its preferences overnight? In general, resources can be categorized along a scale of less or more investment required, less or more revenues, and less or more risk to obtain or to lose.

This chapter aims to move towards more understanding of the dynamics of resource extraction by armed groups. The starting point is some of the theory and predictions as discussed in the Theory chapter (Ch 1). To recap, the first prediction is that armed groups tend to increase their Return On Investment (ROI) over time (Beardsley and McQuinn 2009). Second, both those authors and Whitehouse and McQuinn (2012) predict that the type of resource extraction may be linked to the

type of group: localized non-ideological (~Imagistic) groups tend to have high-ROI resource extraction without much investment, large-scale ideological (~Doctrinal) groups tend to have low-ROI resource extraction, often based on long-term community relations (Beardsley and McQuinn 2009; Whitehouse and McQuinn 2012).

One of the limitations of the Beardsley and McQuinn (2009) account is that it did not specify in depth what ROI consists of or how it can be measured. A second limitation, as discussed below, is that the concept of ROI might be too limited to capture the dynamics of resource extraction. It is argued here that Risk needs to be taken into account as well. The theory development on ROI and Risk is one of the contributions of this thesis; this will be the subject of the next section. A third limitation is that not much work has been done to operationalize resource extraction of modern (armed) groups within the framework of the Modes. This limitation will be addressed not only in the next section, but as an extension of that, particularly in the Methodology section further down below. But first, the problems with Return on Investment are considered, and ways to improve our understanding of resource extraction via the concept of Risk.

Theory of ROI and Risk

Both in the Predation Profile theory (Beardsley and McQuinn 2009; hereafter: PP theory) and the Modes theory, there is a relationship hypothesized between the way a group extracts resources and a group's type of social organization. Both theories state that the organization of a group is a solution to (or adaptation to) a resource extraction problem.

The PP theory poses a quasi-quantitative distinction based on the notion of Return on Investment (ROI). ROI may be characterized as "the ratio of resources gained from an investment relative to the amount invested", or $ROI = \frac{\$\$return}{\$\$investment}$

, in principle an entirely quantitative measure. Also in the PP theory, resource extraction is divided in two categories: on the one hand, groups are organized in reaction to low ROI, and on the other hand in reaction to high ROI. This dichotomy regarding ROI is qualitatively labelled as 'Resource-based' versus 'Community-based' respectively. Resource-based strategies typically entail extraction from high-value sources like surface diamond mines and timber sites and voluntary monetary contributions of foreign people or regimes, whereas Community-based extraction strategies entail continued extraction of small voluntary or forced contributions from the local population.

The Modes theory makes a qualitative distinction between high-value, rare, local, movable resources on the one hand and low-value, common, distributed, relatively sedimentary resources on the other. These types of resource extraction are linked to the Imagistic and the Doctrinal Mode, respectively.

Although originally conceived in different contexts, it was recognized that the two theories match and propose similar things, not only regarding to group organization profiles but also regarding resource extraction types and resource extraction as potential driver for group structure.

Problems

In order to test the similar hypotheses of both theories, it is necessary to operationalize 'resource extraction', but as will become clear, that is challenging or even problematic for armed groups.

1. Quantification of quantitative terms –most notably ROI– is problematic

Measuring the ROI is extremely hard in the context of civil war. At face value, ROI seems to be as operational as one can get; fill in the numbers and the answer can be calculated. However, by definition, non-state armed groups are outside of the law and tend to have clandestine monetary transactions. How to measure monetary

transactions in the field? For instance, when a group exploits a diamond mine, what is the return? Or is it known –especially to outsiders, but even to the group– what the return is of the voluntary contributions of a local population? How would one estimate what return, expressed in monetary units, could be attached to providing shelter by the local population?

On the investment side, the picture might be even more obscure. Suppose a group is getting more or less voluntary contributions from the local population, what is the investment? Many things may play a role in this: What would it cost to create the goodwill? Only ethnic bonds? Or also setting up service organizations (costing *what*?), investing time and thereby foregoing other opportunities, providing goods (costing *what*?) and 'services' (*id*.), disseminating ideologies (costing *what*? do the cost of mosques, for instance, count?), and so on. It seems close to impossible to assess the investment here.

To summarize this point: It may be hard if not impossible to take into account everything that adds up to both the total return or the total investment. Hence, at best, ROI will be an imprecise, gross estimate; at worst, calculating the ROI may be close to impossible.

2. Qualitative terms in the Modes theory are hard to quantify too

Apart from the original religious (Whitehouse 2000, 2004), 'tribal' (Whitehouse 1995, 1996) and pre-historic (Whitehouse and Hodder 2010; Whitehouse et al. 2013; Whitehouse, Francois, and Turchin 2015) environments to which the Modes theory was first applied, if the claim is that the Modes theory is applicable to the context of civil war as well, it can be asked what the operationalization of the general resource descriptions as given by the theory would be. For instance, the Modes theory talks about 'rare, movable resources', but what would for instance 'movable' entail? To give an example from the context of civil wars, take the regular contributions from expats that are dispersed over a large area

(e.g. half of the world, or at least often several countries). These methods of resource acquisition (regular, wide area) are typically linked to Doctrinal resource provision. However, given the speed of transactions, they could be considered as very movable resources, suggesting a link to the Imagistic Mode instead. To give another example, exploiting a diamond mine could mean daily, regular, predictable work. Yet, the (Whitehouse and McQuinn 2012) article seems to suggest that this type of resource extraction is linked to an Imagistic group. Of course, one might argue that the daily, regular, predictable work is done by the child slaves, not by the violent group, which always needs to be alert to attacks and threats (an indication that *risk* is an important factor). But this only illustrates that it must be made very clear what is meant by categories such as 'value', 'frequency of occurrence', 'locality' and 'movability' and that actually the outer ends of the values of these concepts –both low and high– can, at least seemingly, be found to be linked to both Modes.

3. ROI is an insufficient concept; Risk must be added

Resource extraction is a standard problem for any organism. Two concepts other than the pure return of a resource play a role in it as well: risk and strategy. Risk can be seen as the risk the organism is exposed to whilst obtaining the resource, or the risk of losing the resource; strategy describes how various behaviours maximize the chance of obtaining the goal. The intuition behind risk and strategy is this: it may be attractive to pursue a resource with a high value, but if there is a high risk of losing it, whereas the alternative approach of pursuing a low-value resource with a low risk of losing it is also available, the organism might be better off *on average* to pursue the low-value resource with a high chance of winning it. Hence, the decision which resource to pursue might be better captured by also including Risk. The shorthand label for ROI and Risk together may be *Expected Reward* (ER). Basically, one can see the ER as "the probability of obtaining the reward times the ROI". To give a somewhat abstract example, if there are two resources, A and B,

where A has a ROI of 50 and B has a ROI of 20, it may seem that A is the better resource to pursue. Yet, suppose that the probability of success of extracting A is 10% and the probability of success of extracting B is 50%, the *expected reward* of pursuing A is 0.1 * 50 = 5, and the *expected reward* of pursuing B is 0.5 * 20 = 10. Hence, *on average* it would be better to try to extract resource B, despite its lower ROI. So, the ROI may not be that good a measure to express the motivation to pick a certain behaviour; instead, ER —with the explicit addition of Risk— may be more to the point. Defined like this, the ER may seem to harbor all problems of the ROI but then even more, because now also Risk needs to be assessed. Yet, it is a more complete and realistic representation of drivers of group organization, and where ROI data are lacking, at least Risk data may be obtained that can explain some of the group dynamics regarding resource extraction. These two points will be addressed now in general terms.

Every strategy entails a certain amount of risk, and a strategy may be characterized as 'a choice to obtain resources in a particular way and keep them' — not dissimilar to the Two Modes or the two resource strategies in the PP theory. In its simplest form, the strategy would amount to a bet: Would one bet on a strategy to obtain a resource that has a high value but also a high probability of failing or even a high risk of being harmful, OR would one invest time and energy in obtaining a resource that has a low value but a high probability of being secured and a low risk for life and limbs? In reality, this is not a dichotomy but a scale, and in reality, the risk is not easily assessed by the actor that considers utilizing a specific resource. Rather, averages and previous experiences count as well. In addition, this is made more complicated by the fact that the average reward is dependent on the behaviour of other actors too. This aspect is well known in both in biological and in political literature in the form of game theory. The idea of frequency-dependent strategies is this, that if everyone pursues the high-value resource, there may be fierce competition for it and hence a high risk of not obtaining it; i.e. of losing the resource, time, energy and/or limbs. That makes the high-value resource less attractive,

hence, it's attractiveness depends on what others do. However, if every other actor waives to pursue the high-value resource, it is less risky to pursue it — hence a more attractive option. As a result, a resource may or may not have a high or a low ROI *an sich,* but it is the *expectation* about getting a particular resource, dependent on (the expectation of) what others will do, that is really relevant to assess the value and feasibility of that resource. More concrete in the context of civil war, if there is a surface diamond mine in a country with a strong state that has excellent monitoring and punishing power, the ROI of the diamond mine may be high, but the Expected Reward for a group that tries to claim the yield as its own is close to zero because they will soon be defeated by the state. On the other hand, if the state is weak, the surface diamond mine has a higher probability to be profitable *for the group*.

In principle, the number of factors that can influence Risk is endless. Giving an exhaustive list of all these factors is therefore impossible. However, it can be theorized that in the context of civil war, a few factors are the most important ones and will capture most of the risk in a parsimonious way. Some of the major factors are (a) properties the resource itself, (b) the behaviour of other actors and (c) the method of acquisition. (*Ad* a) First, the resource itself contributes to the risk if it is highly movable *on its own conduct.* In a classical Modes context, a bull hunt may serve as a good example. The bull does not want to die so resists to be caught, tries to escape or fights back — effectively increasing the risk of not catching it, to waste time and energy and to suffer injury or death. In the context of civil war, members of the local community may or may not voluntarily contribute resources or even resist to provide resources. The mood of the local population might swing, and hence the size of their contributions. Similar reasoning applies for other actors with agency, like potential hostages, companies to be looted, or -important for many armed groups- a (foreign) regime that provides support as long as their political agenda is advanced. (*Ad* b) Second, the behaviour of other actors pursuing the resource is relevant too, as briefly explained above. In a classical Modes theory, it may be other tribes or groups that are also after a particular resource, for instance a hunting ground. In the

context of civil war, the primary other actor is the state. Secondary other actors are other groups that might also pursue a particular resource (but this is not always the case in a civil war), and a tertiary other actor is the local population, for it might try to claim the same resource or might try to keep the revenue of a resource for itself. A quaternary other actor are various parties that can increase or lose their goodwill after a certain action of an armed group, for instance expats or foreign governments that are funders of a particular group. (*Ad* c) Third, the method of acquisition is relevant too for the probability / risk because there are less effective or more effective methods of acquiring a resource; hence, there are less and more risky methods of acquiring a resource (even if the investment is the same). In a classical Modes context, the risk and success rate of hunting a bull with a spear is different from hunting a bull with a bow plus arrow, although the investment may be quite similar (and the reward too: the bull). In the context of civil war, there are many ways to exploit, say, a diamond mine or a local population. Exploiting a diamond mine by using clothed adults as quarrying slaves is riskier than exploiting that same diamond mine by using naked children. Obtaining contributions from the local population by providing services and a story about a bright future may be less risky than obtaining contributions of that same population by extortion and force — after all, that population may revolt against the oppressing group. In addition, there is a (methodologically problematic) interaction with the organization of the armed group, as various forms of group organization can increase or decrease the risk of (not) obtaining a particular resource. To give an example, suppose there is a bull hunt. A group may choose the strategy 'whomever shoots the bull gets half of the meat', effectively generating internal competition. Yet, a group may also choose the strategy 'let us work together to shoot the bull and distribute the meat evenly', effectively generating internal cooperation. It may be that the second method is far more effective. That, again, has the consequence that the ROI is an insufficient concept to understand what groups react to, because from the resource alone it cannot be inferred what the return is; this is because there may or may not be a return at all.

One also needs the probability of succeeding, which may be dependent on group organization too. Hence, group organization (read here: Modes) may not only adapt to ROI [and territorial objectives], but also to risk.

Of course, one could be inclined to incorporate 'risk' into 'investment' to keep up the notion of ROI. After all, 'risk management' is a (general term for a) way to cope with risks, and indeed, risk management reduces the risk, but comes at a cost, so adding that cost to the investment may seem the solution to uphold the notion of ROI as representative for the real world. However, this approach has one undesirable consequence: important (causal) information is lost. It is clearer when risk is separately assessed[1], so that there is less conflation of concepts and more precision what contributes to what. Take again the example of a surface diamond mine under a strong vs. a weak state. One could assess the investment of a rebel group in one country for a similar mine as being higher than in another country when in the first country the state is stronger than in the second. However, including such risks into 'investment' has the consequence that information is lost: state power. Given that the type of organization of a group is partially predicted from the resources plus the probability of obtaining that resource, the state power may be a notable factor too in predicting organization type. For instance, one may find significantly more Imagistic groups in countries where state power is weak. If one concentrates on ROI only, even if it incorporates risk, then this pattern is not explained. If risk is singled out, it has a better chance to be explained or to be explicative. Added to that, it will be very hard to assess the cost of 'risk management', whereas there are already readymade indexes of state power available. So also in a practical sense it seems desirable to make separately recognizable factors that constitute the risk.

In conclusion, the ROI in itself is indeed one component to assess the value of a resource, but falls short on providing the total picture. More relevant to actual

[1] To 'fractionalize' risk; see Whitehouse and Lanman (2014) for a similar approach to, and the benefits of, fractionalization of ritual and cohesion.

life is to include Risk as well. Two groups may be in the situation with the Expected Reward just above zero. But if one is achieving this based on a high Risk, high ROI strategy, and the other is achieving this through a low Risk, low ROI strategy, that seems the theoretically relevant distinction.

Solutions

Although there may be these problems with ROI, Risk, Resources and their operationalization, there are a few solutions too.

1. *Forget about the ROI or Risk; instead, study correlations between resource type and organization type or group properties*

   If the ROI and Risk are indeed hard to assess, perhaps it is wise to lay the ROI and Risk aside until enough progress has been made to measure it in the field. Instead, one could focus on correlations or associations between resource types and organization types, because these require less background theory and assumptions. It may appear that –for instance– certain Modes or group properties are more often associated to certain resource types, for instance, groups without clear ideology, multi-faceted service bodies, hierarchical levels or widespread activity may well correlate closely with exploitation of surface diamond mines or timber trade. (Or not.) Whatever the outcome, the result can be a base for further research. It would already be a step in the right direction to find correlations between resource types and group organization types or group properties. Further and later research can elucidate these correlations and perhaps find that these are causal relations. This first solution is indeed one of the approaches followed in this study.

   However, one could prefer to take the plunge and use ROI and Risk. In that case, the following two options may be pragmatic starting points:

2. *Make a ranking of ROI and Risk*

Despite the difficulties of assessing ROI and Risk, one could estimate the broad level of these parameters per group per resource type — and per time period if for instance the change over time of ROI and Risk is to be studied. The indicators of ROI and Risk need not be an actual number, but they may for starters be broad categories like 'low', 'medium' and 'high'. This seems to be in the vein of the Beardsley & McQuinn (2009) article, because that article generally seemed to equate certain resource types with a 'low' and a 'high' ROI. Following that lead, the assessment of ROI and Risk per resource type could be based on several forms of input, for instance: make an own assessment, with the Whitehouse & McQuinn and the Beardsley & McQuinn articles and civil war literature as starting point; or let a panel assess this; or let experts of a particular group or civil war do this. An added advantage of this method is that it can be done after the resource data has been collected, i.e. solution (1) can be 'translated' into solution (2). Asking experts to assess the ROI and Risk is a step towards taking other factors in civil wars into account too, because per civil war / group / area / specific resource, the expert can take factors such as state power and presence of other actors into account as well. All of these respective assessments can subsequently be part of a correlation or even a longitudinal analysis. This second method, assessing the ROI and Risk per resource type in the categories 'low', 'medium' and 'high', will also be used in this study.

3. *Actually find the numbers for the Investment and the Return.*

Perhaps somewhere, from the spreadsheets of the UN to the premises of the CIA, it is known which group receives what from whom. This would be a relatively quantitative number attached to at least the Return. On basis of surmised investments (weapons, hours, food, etc.) one could make an estimation of the Investment — though it is unlikely that this can be done for more than a

few cases, if at all. But let's be positive, and let's assume that in some cases the Investment in actual money is known or can reasonably be estimated. With these numbers, the actual ROI could be calculated (estimated). This is still more refined than the assessments per group per resource type by expert as mentioned under (2); no longer a few categories but an actual ratio with an infinite number of scalar outcomes. Assessments of the ROI of group resources by experts can be compared with the (few) calculated ROIs, and perhaps gives a foundation to extrapolate ROIs to other armed groups. This method will not be used in this study but will be left for later research.

4. *Fractionalize Risk / Expected Reward*

If it is indeed true, as suggested above, that a large part of the risks for a group in securing a resource are represented by the three categories of State power, Other groups, and Creation of goodwill/relation with the local population, then it makes sense to split out the Risk into these three factors (to begin with). This further fractionalization of different Risk factors per group could increase the explanatory or predictive power of the theory how group organization and resources are linked. Indeed, data on the presence of other groups is available in existing datasets (e.g. UCDP, NSAEX), relative State power as well (e.g. NSAEX), and relation with the local population is part of the database of this project and other datasets (e.g. OSAM). Yet, for reasons of constraints in time available for this project and space in this thesis, this method will not be used in this study. Nonetheless, it seems to be relatively achievable in a potential follow-up study.

With these theoretical considerations in mind, it is possible to readdress the predictions and convert these into research questions, with the additions of the concepts of Risk and Resource types. Resource types are a good entry point for exploring the utilization of resources by armed groups.

Research questions of this chapter

1) What are the most prevalent resource types utilized by armed groups, and to what extent do the groups rely on these resource types?

As mentioned above, Beardley and McQuinn (2009) describe the resource types of "taxation of the local population", "surface diamond mining", "remittances", "international aid" and "running non-profit organizations". Whitehouse and McQuinn (2012) on their turn mention "payment of tax from local communities", "donations from local communities", "taxes from businesses", and "surface mining for diamonds". The idea is that such resource types influence the structure and behaviour of armed groups, but how common are these resource types anyway? Are there other important resource types for armed groups?

2) Is ROI of resource usage increasing and Risk of resource usage decreasing over time?

The prediction (from Beardsley and McQuinn 2009) is that ROI should increase over time; the idea is that groups prefer to have more Return on less Investment, because that should give them a competitive edge. Can an increase in ROI over time be found? Moreover, this chapter's introduction theorized that it is desirable to have more certainty regarding one's revenue stream, so the prediction is that the Risk profile of the resource types should decrease over time. Can that be found?

3) Are particular resource types associated to certain Modes properties?

As found both in Chapter 3 and 4, it is hard, if not impossible, to establish two distinct 'divergent' Modes amongst armed groups. Hence, it is hard, if not impossible, to associate particular resource types or ROI and Risk indices to the two Modes. However, it was found that when drilled down to individual group

properties (variables), the relations between these could give a fair support of parts of the Modes theory under some circumstances; hence, it makes sense to investigate whether linking resource data directly to the Modes properties gives significant results regarding the relationship between Modes and resources. Resource data will be expressed in two ways:

a) What is the relationship between ROI and Risk on the one hand, and Modes properties on the other?

   ROI and Risk are in a way condensed and abstract resource data, but these data may give a quick insight in whether specific Modes properties are linked to particular degrees of ROI or Risk. Moreover, the results of this research question can build on and extend the results of the previous research question, which also dealt with ROI and Risk.

b) What is the relationship between specific resource types on the one hand, and Modes properties on the other?

   ROI and Risk data, as operationalized here (see directly below), contain more assumptions than the primary data on resource types as provided by the data sources. In addition, the PP theory predicts that community-based resource extraction like 'taxation of the local population' and 'voluntary contributions' require services to the population to be sustainable, and the 'number of social services' and 'installing a law' are some of the variables on the Modes side in this research (see previous chapters). Hence, it may be prudent to associate Modes properties directly to resource types, not only the two Modes properties just mentioned, but all of them, to see whether there are consistent patterns.

Introducing the data

The broad types of variables used in this chapter are Resource types[1], ROI and Risk indicators, and Modes variables. Modes variables have been introduced in the previous two chapters so see the applicable sections there for a description of the Modes variables. Here, the two main other categories will be described, the Resource types and the ROI and Risk indicators.

Imputations were not done for the resource data; for 49 of the 50 groups, resource data were provided by experts or literature and were assumed to be complete. The complexity of the resource data made it also very difficult to do straightforward imputations; it seemed pragmatic not to do complex imputations for just one group with lacking resource data. Hence, in what follows, the sample size is 49, not 50.

Resource types

The approach to use Resource types in this study stems from the two target articles. The Resource types that these articles mentioned are listed above. Via a literature study and expert consultation this list was expanded to 22 pre-defined Resource types:

[1] Starting with a capital, 'Resource type' refers to a variable rather than a concept only.

official regime of country	booty/looting of corporations
wealthy citizens of own country	hostage taking
foreign regime	human trafficking
wealthy citizens of foreign country	extortion of aid organizations
diaspora contributors	drug trade / smuggling
protection money/extortion of locals	weapon trade
taxation of local population	oil
local support / voluntary contrib.	surface diamonds
running corporations	timber
running 'charity' organizations	minerals
booty/looting of civilians	plantation (e.g. rubber, shares of palm oil, etc.)

The entire questionnaire and certainly also the Resource types went through a few rounds of expert feedback before they became definitive. Hence, the expectation is that the list of these Resource types covers most of the possibilities. This list was presented to experts in a question form (see Appendix 1, question 7). An extra 'wild card' Resource type was given in the form of 'Other, please specify…', though in practice this was filled in only twice by experts. Experts were asked to rate the importance of each of these Resource types for the NSAG with the options 'substantial', 'moderate', 'minimal', 'none', 'present' and 'rumored'. The first four options of this list are ordinal, the last two are non-ordinal. 'Present' is to indicate when a Resource type was used or obtained by a NSAG, but unclear to what extent. 'Rumoured' means the same, but then without reliable proof. An example of what the data could look like for a group is as follows:

start month	start year	end month	end year	resource type	degree of reliance
	1996		2006	taxation of local population	moderate
	1996		2006	booty/looting of civilians	minimal
	2007		2008	taxation of local population	moderate
	2007		2008	booty/looting of civilians	moderate
	2007		2008	drug trade	rumoured

ROI and Risk

The data that resulted from the questions are about the *types of resources*, as presented above. However, some of the hypotheses and research questions are caught in terms of ROI and Risk. Hence, a conversion was made from Resource type to ROI and Risk. Per Resource type as asked in the question list, estimates were made what the ROI and Risk most likely would be in broad categorical terms (low, medium, high — see solution 2, above), based on heuristic reasoning. Risk was split up in two types: one for the Risk of obtaining the resource, labelled 'Risk obtain', one for losing it, labelled 'Risk lose'. Especially when the investment is high, the risk of losing (keeping) the resource plays a large role as not only the revenues are lost when the resource is lost but also the investments.

In table 5.1, the resulting conversion scheme is presented. The left column ('Resource type') is exactly the Resource type as mentioned in the question list that was sent to the experts. The columns 'ROI' and 'Risk' contain the estimates {'low', 'medium', high'} and the reason why that assessment was given. A condensed overview is given in table 5.4 (page 250, three right most columns for the assigned ROI and Risks).

Resource type	ROI	Risk
official regime of country		
	High. The investment is low because the official regime does all the work of collecting the resources, the group does not need to do much investment. The return is high because the official regime often has large quantities of money because of tax revenues. High return, low investment = high ROI.	Low to obtain the money, medium to lose the source as decisions to end the funding can on the one hand be taken nearly overnight or -in unstable states- the regime might be overthrown, on the other hand, most official regimes do not change on e.g. an annual basis and are quite stable, hence, can be a stable

		source of funding. On average, that means 'medium' to lose.
wealthy citizens of own country [1]		
	High. The investment is low because resources are concentrated in a few, specific spots, and those spots are either voluntarily making their contributions or relatively easily forced to make such contributions. The return is relatively high because the citizens are wealthy. High return, low investment = high ROI.	Quite low to medium to obtain the money because it can be based on voluntary contributions or be taken by force from a relatively defenceless actor. Low to medium to lose the source because voluntary contributions can end when the goodwill ends, but often the wealthy individuals are committed to the goal of the group. This was summarized as 'medium' and 'medium', respectively.
foreign regime		
	High. The investment is low because the group gets money without much effort. The return is high because the foreign regime often has large quantities of money because of tax revenues. High return, low investment = high ROI.	Low to obtain and lose it, see 'official regime of country'.
wealthy citizens of foreign country[2]		
	High. The investment is low because the resources are concentrated in a few, specific spots, which are easy to manage, and often citizens of a foreign country make their contributions voluntarily. The return is high because the citizens are wealthy. High return, low investment = high ROI.	Low to obtain the money, medium to lose the income source given that foreign based money is less easy to control, but it is not one source point so losing one source point often does not mean the end of all income from this resource type. In more recent years, several measures have been taken to hinder money laundering and to hinder transferring

[1] This includes both voluntary and involuntary (e.g., forced) contributions.

[2] This includes both voluntary and involuntary (e.g., forced) contributions.

		sums of money outside of state control. It was summarized as low.
diaspora contributors		
	Medium. Diaspora contribution is a mix of voluntary and forced contribution. The investment is notable because forcing people to make contributions is more work, and all contributions tend to be smaller, making the management more complex. The return can be sizable as well. A sizable return, a notable investment = medium ROI; also lower than for e.g. 'wealthy citizens of foreign country'.	Low to obtain the money, low to lose the income. In practice, it has appeared that diaspora contributions often continue for many years, and if a particular source of money is lost there are still many other diaspora contributors left.
protection money/extortion of locals		
	Medium to low. The investment is medium because many small amounts need to be collected, but not in a structured way. No production of public goods are required from the armed group (except from keeping other armed actors out of the area) and over-asking is less of a problem than with e.g. tax collection because the contributions are not voluntary anyway, so that the revenues can be higher per source point. There is a capping on what can be extorted, though, because of migration / fleeing the area. That makes the potential returns medium high. Medium high return, medium investment gives a medium ROI.	Low to obtain the money, low to lose the source. This resource type is especially possible when the group already has control of an area; in that case, locals are often defenceless. Hence, it is relatively risk free to get the money and given that there are no contestants, it is relatively risk free to keep the resource.
taxation of local population		
	Low. The investment is high because tax collection is a process of collecting many small amounts, often over a large area.	Low to obtain the resource, low to lose it. Taxation often occurs when the group is established in an area and has a certain

	In addition, administration, regularity and probably creating goodwill (e.g. delivering services) make this a process with a high investment; in fact, the highest of all resource types listed here. The returns can be high as well because the combination these bits can result in a large amount. A high return, yet a very high investment = low ROI.	goodwill. Losing an individual source point does not really affect the income stream.
local support / voluntary contrib.		
	Medium. Or more precisely, medium on the short term, low on the long run. Whilst voluntary contributions by locals initially do not require much effort (e.g. in the contagious frenzy of a 'revolution' people may rush to deliver goods and money), the quantities per source point are low. Voluntary contribution will not continue for a long time if the group does not provide services in return, which is a high investment. For the short term, there is a medium return, low investment, so a medium ROI. For the long run, there is a low return, high investment so a low ROI. It was summarized as 'medium', also because the money comes far easier to the group (when it is there) than e.g. taxation, so it seems plausible to rate the ROI higher here.	Low to obtain the resource, medium to lose it. Because contributors are local and within the area of the group's control, and because they make voluntary contributions, the risk to obtain the money is low. However, losing the goodwill of the local population is a risk because support of the group can be lost in a few years when the group does not deliver what it promised.
running corporations		
	Low. The investments are high because corporations need constant attention and management, presumably also starting capital. Although returns can be high, that is not the case for the average	Low to obtain the resource, medium to lose it. Setting up and running a corporation can be done entirely within a legal framework and within the own control of the group. Also, appropriating

	corporation. Moderate return, high investment = low ROI.	an already existing corporation, even by force, is low risk because that can only be done when a group already has control of the area in which the corporation resides. However, typically, even legal corporations operate in a competitive environment, and if a corporation engages in illegal activity then it can face (inter)national scrutiny and bans; hence, the risk of losing the resource is medium.
running 'charity' organizations		
	Medium. The investment is high because setting up an organization, promoting it and collecting donations is a relatively elaborate process. However, no competitive services as for running a corporation need to be delivered, making the investment lower than for a corporation. The returns can be moderately high. A moderately high return and a moderately high investment give a medium to low ROI; it was summarized as medium here.	Low to obtain the resource, medium to lose it. Setting up a 'charity' organization is largely within the own conduct of a group. The 'charity' organization is also not violently opposed by the local population; in fact, people make voluntary contributions to the organization, making the risk to obtain the funds low. However, (inter)national governments can be keen on tracking cloaking organizations that cover up funding a goal they strongly disagree with, so there is a continuous risk the 'charity' organization will be terminated or nullified.
booty/looting of civilians		
	Medium. The investment is low; civilians tend to be defenceless and give up their resources easily at the point of a gun. In addition, not much needs to be organized for looting and that nothing needs to be done in return. The returns are moderate or low. Although the civilians are robbed of everything that a group (or group	Low in obtaining the resource, high in losing the resource. Civilians tend to be defenceless, so looting has a low risk. However, once looted, an area has much less resources and civilians tend to flee areas where there is heavy looting. The resource base is quickly depleted. Hence a high risk to lose.

	member) deems valuable —more than with asking for protection money— relatively little can be gained from the average civilian, especially in war-ridden environments. The relative harvest per source point (civilian) is therefore much lower than for e.g. looting a corporation (see next) because corporations have (far) more resources per source point. A moderate to low return, a low investment = medium ROI.	
booty/looting of corporations		
	High. Whilst looting a corporation requires some planning, not many group members are needed for it, and not many resources. Hence, the investment is relatively low. The returns tend to be relatively high. A one-shot action like robbing a bank can provide millions ($, £, €, …). High return, low investment = high ROI.	Low to medium to obtain the resource, medium to lose the resource. Depending on whether the group has control over a certain area, it can be quite dangerous to loot a corporation, which may be under police or army protection; but not if the group has control over the area. Once looted, the corporation has less resources and can even go bankrupt, or will strongly increase its security measures. Hence, this resource type is difficult to sustain. Summarized as a low risk to obtain, medium to lose.
hostage taking		
	High. Whilst hostage taking requires some planning, not many group members are needed for it, and not many resources. A hostage is easily movable, and whilst care for a hostage incurs a bit of cost, the total investment is not high. However, the revenues are high, sometimes millions ($, £, €, …). A high return, a low investment = high ROI.	Medium to obtain: hostages have a mind on their own and armed force is always required; medium to lose, as governments tend to put more effort in finding their citizens than, say, finding a delivery of diamonds.
human trafficking		

	Medium. Setting up a trafficking line requires planning, connections and skills. However, further public services are not necessary. Hence the investment is moderate. The number of source points (humans) is relatively low and the amount of money per person is medium-high. A medium-high return, a moderate investment = medium ROI.	Medium to obtain, medium to lose. The trafficking routes can be sufficiently lucrative to warrant competition between groups. In addition, governments of countries that receive the trafficked humans tend to put measures in place to curb the trafficking. In addition, the routes can be long, so there are many points where the chain can fail. Yet, in practice, one sees human trafficking persisting for at least a few years. Hence, for both risk types summarized as 'medium'.
extortion of aid organizations		
	High. Armed groups often have a monopoly in a certain area and can demand a certain percentage from a committed aid organization for them to be able to access an area. The investment for the group is low, because the aid organization has the cost of setting up the supply line and funding the goods. The resources are relatively concentrated and neatly packaged which makes their management easy. The returns are moderate, but compared to the investment, the ROI is high.	Low to obtain, high to lose. Once a group has control over a certain area and can (deliberately) cause a humanitarian disaster, aid organizations are keen to help and spontaneously try to come to the area. The group needs to do little more than ask for a percentage of the goods. However, when it is getting too dangerous or when the aid organizations change their policy w.r.t. whether they want to help the group getting resources, a decision can be taken within a week to end the aid and thereby the supplies.
drug trade / smuggling		
	High. Setting up a trade chain requires planning, connections and skills. However, the cost of production fall on the 'farmer'. Hence, the investments are moderate. In contrast, the value per weight and size is very high, which makes drugs (and also diamonds, see elsewhere) an ideal illicit good. A very	High to obtain, high to lose. Generally, drug trading is done outside of the area of group control. The trading chain has several points that are vulnerable; drug trading is under heavy international pressure ('war on drugs'); and trading routes and monopolies are highly contes-ted between groups. Hence, this

	high return, a moderate investment = high ROI.	resource type is difficult to set up and obtain and has a relatively high risk of being lost to the group.
weapon trade	Medium. Revenues can be fairly high, but the operation of illicit weapon trade is more complex than e.g. diamond or drug trade because the value per weight and size is lower, making transportation and storage costs higher. Whilst everyone can use diamonds or oil, not every party is interested in weapons, which means that it is a more specialized market. A fairly high return and moderate investment = medium ROI.	Low to obtain, medium to lose. Competition between groups for weapon trade is low; the most important limitation are official governments worldwide that may oppose such weapon trade. Yet, often smugglers know how to get around these limitations and foreign regimes can be so strongly opposed against each other that they actively protect weapon trade with a certain group when that group combats the opposing government. This can go as far as that governments deliver weapons themselves to non-state armed groups. However, much of the politics of weapon trade and much of the trade line is outside of the control of the group; hence, there is a medium risk that the group can lose this type of resource.
oil	Medium. This is one of the more variable resource types. Investments can be between low and high; low if the group controls (but not runs) a functional oil drilling well by force of arms and the revenues can be secured; high investment if pipelines are illegally tapped and barrels are sold on the local black market. Returns can be between low ($xxK per year) and very high ($1M per week). Hence, the ROI may be high,	Medium to obtain, medium to lose. Oil extraction and trade is only possible when the group already has the control of the area in which the oil well resides. When the area is already controlled by the group and when controlling the oil well is a by-product of having control of the area, the risk is low. If it is the aim, however, to gain control over the oil well then there can be fierce fighting over something that is worth millions or more, making the risk high. The low and high

	medium or low. This was 'averaged' as medium.	risk are summarized as medium to obtain. The risk is medium to lose, especially linked to losing control of the area.
surface diamonds		
	High. The investment is low because it takes only a few guns to force e.g. (naked) children to harvest the diamonds, for which not much technical skill is required. Transportation costs are very low because much value is concentrated in very small items. High returns, low investment = high ROI.	Medium to obtain, high to lose. Similar to oil, the risk can be low or high. Surface diamonds are so valuable that there will be fierce competition over that resource, making the risk high to lose the resource.
timber		
	Medium. Whilst individual logs can command reasonably high prices (a few hundred $$), the operation of timber harvesting and transportation is relatively complex. The return is medium-high, the investment as well. Medium ROI.	Low to obtain, medium to lose. Timber trade is strongly linked to having control over a (hardwood) area. It will be rarely if ever the aim for a group to get control over an area specifically for the timber, so it can be considered to be a by-product of ruling a forest area. There will be less competition over the resource (area) than for e.g. drugs, oil or surface diamonds, given the lower ROI of timber. There will also be little competition for the trade chain. However, timber is not easy to disguise, so illicit trading is less easy then for, say, diamonds. The highest probability to lose the trade is because of international regulations, which is more something of the last decade (00s-now) than of the first part (80s, 90s) of the period researched here.
minerals		
	Medium. Whilst the investment may be nearly as low as for e.g. surface	Medium to obtain, high to lose. See 'surface diamonds' for an explanation.

	diamonds, the transportation and marketing is more difficult and more targeted. Medium return, low investment = medium ROI.	Given the (guesstimated) lower ROI, the risks may be somewhat lower, but probably similar enough to assign the same risks, also given the crude categories of 'low', 'medium' and 'high'.
plantation (e.g. rubber, shares of palm oil, etc.)		
	Low. Owning and running a plantation can be complex, requiring constant input. Even if it is based on forcefully taking percentages of the harvest, the product is not of high value per weight or volume. Moderate return, medium-high investment = low ROI.	Low to obtain, medium to lose. Given the parallels, see 'timber' for the explanation.
other, namely…		
	n.a.	n.a.

Table 5.1 — The ROI and Risk for all resource types used in this study.

After ROI and Risk values were assigned to resource types, it was investigated how these ratings were related. As can be seen in table 5.2, all three parameters —ROI and both Risk types— are positively related, which is indeed what can be expected. The relationship between the two Risk types is stronger than between ROI and each of these Risk types individually, which is not surprising either. Whether this reflects reality or rather the subconscious correlation in the mind of the assessor can currently not be distinguished. In future research, if this method (solution 2) to obtain ROI and Risk data were to be used, then panels with members who independently assess ROI and Risk could improve the reliability of the ratings.

Spearman's correlation

	Risk obtain	Risk lose
ROI	.29	.30
Risk obtain		.48

Polychoric correlation

	Risk obtain	Risk lose
ROI	.46	.38
Risk obtain		.73

Table 5.2 — Correlations between ROI, Risk to obtain and Risk to lose a resource.

Aspects of resource usage will be explored in this chapter via three research (sub)questions. Further methodological specification will be given per research question.

Parameter space, scenarios

Computer simulations often use a 'parameter space' to investigate robustness of findings: a range of values is used for every parameter, that can show whether the outcome is dependent on a specific value of a parameter, or not. In this chapter, a parameter space was created as well, though here for statistical analyses. The following variations play a role to different degrees for (sub)questions of this chapter (details will be given where applicable):

- a correction for Galton's problem / autocorrelation with the geo-cluster covariate or not
- the use of Holm adjustments (or not) as used in the previous data-driven chapters
- a range of translations from an ordinal ranking of the 'Degree of reliance' of a Resource type to a number
- a correlational approach and/or a regression approach
- calculation of a parameter per armed group and then averaged, versus a bootstrapped sample on the raw data
- a splitting-up of Risk into 'Risk obtain' and 'Risk lose', as described in the theory section of this chapter
- a splitting-up of ROI and both Risks into 'low', 'medium' and 'high'

Combinations of these parameters can also be labelled 'scenarios' in what follows. The advantage of using this wide range of scenarios is that it gives better insight in the robustness of the results and decreases the influence of making 'wrong' assumptions. The disadvantage is that the methodology and results sections get longer and more complicated. The hope is that that is a cost that can be bore in light of the benefits.

1. What are the most prevalent resource types, and to what degree do armed groups rely on these?

This is an introductory and exploratory research question, to get a general understanding of resource extraction by armed groups when it is expressed in resource types. Furthermore, the results can help with the interpretation of, and strengthen the intuition with regard to, the relationship between resource types and Modes properties, which will be the subject of the third research question of this chapter.

Methods

The Resource type data were as specified above (page 233, and see table 5.1 on page 234 for an example). Because some groups had more than one data source (~expert), the resource data were linked to the group data as used in the previous two chapters; there, 100 subsamples were made, with per group a random draw of the data source to get one data source per group (the 100 imputed datafiles). Per subsample, 200 sub-subsamples were made, whereby per group a random period was chosen from the resource data, with the probability of choosing a certain

resource period per group proportional to its duration[1]. That assigns a higher weight to Resource types that were used for a longer period by a group. The counts of all sub-subsamples were added, and subsequently divided by (100 subsamples * 200 sub-subsamples).

Results

The resulting numbers are the ones presented in table 5.4 below in the intersection cells of Resource type (rows) x Degree of reliance (columns 'minimal' … 'present'). As can be seen, the Resource type that was used the most was 'local support / voluntary contribution'. In fact, the top five is constituted by what could be termed as 'the population is the resource' — be it voluntary or coerced, be it locally or in diaspora. Only from the 9th highest percentage in use, resource types that deal with trading in goods start to appear. Although 'taxation of the local population' is used by about half of the groups, the weighted counts under 'moderate' and 'substantial' for this resource type is among the highest in the table. Tentatively one could interpret that as groups either use taxation of the local population to a large degree, or not at all. Another striking result is that by far the most groups, 45 of 49, used 'local support / voluntary contribution' as resource at least at one point in their existence. The number of groups that relied substantially on this resource was also the highest, about one quarter of all groups. 'Drug trading' —illegal just about everywhere in the world— has the highest rate of 'rumoured' reliance. The use of 'surface diamonds', often mentioned in the target articles, does play a role for about one sixth of the groups in the sample.

[1] Because per group there could be a different numbers of resource periods compared to other groups, a straightforward frequency table of the occurrence of resource types would have overrepresented groups with more periods. In addition, these periods could also have different durations. Hence, to find the distribution of the different resource types over all groups, a second sampling strategy was added on top of the first 100 subsamples.

The higher the difference between the 'sum of counts' and the 'total number of groups', the more groups did not use the particular resource type for their entire lifespan. This is reflected in the column '% period not in use'; the higher that percentage, the more volatile the usage of the resource. Perhaps it can be interpreted as: the higher that percentage, the more opportunistic or risky the utilization of a resource could be, and the percentage can also be seen as a gross indicator of Risk. This is a testable proposition:

- As indicated, Risk is split up here in 'Risk [to] obtain' and 'Risk [to] lose'. For 'Risk obtain', there is only one resource type with Risk='high', so that resource type was left out of the analyses. Then two categories remain, 'low' and 'medium'. With a simple t-test, it appeared there is a significant difference between $mean_{low}$=16.3 '% period not in use' and $mean_{medium}$=33.6%, p=.047, t=-2.39, df=7.19. However, the percentages of several resource types are based on only a few groups and therefore not very robust. If only resource types are used with 10 or more 'total nr of groups', then the t-test is not significant at all ($mean_{low}$=18.8% and $mean_{medium}$=23.1%, p=.59, t=-0.63, df=2.20).
- For the Risk to lose the resource ('Risk lose'), the class of 'high' risk contains 5 resource types, so here the 'high' risk was included in the analysis. An ANOVA revealed no effect (p=.16, F(2,25)=1.97). When resource types with a 'total nr of groups' less than 10 were left out, the significance was even less.

All in all, when the 'percentage not in use' that is based on empirical evidence is compared with 'Risk obtain' and 'Risk lose' which were non-empirical assessments, then there is no convincing indication that there is a significant relation.

Finally, it can be asked whether groups in general tend to favour or avoid a low, medium or high ROI or Risk resource type. Do they, on average and without considering anything else like changes in time, for instance use more resource types that were classified as 'high ROI' or classified as 'low Risk' (to lose or obtain)? This

was established via a simple ANOVA of the 'sum of counts' of the low, medium and high categories per ROI and the two Risk types (see table 5.3). Although that test is a bit crude, it appeared that the p-values were so far removed from significance that further refinements were deemed unnecessary. There was no difference in the weighted number of groups (column 'sum of counts' in table 5.4) that utilized Resource types from a particular ROI or Risk category. The right-hand side in table 5.3 'with > 10 total nr. of groups' is given for compatibility with the previous ANOVAs, to concentrate on the most utilized resources. Also in that sub-selection, there was no specific preference for a low, medium or high category.

	All Resource types			with > 10 total nr. of groups		
	Df	F	p-value	Df	F	p-value
ROI	(2, 25)	0.028	.97	(2, 16)	0.99	.39
Risk obtain	(2, 25)	0.48	.62	(2, 16)	0.05	.95
Risk lose	(2, 25)	0.18	.84	(2, 16)	1.127	.35

Table 5.3 — ANOVAs for the weighted number of groups per score (low, medium, high) for ROI, Risk obtain and Risk lose

resource type	minimal	moderate	substantial	rumoured	present	sum of counts	total nr of groups	% period not in use	ROI	Risk obtain	Risk lose
local support / voluntary contribution	9.6	10.8	13	1	6.8	41.2	45	8.4	medium	low	medium
booty/looting of civilians	5.1	9.9	6.8	2	6.5	30.3	35	13.4	medium	low	high
wealthy citizens of own country	6.7	6.6	8.3	3.5	4	29.1	35	16.9	high	medium	medium
diaspora contributors	6.6	8.2	2.9	3.7	5.5	26.9	32	15.9	medium	low	low
protection money/extortion of locals	5	7.6	6.3	0.4	7.1	26.4	32	17.5	medium	low	low
foreign regime	4.9	5.6	8.3	3.2	2.6	24.6	33	25.5	high	low	low
taxation of local population	1.7	9.5	8.2	0	4.2	23.6	27	12.6	low	low	low
booty/looting of corporations	3.4	6.2	5.2	0	7.6	22.4	28	20	high	low	medium
drug trade / smuggling	3.3	5.1	2.3	6.9	3.5	21.1	24	12.1	high	high	high
weapon trade	3.1	2.8	3	3.2	5	17.1	21	18.6	medium	low	medium
official regime of country	2.7	3.8	6.2	1.4	1	15.1	21	28.1	high	low	medium
minerals	3.9	2.6	4.3	1.7	1.8	14.3	17	15.9	medium	medium	high
running "charity" organizations	5.3	2.9	2	0	3.8	14	16	12.5	medium	low	medium
wealthy citizens of foreign country	3.2	4.5	0.5	2.4	3.3	13.9	17	18.2	high	low	medium
timber	1	3.8	3.9	0.4	2.5	11.6	15	22.7	medium	low	medium
hostage taking	1.1	4.2	2.8	0.6	2.7	11.4	18	36.7	high	medium	medium
plantation	2.6	3.6	2.8	0.2	2.1	11.3	14	19.3	low	low	medium
running corporations	4	1.8	2	0	3.3	11.1	14	20.7	low	low	medium
extortion of aid organizations	2.5	1.1	0.5	1	2.8	7.9	11	28.2	high	low	high
surface diamonds	1.3	0.8	1.7	0.2	1.2	5.2	8	35	high	medium	high
oil	0	1.4	1.1	0	0	2.5	4	37.5	medium	medium	medium
own work / jobs of group members	0	0	1	0	1	2	2	0	medium	low	low
human trafficking	1	0	0	0.2	0	1.2	3	60	medium	medium	medium
taxation of trade route	0	0	1	0	0	1	1	0	medium	low	low
war booty - taken from the enemy	0	0	1	0	0	1	1	0	high	low	medium
trade	0.7	0.1	0.2	0	0	1	1	0	medium	low	medium
religious institutions	0	0	1	0	0	1	1	0	medium	low	low
other armed group	0	0.3	0.1	0	0	0.4	1	60	high	low	medium

*Table 5.4 — The weighted number of groups per resource type per degree of reliance. The 'sum of counts' is a sum of all 'degree of reliance's, the 'total number of groups' is the total number of groups that used the resource, regardless of the period weighting, the '% period not in use' is the percentage of the total periods that a certain resource type was not in use (((total nr of groups – sum of counts)/total nr of groups)*100%). The three right most columns (ROI, Risk obtain and Risk lose) are a simple reproduction of the scores as given in the assessment.*

Conclusions

Perhaps the most interesting result is that the Resource types that are most frequently used are population based, not tradable material goods like timber, diamonds, drugs or similar. The two Resource types that are used by just about every group, namely 'voluntary contribution' and 'looting of civilians', are based on the population in the immediate vicinity. The analyses for the third research question further down below will reveal whether such differences are related to different types of rituals and other Modes properties (see page 269; e.g., there is *some* indication that looting civilians is positively correlated to the number of Imagistic rituals). About one quarter of the Resource types in this research is hardly used by any group. Apart from substantive interest, such results could be meaningful when further analyses are done regarding the association with Modes properties, because a variable should provide enough variability to be able to generate meaningful results.

The Degree of usage (low, medium or high) of ROI and Risk was not related to the weighted number of groups using the Resource types in these categories, which is an indication that overall ROI and Risk -independent from each other or independent from anything else- are not a factor for whether groups use particular Resource types or not. More concretely, there is no evidence from these preliminary analyses that groups tend to avoid for instance low-ROI or high-Risk Resource types. That is an interesting result in its own right, but may also have bearing on analyses that follow hereafter: no statistical corrections are required for over- or under-representation of ROI or Risk with a certain Degree of usage.

2. Is ROI of resource usage increasing and Risk of resource usage decreasing over time?

In the introduction, one of the main resource related hypotheses was that groups tend to shift to Resource types with a higher ROI. In addition, it was tentatively argued that groups increasingly might shift to Resource types with lower Risks, to avoid being without resources at all. This section will test these two hypotheses.

Methods

The approach taken here is that changes in ROI or Risk can be expressed in the form of a slope of a linear regression. When the slope of the sample of groups is not significantly different from 0, then the ROI and/or Risk do not change during the lifespan. The time dimension is placed on the x-axis. Time is expressed in (per) year or in percentage of a group's lifespan. The ROI and Risk can be seen as a dependent variable and are placed on the y-axis. They are expressed either as percentage that a 'low', 'medium' or 'high' ROI or Risk constitute a group's Resource type usage, or expressed as the counts of the number of Resource types in the 'low', 'medium' or 'high' category for ROI and the both Risk types.

Axis	What is expressed?	How?
X (horizontal)	Time	% lifespan, year
Y (vertical)	Resource usage	ROI, Risk obtain, Risk lose; all separate Subdivided in {low, medium, high} usage, all separate Count or percentage per usage per ROI or both Risks

Conversion of expert data to analysable ROI and Risk data

Empirical resource data were in the form of Resource types, converted to ROI and Risk as discussed above. Per ROI and both Risk types (hereafter 'RRR'), dummy variables were created (0 / 1) per Resource type (for a more in-depth example, see Appendix 4), one dummy variable for 'low', one for 'medium' and one for 'high' per RRR. For instance, if a group had 'foreign regime' as resource type for a certain period, then the ROI 'high' dummy column got the value 1 for that record (see table 5.1, 'foreign regime' was assessed as high ROI), the ROI 'medium' and ROI 'low' dummy variables the value 0. Given that it is quite intuitive to assume that when a group utilizes, say, a high-ROI resource substantially then its overall ROI is higher than when the group would have used that same high-ROI resource type only minimally, other things being equal. Hence, a weighting scale was designed for the different 'Degree of reliance's. That scale had four variants (scenarios), to be able to get a sense in the analyses to what extent the assumptions underlying the scale would be influential. There is a base scenario where all Degrees of reliance get the same weight (effectively nothing changes with regard to the dummy columns), and three other scenarios that increasingly emphasize the difference between the Degree of reliances. The 'rumoured' weight was set to 0.3 in all three alternative scenarios, and the 'present' category was set equal to the 'minimal' category, namely 1. From 'minimal' via 'moderate' to 'substantial', either a slight difference was modelled (1→2→3), a moderate increase (1→3→5) or a strong increase (1→4→7). Each scenario was individually labelled according to their weights (e.g. "R_0.3_1_1_2_3"), etc. Every dummy variable was multiplied by the weighting thus created; e.g. if 'foreign regime' was used substantially, and the Reliance weight was "R_0.3_1_1_2_3", then the dummy variable was multiplied by 3.

Hereafter, two overall, aggregate variants of ROI and the two Risks (hereafter 'RRR') were calculated per group, namely the two variants of time that were mentioned before: 'per year' or 'per percentage of the total lifespan of the group'.

The RRR values were either left as they were or converted into percentages per RRR score (low, medium, high) per period per group.

Per period per group, the midpoint of the period was taken as representative point on such a time scale per group. For change per year, the number of years between two midpoints was used. For percentages of time, that midpoint can be divided by the total lifespan of the group. Groups with only one period naturally had no change per year or during their lifetime.

To calculate numbers per percentage of the total lifespan, the earliest start date of the first period in the resource data for a certain group constituted the start of the lifespan for that particular group, and the last date of the last period in the resource data for that group constituted the end of the lifespan for that particular group.

After the percentage of low, medium and high ROI and Risks per group per time unit were obtained, stacked plots were created.

Following from there, two ways to obtain population wide parameters (slopes) were used: first reduce the various periods per group to one parameter per group, namely one slope per group, and then combine these; OR calculate the population slope directly on a dataset that contains all data points of all groups but then with some weighting mechanism for the different periods per group. The first method was done in a straightforward manner, labelled here 'slope per group, then averaged'. The slopes per group that were calculated first were the percentage change per ROI and Risk type per score (low, medium, high) per year or per percentage lifespan. The three advantages of the first method are its simplicity, the possibility to see the variation in slopes more clearly, and (but that was not used in this thesis) the possibility to reuse the slopes per group in later analyses where they can be combined with other data per group. The advantage of the second method is that the uncertainty for the calculation of the slope per group is incorporated in the statistical

parameter as well, whereas in the first method the slopes are treated as if they were observed data (discarding the residual variation per group).

For the second method, different periods per group were taken into account by giving each resource data point a weight of 1 divided by the number of periods per group. In other words, the probability of a draw of the data points inversely related to the number of periods per group. For all groups+data sources of the 100 imputed datafiles as used in the previous two chapters, the resource data were matched to these groups+data sources to obtain only one data source per group for the resource data as well. Per imputed datafile, 100 subsamples were made with the random draws per group of the resource data. Then the sample slope and the AIC were calculated based on the type of linear regressions as given in table 5.6 below. These 100*100 subsamples gave a total of 10,000 slopes and AICs per model (with or without corrections for autocorrelation). Those 10,000 numbers per parameter were condensed into one number with standard errors. This second way to calculate the population parameter is labelled 'bootstrapped slopes'

Dealing with autocorrelation

As already hinted in the previous paragraph, and similar to the previous chapter, the regional covariate was used to correct for relatedness between armed groups. Specifications for the regional covariate were given in the previous chapter. This time, there is no distinction between 'all variables corrected' and 'only autocorrelated variables corrected'; the geo-cluster is simply used as covariate in all regressions. For the scenario that per group a standard linear regression was calculated ('slope per group, then averaged'), first, the slope was calculated per group with standard linear regression without corrector. Second and thereafter, the population (=mean) slope was calculated by treating the population slope as the intercept of a generalized linear model function with region as covariate, which effectively gives the mean value of what goes in the linear functions, corrected for

region[1]. For the bootstrapped slope, the covariate was part of all constituent (bootstrap) regressions.

Results

Stacked plots

The stacked plots of the percentage of low, medium and high ROI and Risks per group per time unit serve the goal to get an overall visual impression of changes over time. These stacked plots showed no obvious change in ROI or Risk over the lifespan of groups (see figure 5.1 for an example). To investigate whether this impression could be backed up by numbers, the population slopes will be presented.

Slope per group, then averaged

Four Reliance weight scenarios multiplied by two slope scenarios (percent change per year and percent change during percent lifespan) were considered, i.e. in total 8 scenarios. Per scenario, three scores (low, medium, high) for three RRR parameters (ROI, Risk obtain, Risk lose) were calculated. In total, there were 4 x 2 x 3 x 3 = 72 analyses for the base scenario and also 72 for the geo-cluster corrected scenario. It appeared that the AIC was the lowest for all analyses with the autocorrelation correction (see table 5.5).

correction →	base	geo cluster
# lowest AIC	0	72
# signif. β's	6	9
# sign. Holm	0	0

Table 5.5 — Meta-statistics per autocorrelation correction for slopes per group, then averaged. The numbers are counts of the number of analyses with the lowest AICs, of the number of significant slopes (β's) without adjustment for multiple comparisons, and the number of significant slopes with Holm adjustment. Per cell, all Reliance weights and slope types (year or percentage lifespan) are combined.

[1] E.g., `glm(slope~1)` is equal to `mean(slope)`; similarly, `glm(slope~regioncode)` is equal to a mean of the slope(s) but corrected for spatial autocorrelation between the groups, using the code for the geographical region of each group (slope) as corrector.

None of the slopes was significant for any analysis with Holm adjustments. However, without these adjustments, nine slopes were significant; the six that were significant for the base scenario were also significant for the geo-cluster corrected scenario. They all concerned a *high Risk to lose* a resource for Reliance-weights other than R_1_1_1_1_1, both for the percentage of lifespan (β = 0.10 to 0.12 for the base and geo-cluster scenario)[1], and for the change per year (β = 0.75 to 0.97 for both scenarios). The other three concerned a low Risk to lose and two medium ROIs.

[1] It could be useful to add the effect size (e.s.) in future research. This has several challenges. (1) The technique here is to use imputed datasets. It is likely that the pooled e.s. should be calculated in a way resembling the calculation of the confidence interval: adding the between-imputation dataset variance to the average within-imputation dataset variance. Software code could be created from that math, for instance starting from leads provided by Jon Lefcheck (https://jonlefcheck.net/2013/03/13/r2-for-linear-mixed-effects-models/) and Maxwell Joseph (http://mbjoseph.github.io/2013/08/22/r2.html); in the end based on papers by Nakagawa and Schielzeth (2013) and Johnson (2014). However, (2) the technique used here is to first create the slope per group, and then average the slope whilst taking the region code into account. As stated in the main text, the disadvantage is that from step one to step two, variance is thrown away because slopes that are calculated per group do not reuse the residuals. Hence, the effect size will be affected. (3) Currently, the glm() function in R does not provide a (multiple or adjusted) model R^2 from which the effect size can be calculated. Although in the particular calculation used here, lm() can be used as substitute (which does provide the R^2), this is not the case later in this chapter with non-gaussian link functions, and even in lm() the R^2 is provided inside a text output rather than as object variable.

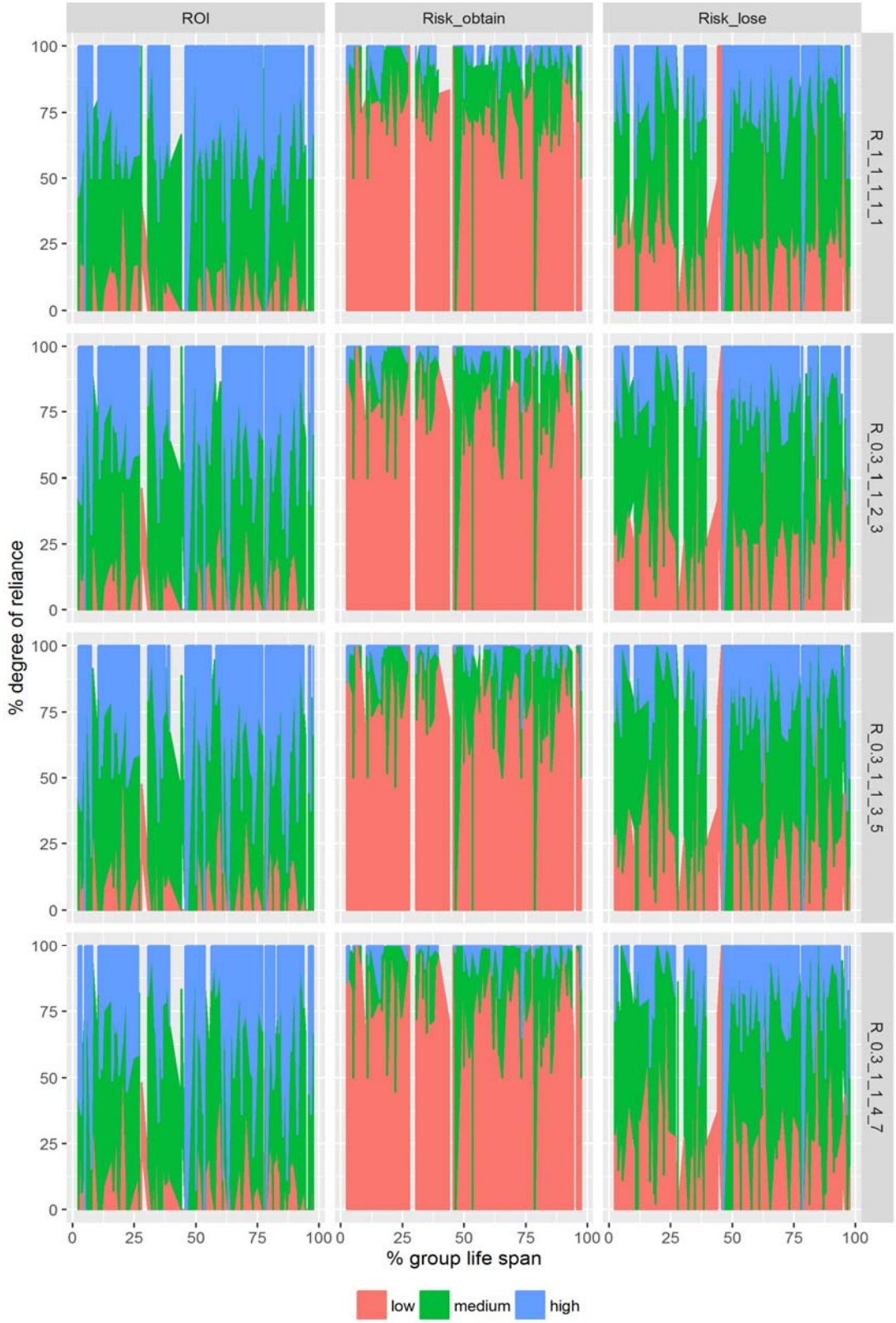


Figure 5.1 — Stacked plots of the percentage per period of various levels of ROI and Risk (low, medium, high) per weight of the Degree of reliance (R_1_1_1_1_1 etc., see method description) during the lifespan of armed groups (n=49). When 100% is not reached, this is due to missing data for some groups for some periods.

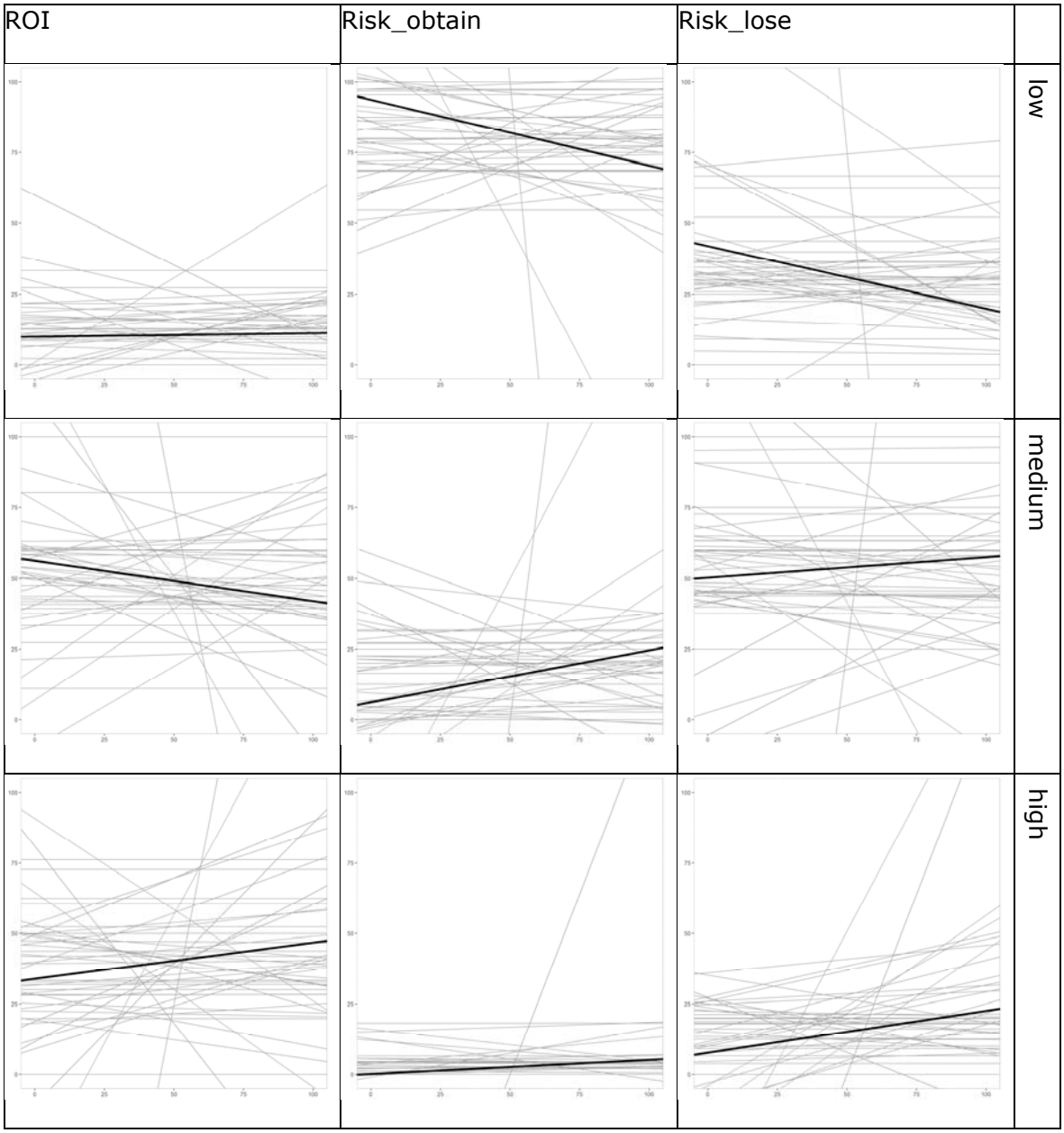


Figure 5.2 — Examples of slopes for the 'Slope per group, then averaged' method. Separately presented are the low, medium and high ROI, Risk to obtain and Risk to lose of the resources. X-axis: lifespan, *0-100%. Y-axis: ROI, Risk (0-100%). Grey lines: individual groups. Thick black lines: average slopes. None of these average slopes were significant, except for 'Risk lose high' (unadjusted for multiple comparisons). These data were not corrected for autocorrelation. The weight for the degree of reliance (Reliance weight) is R_0.3_1_1_2_3 for all graphs shown above, but for other weights the patterns were similar.*

The overall impression was that for most Reliance weights, the signs of the slopes per ROI or Risk strength tend to be the same, though on occasion the 'mere

presence' scenario of R_1_1_1_1 deviated. The same was true for significance of the slopes. The direction of the slopes also tended to be the same, compared between the scenario when the change is expressed per year or per percentage of lifespan. However, the main question is whether one feels inclined to conclude that the ROI tends to increase, and the Risk tends to decrease. There is no convincing evidence that the ROI did change (only two non-Holm adjusted slopes for ROI were significant, and they concerned 'medium' ROI). The same can be said for 'Risk obtain' — nothing significant there. The only case that could possibly be made if one neglects the non-significance after Holm adjustments and sees the consistency of significance of 6 of the 8 non-adjusted scenarios as meaningful, is that Resource types with a high Risk to lose tend to increase over time.

Bootstrapped slopes

The population slopes were estimated in two ways: with weighted counts, and with percentages per ROI, Risk obtain and Risk lose per 'low', 'medium' and 'high'. Only slopes and their 95% confidence intervals (ci's) were calculated in the bootstrapped regressions. Slopes that did not cross 0 with their ci's were considered to be significant.

None of the slopes for the base or geo-cluster corrected regressions were significant, so the null hypothesis (=no effect) cannot be rejected.

Conclusion

There is no evidence that ROI increases or even changes during the lifespan of armed groups. Neither in the stacked plots, nor in the combined slopes per group, nor in the bootstrapped analysis could any compelling evidence be found; the null hypothesis of no effect or change cannot be rejected.

As for Risk, the conclusion is basically the same, though there is some evidence that Resource types gradually shift towards types with a higher Risk to lose these: when individual slopes per group are combined to a population parameter, there was *some* evidence that a high Risk to lose had a positive slope whilst the slope for a low or medium Risk to lose a resource was not (or in less models) significant; so perhaps there is an effect that groups shift over time to Resource types that have an increasing Risk to be lost again, once obtained. This, however, rests on a charitable interpretation of significance, namely with neglecting Holm adjustments for multiple comparisons.

As a side effect and a small methodological finding, the most difference between the four Reliance weight scenarios could be found between on the one hand the scenario where mere presence or absence of a resource type was used in the analyses (R_1_1_1_1_1), and on the other hand where higher Degrees of reliance ('minimal' → 'moderate' → 'substantial') indeed got increasingly more weight. However, it is early to make conclusions, and the picture emerges that at most a differentiation between presence or absence on the one hand, and one -rather than three- increasing weight scenarios will be sufficient to capture the difference in future research.

3. In what way is resource extraction related to Modes properties?

Although changes in ROI and Risk over time did not seem to go in any direction in particular, it could still be the case that some form of ROI and/or Risk are related to Modes properties. Hence, the first research question of this section is:

a) Are low-ROI and low-Risk positively related to Doctrinal properties, and negatively to Imagistic properties?

Nonetheless, ROI and Risk scores are derived from Resource types based on assumptions; maybe these assumptions are not to the point. Hence, it makes sense to have a look at the very basic data, namely the Resource types *sec*. Therefore, the second question of this section is:

b) What is the relation between individual resource types on the one hand, and Modes properties on the other?

To give some examples, are 'taxation of the local population' and 'voluntary contribution' positively related to the 'General' group properties ('group size', 'group size divided by troop size', 'growth rate', 'number of hierarchical levels'), positively to the 'social' group properties ('providing social services', 'installing a law', 'having a social service organization'), and negatively to the 'Imagistic' properties ('number of Imagistic rituals' and 'Imagistic leadership')? Are non-investing Resource types such as 'surface diamonds' positively related to the occurrence of Imagistic group properties, such as the number of Imagistic rituals and Imagistic leadership?

Methods

a) ROI and Risk versus Modes properties

The starting point was the data as generated thus far for this chapter. For the previous research question the 'ROI', 'Risk obtain' and 'Risk lose' (RRR) values were calculated as a percentage per period per group per RRR score ('low', 'medium', 'high') per Reliance weight (that converts the Degree of reliance, like 'substantial' etc., to a number). For this question, these percentage data were condensed one step further by calculating the weighted average of all periods per group per RRR type per RRR score per Reliance weight. That resulted in 9 variables (ROI-low, ROI-medium, ROI-high, Risk-obtain-low, Risk-obtain-medium, … etc.) for 4 Reliance weight scenarios per group. All 9 RRR variables were Independent

Variables to predict all individual Modes variables (DVs). For every Modes variable, one by one, all combinations of the 9 IVs were used in a regression. The regression with the lowest AIC for every Modes variable was assumed to represent the best model fit for that Modes variable, i.e., showed which scores of ROI and Risk could best predict a Modes property. The choice to leave 'low', 'medium' and 'high' separated was to avoid further assumptions on how to combine these into one number. However, up to a certain point one could say that these variables *are* combined because they jointly function as predictors in a regression. The form of the regression depended on the type of the Modes variable. Semi-continuous variables like group size were predicted with a gaussian link function; binary outcome variables, like providing a social organization or not, were predicted with a logistic regression; and count data like the number of Doctrinal ideological properties with a Poisson link function. Spelled out, they were as follows:

DVs: Modes variables

Gaussian	Logistic	Poisson
group size	One or more Doc. rituals	Nr. of Doc. ideol. properties
group size ÷ troop size	Doctrinal leadership y/n	Nr. of Doc. rituals
growth rate	Installs law y/n	Nr. of rare dysph. rituals
nr. of hierarchical levels	Social organization y/n	
nr. of social services	One or more rare dysph. rituals	
nr. of shared neg. experiences	Imagistic leadership y/n	

IVs: ROI, Risk obtain and Risk lose per RRR weight

RRR-scores: 9 DVs:

	low	medium	high
ROI	✓	✓	✓
Risk obtain	✓	✓	✓
Risk lose	✓	✓	✓

Reliance weight: 4 scenarios:

R_1_1_1_1_1 all 9 RRR-scores / DVs, all Modes vars	*R_0.3_1_1_2_3* all 9 RRR-scores / DVs, all Modes vars
R_0.3_1_1_3_5 all 9 RRR-scores / DVs, all Modes vars	*R_0.3_1_1_4_7* all 9 RRR-scores / DVs, all Modes vars

Table 5.6 — The scenarios used to investigate the relationship between ROI and Risk versus the Modes properties.

Again, the regional cluster was used as a covariate in the regression and compared with the uncorrected 'base' scenario.

b) Individual resource types versus Modes properties

Resource types were converted to numbers similar to the description given in the general Methods section of this chapter (and also see Appendix 4), namely first by converting presence or absence of Resource types to dummy variables, then multiplying these 0/1 values by the Reliance weights, and finally multiplying these numbers by the fractional weight for the period(s) per group that the Resource type was present. That resulted in a number on a ratio scale per resource type per group.

These numbers were used for two types of analyses: (i) Spearman's rho, like the analyses of the two previous chapters, and (ii) the same type of regression models as described directly here above (see (a)) for ROI and Risk, but then with the 'numericalized' Resource type data. In principle, the Spearman's correlations are more robust, as they do not need a normal distribution of the variables or the residuals. However, the regressions also have methodological advantages: the metrics for the 'best fit' -in this thesis typically the AIC- is more straightforwardly

usable, and the regressions can deal better with binary (Modes) data (yes/no) when it is used as a dependent variable (DV) in a logistic regression, whereas in a Spearman's rank correlation, 0/1 variables give a lot of ties, which decreases the statistical power. For both the Spearman's correlations and for the regressions, there is the handicap that some Resource types data contain many non-observations (i.e. absence, i.e. zeroes). Again, for Spearman's correlations, that gives a lot of ties —but now on the 'resources' side, which might give double ties on both sides of the correlation—, and for the regressions that gives a skew in the Independent Variable(s) that takes the distribution quite far from normal. Another way to state this is that variation is missing in the (predictor) variable. In the best-case scenario, both methods complement each other, and if it appears that the correlation and regression results are similar, that would be a signal that the findings are (more) robust; if they are notably different, then much more caution should be exerted.

For (i) Spearman's correlations, the resource data were recalculated for autocorrelation in the way as described in the previous chapter (page 191), with a two-step process whereby the first step was a recalculation into an instrumental variable, the second step was the actual analysis — basically a partial correlation. For the Modes data, the instrumental values were already available (see previous chapter). When Resource data were corrected with the geo-cluster covariate, then Spearman's correlation was calculated only with geo-cluster corrected Modes data, not with uncorrected data; and vice versa. In total 8 scenarios were investigated, namely four Reliance weight scenarios and two scenarios for autocorrelation (base and geo-cluster corrected).

For (ii) Regressions, Modes variables were treated as the DV, every 'numericalized' Resource type as IV. The same link functions (gaussian, logistic, Poisson) for the Modes variables were used as specified under (a) ROI and Risk above. There was always only one predictor as IV, namely each Resource type

individually. No combination of more than one Resource type was used here on the IV side, for two reasons: to keep clear to what extent every individual Resource type could predict a Modes variable, and to be able to compare the results with the Spearman's correlations.

Results

a) ROI and Risk versus Modes properties

As mentioned, the approach followed here is to first fit models per Modes variable, then see which model per Modes variable has the lowest AIC, and consider these as the 'best' model, including the p-values of the individual parameters per model. In figure 5.3 and more extensively in Appendix 5, examples are given of which combinations of ROI or both Risks (all split up in 'low', 'medium' and 'high') best predict the Modes properties. These example figures are not necessarily based on representing the overall best predictors, but to give a feel for the underlying data that is presented in condensed form thereafter in figure 5.4. Presented in figure 5.3 is the most basic

	ROI low	ROI medium	ROI high	Risk obtain low	Risk obtain medium	Risk obtain high	Risk lose low	Risk lose medium	Risk lose high
grpsz	0.08						0.09		
gsdts									0.2
grwrt					0.61				
hrchL				0.01	0.01	0.01			
Dideo		0.09							
Drits	0.06			0.01					
Dritb				0.07					
Dlead			0.03						
socsv	0			0.04	0.04	0.04			
law	0.06	0.05	0.05			0.01			
socor		0.19							
lrits	0.03	0.04	0.04	0.02					
lritb				0.04	0.04	0.04			
llead		0.09							
Snegx					0.07			0.07	

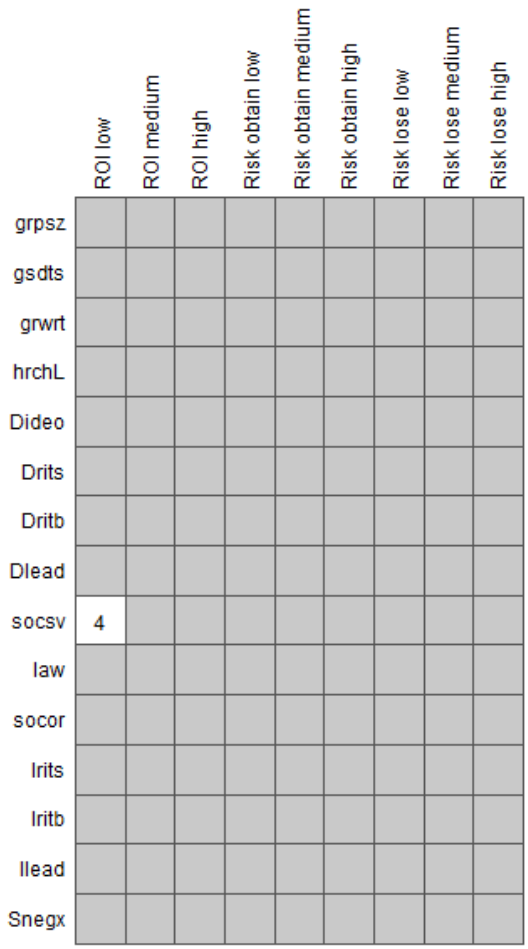
Figure 5.3 — The relationship between Modes variables (rows) versus ROI and Risk (RRR, columns) without corrections for autocorrelation. The most basic scenario is shown: no Holm adjustments, no geo-cluster correction, no increase in Reliance weight (R_1_1_1_1_1). Represented are those combinations of RRR variables that had the lowest AIC per Modes variable, with those RRR variables highlighted in the row that were part of the IVs in the model. The numbers in the cells are p-values of these RRR variables. Dark grey cells: the RRR variable was not part of the model. Light grey: the RRR variable was part of the model with the lowest AIC, but not significant. White: idem, but significant. The abbreviations as used for the Modes variables is the same as in chapters 3 and 4.

variant: no Holm adjustment, no geo-cluster correction, and the same weight for all Reliances.

All Reliance weight graphs considered (see Appendix 5 for several more examples, half of them not shown), a few tendencies stand out. First and probably most importantly, when Holm adjustments are applied, only two IV-DV combinations are significant, and not only significant, but significant in at least three of the four Degree of reliance-weight scenarios (see figure 5.4). The first of these is that low ROI consistently predicts the number of social services provided (β=0.11), the second is that medium Risk-to-lose nearly consistently predicts the number of shared negative experiences, though with a much smaller slope (β= -0.018).

Second, with or without Holm adjustments, there is no single predictor, be it 'low ROI' or 'medium Risk to lose a resource' or any other combination, that consistently predicts either Doctrinal Modes properties or Imagistic Modes properties. In more visual terms, there is no column that is particularly full of 'light grey' or 'white' cells for either of these Modes clusters. There also does not seem to be a case that low ROI typically predicts Doctrinal-related Modes properties, and high-ROI typically predicts Imagistic-related Modes properties.

without correction for autocorrelation



autocorrelation correction with geo-cluster

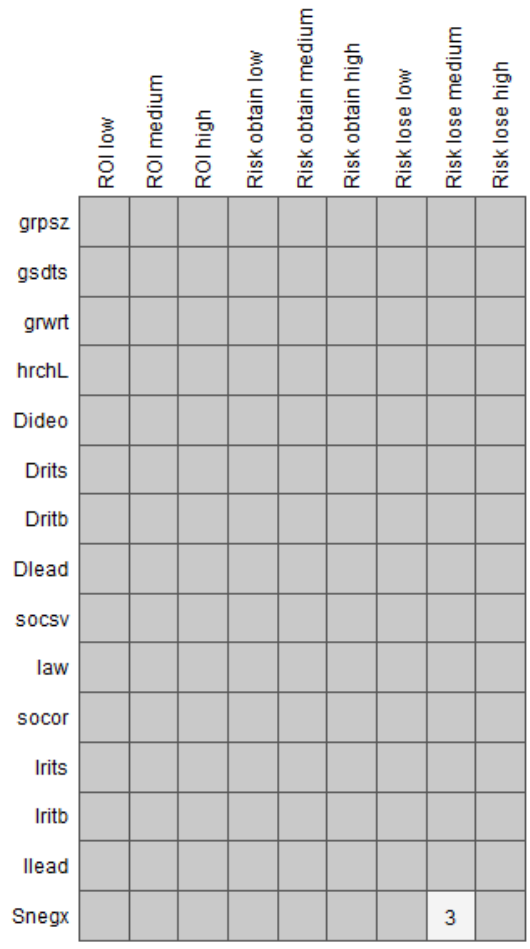


Figure 5.4 — The number of significant predictors per Resource variable per Modes variable after Holm adjustment when all four Degree of reliance weight scenarios are combined.

Third, it seems that IVs being included in the model tend to occur in groups of three; that is to say, quite often all three ROI scores ('low', 'medium', 'high') are part of the best model, and not much else; OR all three Risk-obtain variables, and not much else; OR all three Risk-lose, but not much else (especially apparent in Appendix 5, where several figures like figure 5.3 are placed next to each other). That would not be a contradiction if at least one of the slopes of a set of three was opposite to the rest, for instance, if a positive high-Risk slope and a negative low-Risk slope would predict a higher the value of a Modes variable. However, when a drill-down analysis was done of the underlying slopes, it became apparent that all slopes in such triplets always had the same sign/direction. Moreover, the slopes

often were rather similar in their numerical range. This same sign/magnitude phenomenon is hard to interpret in substantive terms, other than in the vein of "apparently, for some Modes properties ROI in general is important and not much else; for other Modes properties, Risk to obtain resources is important and not much else; and for yet other Modes properties, Risk to lose resources is important and not much else". That could be true, but one still wonders whether it could be a partial artefact of the methodology, including selecting the lowest AIC. Perhaps that if a Modes variable is sensitive to either ROI or one form of Risk, most of the remaining variance is further weeded out by including the two other scores. If that were to be true, then the ROI and Risk variables, that are now split-out into 'low', 'medium' and 'high', might be condensed into one. It needs more research to explore to what extent that can be done, and to what extent these findings are reflecting reality or a methodological artefact.

Fourth, without adjustments for multiple comparison there is some difference between Reliance weights regarding which ROI and Risk variables are part of the best fitting model per Modes variable. This difference is somewhat more pronounced between 'mere presence or absence' of a Resource type (R_1_1_1_1_1) and the rest, than between the scenarios with increasing weight for increasing Degree of reliance (overlap between the last three not shown in the figures). With Holm adjustments and purely focusing on the significant combinations, this difference disappears.

b) Individual resource types versus Modes properties

Individual resource types such as '[sponsoring by a] foreign regime', 'diaspora contributors' and 'booty/looting of civilians' were related to individual Modes properties on two ways: via correlations and via regressions. This section has a look at the correlations (Spearman's), again split out in p-values and AICs.

The next section presents the regressions. As in previous analyses, a multi-dimensional matrix of scenarios was analysed, with corrections for autocorrelations, weightings for different translations of the Degree of reliance to numbers, and Holm adjustments.

i) Correlations

- P-values

One example of such a scenario for the resulting correlations is given in figure 5.5. The point of presenting this figure is simply to give the reader an idea of the underlying numbers in the summaries. Because there were four Reliance weights times 2 autocorrelation corrections, there were 8 scenarios (unadjusted for multiple comparisons); it is not practical to present all of these. It is the most basic of all scenarios (no corrections, no weighting, no adjustments, see figure description):

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	Ilead	Snegx	RelSec
official regime of country	-0.2	-0.11	0.02	-0.09	-0.12	-0.02	-0.06	0.04	-0.27	-0.04	-0.1	-0.16	-0.11	-0.05	-0.2	-0.05
wealthy citizens of own country	0.03	-0.34	-0.03	0.06	0.03	0.15	0.12	0.25	0.01	0.06	-0.01	0.32	0.35	-0.01	0.21	0.03
foreign regime	0.38	-0.19	0.09	0.08	0.12	-0.07	-0.12	0.21	0.18	0.19	0.11	0.34	0.26	0.03	0.18	-0.01
wealthy citizens of foreign country	0.04	-0.18	0.05	0.06	0.42	0.25	0.22	0.06	0.24	0.19	0.3	0.33	0.27	-0.09	-0.07	0.32
diaspora contributors	-0.07	-0.06	-0.02	0.01	0.11	-0.06	-0.08	0.1	0.02	-0.01	-0.05	0.27	0.25	-0.02	0.14	0.09
protection money/extortion of locals	0.12	0	-0.26	0.08	0.02	0.02	-0.09	-0.02	0.02	0.24	-0.09	0.5	0.5	0.14	0.04	0.07
taxation of local population	0.42	0.01	0.2	0.06	0.04	0.24	0.1	0.03	0.36	0.5	0.08	0.27	0.23	-0.13	0.04	-0.06
local support / voluntary contribution	-0.13	-0.13	-0.07	-0.13	-0.06	-0.07	-0.1	0.09	-0.09	-0.03	0.08	0.2	0.23	0.11	-0.32	-0.08
running corporations	0.21	0.16	-0.1	0.25	0.31	0.3	0.2	0	0.45	0.27	0.35	0.37	0.31	-0.19	0.08	0.23
running 'charity' organizations	0.1	0.07	0.15	0.08	0.27	0.11	0.09	0.02	0.24	0.07	0.15	0.05	0.01	-0.21	0.07	0.29
booty/looting of civilians	0.01	-0.12	-0.08	0.04	0	0	-0.17	0.06	0.06	0.24	0.01	0.33	0.31	-0.02	-0.16	-0.08
booty/looting of corporations	0.12	0.1	0	0.26	0.11	0.11	-0.08	0.02	0.29	0.36	0.09	0.31	0.34	-0.18	0.09	0.01
hostage taking	0	-0.05	0.01	0.08	0.18	-0.04	-0.08	0.06	-0.02	0.18	0	0.24	0.25	-0.03	-0.05	0.15
human trafficking	-0.08	-0.02	-0.08	0.07	0.05	0.28	0.13	-0.15	0.02	0.18	-0.16	-0.02	0.03	0.18	-0.2	0.23
drug trade / smuggling	0.25	0.08	-0.02	0.13	0.25	0.22	0.09	-0.12	0.39	0.47	0.19	0.33	0.4	-0.02	-0.04	0.04
weapon trade	0	-0.02	-0.04	0.01	-0.07	-0.12	-0.1	-0.35	0.04	0.31	-0.02	0.24	0.25	0.19	-0.13	-0.05
oil	0.1	-0.19	0.17	0.07	0.12	0.19	0.16	0.18	0.05	0.05	-0.03	0.15	0.13	-0.12	0.2	0.12
surface diamonds	0.45	0.21	0.13	0.04	-0.12	-0.07	0.02	-0.2	0.08	0.12	0	0.19	0.17	-0.01	0.01	-0.13
timber	0.12	0.08	-0.03	0.03	0.02	0.16	0.17	-0.23	0.3	0.39	0.09	0.25	0.28	0.13	0.15	0.06
minerals	0.3	0.15	-0.13	0.16	0.06	0.26	0.18	-0.09	0.3	0.36	0.1	0.27	0.27	-0.01	0.14	0.06
extortion of aid organizations	0.15	-0.19	-0.05	-0.02	0.06	-0.04	-0.11	-0.2	0	0.22	-0.08	-0.12	-0.12	0.09	0.02	-0.1
plantation	0.33	0.08	0.04	0.08	0.07	0.23	0.13	-0.12	0.36	0.37	0.14	0.14	0.11	-0.01	0.1	0.13
war booty - materials taken from the enemy	0.04	0.01	0.08	-0.03	-0.19	0.01	0.09	-0.06	0.09	0.02	0.04	0.18	0.17	-0.02	0.09	-0.11
religious institutions	0.03	-0.02	-0.09	-0.22	-0.04	-0.06	0.09	0.2	-0.15	-0.17	-0.11	-0.12	-0.12	-0.07	-0.14	0.03
trade	0.08	0.09	0.22	0.23	0.07	-0.06	0.09	-0.1	0.2	0.12	0.18	0.18	0.17	-0.07	0.09	-0.11
other armed group	-0.07	0.07	0.01	-0.11	0.09	-0.18	-0.23	-0.03	0.07	0.12	-0.11	-0.12	-0.12	0.01	0.09	0.11
own work / jobs of group members	0.01	0.14	0.07	-0.06	0.04	-0.26	-0.33	-0.15	-0.13	-0.03	-0.12	-0.02	0.03	0.18	0.13	0
taxation of trade route	0.14	0.17	-0.17	0.04	-0.12	0.19	0.09	-0.1	0.2	0.12	0.18	0.09	0.17	-0.07	0.23	-0.11

Figure 5.5 — Spearman's correlations for Resource types (rows) with Modes variables (columns). The numbers are the correlations; white cells indicate a significant correlation ($p<0.05$), grey cells a non-significant correlation. The correlations are not adjusted for multiple comparisons. The scenario is R_1_1_1_1_1 x base, i.e. mere presence or absence of Resource types -though weighted for duration- and no corrections for autocorrelation.

Instead, when these are condensed into one plot whereby all significant correlations of all scenarios are counted per cell, the results are as follows:

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	Irits	Iritb	llead	Snegx	RelSec
official regime of country	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wealthy citizens of own country	0	-1	0	0	0	0	0	0	0	0	0	4	4	0	0	0
foreign regime	4	0	0	0	0	0	0	0	3	0	0	4	0	0	0	0
wealthy citizens of foreign country	0	0	0	0	4	0	0	0	0	0	1	1	0	0	0	4
diaspora contributors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
protection money/extortion of locals	0	0	0	0	0	0	0	0	0	3	0	4	4	0	0	0
taxation of local population	4	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0
local support / voluntary contribution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3	0
running corporations	0	0	0	0	4	4	0	0	4	0	4	4	4	0	0	0
running 'charity' organizations	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4
booty/looting of civilians	0	0	0	0	0	0	0	0	0	3	0	4	4	0	0	0
booty/looting of corporations	0	0	0	0	0	0	0	0	0	4	0	3	4	0	0	0
hostage taking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
human trafficking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
drug trade / smuggling	3	0	0	0	0	0	0	0	4	4	0	4	4	0	0	0
weapon trade	0	0	0	0	0	0	0	-4	0	4	0	0	0	0	0	0
oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
surface diamonds	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
timber	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0
minerals	4	0	0	0	0	0	0	0	4	4	0	3	3	0	0	0
extortion of aid organizations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
plantation	4	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0
war booty - materials taken from the enemy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
religious institutions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
other armed group	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
own work / jobs of group members	0	0	0	0	0	0	-4	0	0	0	0	0	0	0	0	0
taxation of trade route	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 5.6 — The total number of significant correlations between Resource types and Modes properties, summed over all Reliance weights (4 in total) for the base (uncorrected) scenario. When correlations were negative and significant, 1 was subtracted; when correlations were positive and significant, 1 was added. The whiter the colour, the further removed from zero, i.e. the more significant correlations were found for a certain Resource type x Modes property combination. The correlations in this figure were not adjusted for multiple comparisons.

This picture is quite different when Holm adjustments for multiple comparisons are applied (and the geo-cluster scenario is added here as well, to create an overall picture):

	grpsz	gsdts	grwrt	hrchL	Dideo	Drits	Dritb	Dlead	socsv	law	socor	lrits	lritb	llead	Snegx	RelSec
official regime of country	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wealthy citizens of own country	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
foreign regime	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wealthy citizens of foreign country	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
diaspora contributors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
protection money/extortion of locals	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
taxation of local population	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
local support / voluntary contribution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
running corporations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
running 'charity' organizations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
booty/looting of civilians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
booty/looting of corporations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hostage taking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
human trafficking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
drug trade / smuggling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weapon trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
surface diamonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
timber	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
minerals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
extortion of aid organizations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
plantation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
war booty - materials taken from the enemy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
religious institutions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
other armed group	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0
own work / jobs of group members	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
taxation of trade route	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 5.7 — The total number of significant correlations between Resource types and Modes properties, summed over all Reliance weights (4) and both autocorrelation correction (2) scenarios. When correlations were negative and significant, 1 was subtracted; when correlations were positive and significant, 1 was added. No gradient in colour was applied here; white cells are different from 0, grey cells are 0. The underlying correlations were Holm adjusted.

The main result after Holm adjustments is that 'taxation of the local population' is positively correlated with installing a law. To a much lesser degree, having Imagistic rituals (Iritb) is positively correlated with 'protection money/extortion of locals'. Finally, the number of Doctrinal rituals (Drits) is in two scenarios negatively correlated with 'other armed group' as Resource type. No other correlations between Modes properties and Resource types were significant after Holm adjustments.

However, one could argue that the amount of zeroes in the data for some resource types (see table 5.4 on page 250) limits the robustness of these correlations, because they create a lot of ties in the ranking and decrease the resolving power of the correlations.

ii) Regressions

Without corrections for autocorrelation but with Holm adjustments, just one relationship was significant: the 'number of Imagistic rituals' was positively predicted by 'booty/looting of civilians' (β=~0.39, range 0.24-0.60) for three of the four Reliance weight scenarios. This relationship fits well with the Modes theory. This finding disappeared after geographical region was included as covariate (see table 5.7, the number of significant regressions is 0 in those scenarios). In line with the p-values, the AIC of the non-corrected regression was lower than with the geo-cluster correction, so there is an argument to see the significant result of the uncorrected version as meaningful. In addition, the non-Holm adjusted Spearman's rank correlations showed a significant correlation between those two variables in 7 out of 8 scenarios, which is yet another argument to see this result as meaningful.

However, and continuing the comparison with the Spearman's rank correlations, whereas after Holm adjustment the regression between the 'number of Imagistic rituals' x 'booty/looting of civilians' was significant, the

correlation was not. Instead, 'taxation of the local population' x 'installing a law' was significant after Holm adjustments in around half of the correlation scenarios, but not with the regressions as done here. That raises the question how the two types of analyses, broadly speaking, compare. To that end, a numerical comparison was made (see table 5.7). As turns out, the number of (non)significant parameters is quite similar, though in the regressions there was a tendency for a smaller number of significant combinations (e.g. the 'number of Imagistic rituals' x 'booty/looting of civilians'). The number of significant combinations that were actually the same for the Spearman's rank correlations and the regressions could differ quite a bit: For p-values that were not adjusted for multiple comparisons, at least half of the significant 'cells' were different. As indicated, for Holm adjusted combinations, there was no match at all.

Reliance weight	correction	adjustment	# signif. corr	# signif. regress	# both signif.	# different signif.	# both not sig-nificant
R_1_1_1_1_1	uncorrected	<none>	41	43	32	20	368
R_1_1_1_1_1	geo_cluster	<none>	47	39	26	34	360
R_0.3_1_1_2_3	uncorrected	<none>	43	30	22	29	369
R_0.3_1_1_2_3	geo_cluster	<none>	49	35	20	44	356
R_0.3_1_1_3_5	uncorrected	<none>	43	25	20	28	372
R_0.3_1_1_3_5	geo_cluster	<none>	40	33	21	31	368
R_0.3_1_1_4_7	uncorrected	<none>	42	22	15	34	371
R_0.3_1_1_4_7	geo_cluster	<none>	40	32	19	34	367
R_1_1_1_1_1	uncorrected	holm	0	0	0	0	420
R_1_1_1_1_1	geo_cluster	holm	1	0	0	1	419
R_0.3_1_1_2_3	uncorrected	holm	2	1	0	3	417
R_0.3_1_1_2_3	geo_cluster	holm	2	0	0	2	418
R_0.3_1_1_3_5	uncorrected	holm	1	1	0	2	418
R_0.3_1_1_3_5	geo_cluster	holm	1	0	0	1	419
R_0.3_1_1_4_7	uncorrected	holm	1	1	0	2	418
R_0.3_1_1_4_7	geo_cluster	holm	1	0	0	1	419

Table 5.7 — (Dis)similarity of the number of (non)significant results when analyses for Spearman's rho are compared with linear regressions for 16 scenarios (4 Reliance weights x 2 autocorrelation corrections x 2 scenarios for adjustment for multiple comparisons).

Conclusions

Are Modes properties predicted by the ROI or Risk of Resource types?

Overall, it was not found that low ROI typically predicts Doctrinal-related Modes properties, or high-ROI typically predicts Imagistic-related Modes properties. It was also not found that low-Risk typically predicts Doctrinal-related Modes properties, or high-Risk typically predicts Imagistic-related Modes properties. The only finding that supported the prediction was that low-ROI was a strong predictor for the number of social services provided: the more low-ROI Resource types were part of the resource strategy of armed groups, the more types of social services were provided. An oddity is that a medium Risk to lose Resource types is significantly and slightly negatively related to the number of Shared negative experiences. Perhaps this would have been easier to interpret if there had been a positive relationship, because then it could be indicative of a generally instable environment. As for now, this finding is left for what it is.

Are Modes properties predicted by individual Resource types?

Overall, after Holm adjustments, it was not found that any Resource type related to any Modes variable, perhaps with two exceptions: using Spearman rank correlations, 'taxation of the local population' was significantly correlated with 'installing a law'; and using regressions, 'booty/looting of civilians' was a positive predictor for the 'number of Imagistic rituals'. Both are in line with the Modes theory.

This picture changed when no adjustments were done for the multiple comparisons of the Spearman's rank correlations. Overall, the several more combinations that appeared to be significant were mildly fitting to the Modes theory or the PPM theory: the 'number of Imagistic rituals' is positively correlated with Resource types like 'protection money/extortion of locals', 'booty/looting of civilians', and 'wealthy citizens of own country'; and Doctrinal 'social' group properties like

'providing social services' and 'installing a law' with 'taxation of the local population', but also -especially installing a law- with 'booty/looting of corporations' and 'drug trading/smuggling'. Perhaps one could summarize that as a mild support for the Modes and PPM theories, though not overwhelming.

As a methodological side point, again, it appeared that the scenario with 'mere presence or absence' of Resource types gives somewhat different results compared to other weightings of the Degree of reliance.

Discussion

Recapping the results

One of the substantive results of this chapter, that is perhaps not directly Modes or ROI or Risk related, is that the Resource types that are most frequently used by armed groups are population based, and are not based on tradable material goods like timber, diamonds, drugs or similar. The two Resource types that are used by just about every group are based on the population in the immediate surrounding, one voluntary, one forced ('voluntary contribution' and 'looting of civilians'). As it turned out, using regressions, 'booty/looting of civilians' was a positive predictor for the 'number of Imagistic rituals' even under strict conditions for significance (Holm adjustments). However, 'voluntary contribution' was not related to any Modes property; if anything, it was negatively correlated to the 'number of shared negative experiences'.

Despite best efforts by using a range of scenarios to find positive results for the predictions derived from theory, there were not that many. Neither for ROI nor for both Risk types there was convincing evidence of change over time, although there was some evidence that there is a gradual shift towards utilizing Resource types

with a higher Risk to lose these. For associations between ROI and Risk and individual Modes properties, the one result that was both robust and interpretable was that low-ROI was a positive predictor for the number of social services. This fits well with the Modes theory. It is unsure whether it is a substantive result that the medium Risk to lose resource types significantly predicted with a small negative slope the number of Shared negative experiences. Lack of theoretical interpretation combined with the small slope would indicate this is a result that should not be emphasized too strongly.

For associations between individual resource types on the one hand and Modes properties on the other -supposed to be the freest of assumptions- there seemed to be moderate support for the Modes theory. The two results that stood out after Holm adjustments were, on the Doctrinal side, that 'taxation of the local population' is positively correlated (Spearman's) with 'installing a law', and on the Imagistic side that 'booty/looting of civilians' positively predicted the 'number of Imagistic rituals' in a regression. Without adjustments for multiple comparisons, different resource types did significantly correlate with various Modes properties, but the match with the Modes theory was mixed.

All in all, the findings did suggest there is no convincing change in ROI or Risk over time, and no general patterns of associations between Modes variables on the one hand, and ROI and Risk or individual Resource types on the other. At best there were a few cases of a (Holm-significant) correlation, association or prediction — which, it must be said, then tended to be in line with the Modes or the PPM theory.

Methodology?

As usual, one could see these results as reflecting reality, or ask some critical questions about the methodology. If it is assumed that the results reflect reality, then the conclusions are as given above. If the methodology is to be critiqued, then perhaps the following three points that are specific to this thesis' methods can be highlighted:

- Is the assessment of ROI and Risk per resource type valid?

  As explained in the introduction, it is very hard to measure ROI and Risk directly. Hence, a crude proxy was used: first register the Resource types, and then assess per Resource type what the ROI and Risks would be. This conversion was given in a table, along with the reasoning behind the conversions. One could of course dispute these conversions, for instance, by arguing that local circumstances influence ROI and/or Risk per resource type, or in general, disagree whether such-or-so Resource type really has a medium Risk to obtain, etc. That is fine, and critique is welcome. Probably, the issue will never be fully resolved if the specific form of one type of ROI/Risk per one Resource type is maintained; there are so many different local circumstances that there are always grounds to disagree. Hence, it makes sense to include local circumstances and other refining parameters, as argued already -though in a limited form- in the introduction. GIS based analyses, such as used in (Skali 2017), and corrections for competition by other actors are important candidates to include in the model.

- Is the weighting via Reliance weight valid?

  Resource use was scored in the dataset via the 'Degree of reliance' per period. It seemed plausible to attach more weight to, say, substantial use of a resource type than minimal or even moderate, leave alone rumoured. Yet, how much more or less weight every Degree of reliance should get is arbitrary. Hence, the approach was to say: it's unknown, so let's do a range of values, to see whether different weightings have any effect at all and if so, how much. It appeared that different weights did not have much effect. Nonetheless, one could argue that those weights were perhaps not realistic, and rather than using, say, an increase from 1→4→7, it should have been 1→40→200 (or whatever else), and *then* various effects would have been clearer. That is perhaps true, but it is left to other researchers to prove the point. This assumption is probably less influential than the previous assumption.

- Are ROI and Risk fruitful concepts?

Finally, one could also wonder whether this whole project of assessing ROI and Risk is worthwhile. The results so far have not been very promising. For those positive results that were there, they were perhaps more related to actual Resource types than to ROI and Risk —for instance, the overall most used Resource types were population based, and there appeared to be associations between taxation of the local population and installing a law— and certainly the analyses directly applied to the Resource types rather than to the derived ROI and Risk contained fewer assumptions and can therefore more directly count as empirical results. Yet, it is hard to conceive that resources play no important role in the dynamics of (armed) groups. As mentioned in the introduction, there is a vast literature on civil war, armed groups and resources (see e.g. Ross 2004; Humphreys 2005), and a rather intense discussion has taken place in the literature about armed groups as predator organizations (Collier and Hoeffler (2000) and ensuing literature), how armed groups are structured by available resources (e.g. Weinstein 2005), the political economy of war and terrorism (e.g. Le Billon 2001; Enders and Sandler 2006; Thies 2010; Vittori 2011; Wittig 2011), resources and chances on peace making (e.g. Beardsley and McQuinn 2009; Maphosa 2012) and other publications on the nexus of resources and armed groups.

Hence, perhaps the effort to research resources in relation to group structure is best spent on other concepts than ROI or Risk. Some suggestions will be advanced in the next chapter (the paragraph on Resources).

Chapter 6 — Discussion

This concluding chapter of the thesis first lists the contributions of this research. Following on from that, suggestions will be made for researching armed groups as a direct extension of the current study. Yet, a critical evaluation of some aspects of the Modes theory will be given, and that could mean the research will go in a different direction. Leading in this discussion are questions like: How did the Modes theory change in the last few years? Are the changes in the Modes theory plausible and fruitful? What should be the empirical evidence if the Modes theory is to be tested?

Later in this chapter, some questions will be asked about how to understand the Modes theory, and depending on the answer, suggestions will be made how to empirically research the Modes theory, or even human culture at large. Future research could take an entirely different approach than the one followed in this thesis. However, for the next section it is assumed that if the research will continue in the way as set out in this thesis, then the listed alterations and additions are important candidates to take into consideration. These are grouped in the broad themes of investigating (Imagistic) subgroups, improving the data quality, extending the current research beyond modern-day armed groups, expanding "Galton's asset", doing more targeted research on the link between group structure and resources, and expanding the database to become a data hub on war and peace.

Improvements of the current research

Some reformulations of a few questions in the question list (see Appendix 1) would improve the understanding of experts or encoders. For instance, as mentioned

in chapter 3, the frequencies of some of the rituals seem to have been interpreted colloquially. A more precise explanation would have been helpful. However, for brevity and to be able to concentrate on the more fundamental issues, such reformulations of the questions in the question list are not spelled out here. What is also assumed without much further ado is that 'bigger is better': more cases (armed groups) in the database would be desirable, especially from South America and the Far East, and some group-dense countries like Myanmar and Syria.

1. More Imagistic data

This research investigated whether the two Modes are present at the level of the entire armed group. One of the findings was that there was not much convincing evidence that the Imagistic Mode was present at that level in the sample of this research. Maybe that was because of methodological issues. To take away that doubt, two suggestions beyond reformulation of some questions are made here.

First, as discussed at some length in the second chapter that dealt with construction of the dataset, there could be an over-emphasis on large, successful and perhaps thereby Doctrinal groups. There is also an indication that a same skew regarding documenting larger and more prominent, possibly more Doctrinal, groups more often may have occurred in the context of Melanesian cargo cults (Whitehouse 2000). Hence, finding a way to record smaller armed groups that still have a considerable lifespan (i.e. are apparently well adapted) is desirable. Exactly how to do that should be worked out probably in conversation with domain experts.

Second, in some instances the Modes theory discusses that particularly that subgroups or splintering groups are organized along the lines of the Imagistic Mode (e.g. Whitehouse 2004, 194; Whitehouse et al. 2012). That, added to the fact that splintering amongst armed groups is a frequent occurrence (Bakke, Cunningham, and Seymour 2012; Tamm 2016), could recognize the possibility that the Imagistic Mode may be found amongst subgroups. For instance, are platoons the tightly-knit

groups that have highly arousing, but low-frequency rituals? Do they have shared negative experiences more often as a subgroup than as an entire group? Collecting data on subgroups is suggested here.

2. Improve data quality

A suggestion from the experience of this research is to find more than one expert per group to create more reliable group profiles. In addition, the suggestion is to create panels to make assessments of the conversions used in this study more reliable as well; most notably the conversions from ritual type (e.g. 'military training/drills') to emotional arousal, and -if one wants to continue with this concept anyway- from Resource type to ROI and Risk.

3. Generalizing the research beyond modern-day armed groups

If it is true that the Modes theory is a general theory on the organization of human groups, then it must be possible to find the Modes in different types of societies as well. An ethnographic encyclopaedia (such as eHRAF) could provide a sample of historic non-pacified societies. For these groups, the ethnographic literature can be encoded in a way that strongly resembles the variables used for the NSAGs. This enables a comparison of groups in modern-day civil wars with warring groups before they were (strongly) affected by modern Western influence.

4. Galton's asset

The research on "Galton's asset" could be further expanded by investigating whether modern non-state armed groups are in one way or another a successor of historic societies such as mentioned in the previous point. For instance, Aceh has been a troublesome part of Indonesia already under Dutch colonial rule. The GAM can be seen as a successor to such insurgencies. British colonial rule had difficulties

administering various kingdoms that are now regions of Burma, like the Karen and the Mon. Is there an ongoing link between historic non-pacified societies and modern-day non-state armed groups? Or to give another example, in a recent study (Skali 2017) it was found that the prevalence of moralizing Gods in ancestral belief systems of individual ethnic groups in Africa prior to European contact were a significant predictor of conflict prevalence and the number of casualties once there was a conflict. Can that be found worldwide? Could eHRAF be used to study this further?

One of the ways in this study to address relatedness between groups was based on categories, namely world region. Yet, data on other important categories could be collected, notably the type of ideology (e.g. Islam, Marxism, etc.) to investigate whether they can predict autocorrelation.

The two main research questions of this research are to find whether the Modes as described in the literature can be found amongst non-state armed groups, and whether the type of resource extraction relates to the Mode of organization. Hence, there are two domains of data: group properties, and the type of resource extraction as related to group properties. Whereas group properties on their own might not be that much influenced by doing business with another group, leave alone getting supplies from another group, for resource extraction that might be an entirely different game: the resource related relations 'did business with' and 'got supplies from' are probably more important in that context. Hence, depending on the research question, the research on Galton's asset can be improved by giving the different relation types different weightings.

Some work has been done "to assess the relative contributions of distinct types of cultural transmission processes to generating the autocorrelated trait distributions commonly found in cross-cultural data" (Dow and Eff 2008, 149). That was expanded in this study by investigating the influence of no less than 17 relation types between armed groups. However, more is possible. For instance, in the current research, the 'weight matrices' only recorded resemblance between groups, and

cultural transfer was inferred in an abstract sense by Moran's I. Yet, when time or direction are taken into account (both recorded in this research's dataset) then cultural flow can be modelled much more accurately. Visualisations can be made that show whether groups of a certain ideological type are more connected than others. The relationship between various forms of networks can be investigated (via e.g. the Mantel test), and the relation types can also be linked to various types of resource extraction. In addition, network parameters such as kernel density, modularity, centralization indices, etc. could be calculated, and flow of information could be charted. Software such as the R package suite `statnet` (www.statnet.org) can be helpful in this, as well as applications such as `Pajek` (http://mrvar.fdv.uni-lj.si/pajek/).

5. Resources

First, it might be fruitful to add to the dataset which resources are actually available to the group in its environment. Pure availability seems to be one of the primary determinants which resources a group can use, hence, what type of resource extraction a group can engage in or adapt to. However, whether this addition is always useful may be questioned to a degree. In this research (as discussed in Chapter 5), the top five resources that groups were using were found to be stemming from the population, be it voluntary or coerced, be it locally or in diaspora. Of course, one could see 'the population' as a resource, but certainly when 'the population' is in the form of diaspora contributors, then 'the environment' can be as wide as the world. Hence, mapping resources has certain nuances to take into account, and pure geography might not be sufficient. Probably it is especially useful for tradable goods. In addition, the population as resource can be seen as more endogenous, tradable goods as more exogenous. This may have bearing on the models used to understand resource extraction. Moreover, this seemingly simple finding that the top 5 of resources is population based, and only from place 9 and onwards there are tradable

goods, may be a valuable addition in the discussion about whether armed groups should be seen as resource extractors with mainly economic aims, or whether they represent something more.

Second, as briefly indicated in the introduction, there is a sizable and ever-growing literature on especially resources and civil war, but also resources and armed groups. This study took the Modes theory as vantage point, but it might not go amiss if more explicit links are made to existent literature from the Conflict Studies branch. For instance, Reno (2007) explains that when there is mutual goodwill between the local population and the militia leaders, this is in a situation where group leaders could not enjoy state patronage, and hence one of the leaders' best bets is to stand on good footing with the local population. The level of state patronage, on its turn, is explained by distance from the capital and historically grown government structures (e.g. as the result of the system that a colonial regime installed, etc.). If that were to be true, then in a way armed groups do not adapt to the type of resources, but ultimately to government type, which is a social construct. (Continuing with speculations along those lines, that would suggest that the biggest selection force on the structure of human societies is other human societies — discussed in more depth later in this chapter.) Quite similarly, Dowd (2012) states that

> "militia groups may be in a position to operate with a greater degree of impunity than rebel groups, owing to the fact that they do not seek to establish a regime in the long-term. This may render them less reliant on popular support, and thereby less concerned with the implications of civilian casualties. Further, militia groups are typically associated with particular national or local elites as a source of funding and support: this may have broader implications for the politics of patronage within states." (p. 10)

and also Tamm (2016) highlights the importance of specifically state sponsorship for the cohesion of armed groups:

> "[A]llocation of external resources affects the intra-group distribution of power between rebel leaders and their internal rivals. S[tate s]ponsors that help maintain an imbalance of power in favor of the leader foster cohesion; those that help flip the imbalance in favor of a rival increase the likelihood of an internal coup within the group. Only when [state] sponsors contribute to a shift from an imbalance of power to balanced power is the rebel group more likely to split into competing organizations." (p. 1)

Questions that could follow for the Modes research could include: Is the type of state sponsorship more important for cohesion than rituals or ideology? Should the political system of resource distribution also be included in the dataset? Is the group type different when the system of colonial rule was different? Does distance from the capital indeed relate to the type of group one can find in violent conflicts?

Lacking in the current study are data on changes over time in group organization and behaviour. It would give stronger causal claims if the time sequence on the group organization side (here: Modes variables) can be measured as well.

Finally, the current method of investigating the link between resources and Modes properties could be applied to other contexts than NSAGs as well, to get a clearer picture how generalizable some patterns are.

6. Comparison with other theories

As stated in the introduction, the focus of this thesis was how well the Modes theory would fare when tested on its own terms in the context of armed groups. However, it can be useful to compare the Modes theory to other theories on the structure and dynamics of armed groups. One candidate theory that stands out in particular is the theory of Weinstein (2005), because it also aims to explain group structure as a function of the type of resource extraction. Like Beardsley and McQuinn (2009) and Whitehouse and McQuinn (2012), Weinstein discerns resource-rich versus resource-poor environments. Just like the Modes theory, he links the types of resources to the development and behaviour of a group: resource-poor environments result in groups with self-restraint and reasonable responsibility towards the local population, resource-rich environments the opposite. Yet, Weinstein (2005) explains the different group behaviours (p. 600) on basis of how different availability of resources attract different types of recruits. In addition, he argues (p. 601) that rebel leaders face an information asymmetry when they want to discern between committed and non-committed recruits. What empirical test(s) would show which

theory is more probable, provides better predictions, gives better understanding, and in which circumstances: Weinstein's theory or the Modes theory?

First, there is a difference in types of groups that are included in both theories. Weinstein assumes that "rebel leaders have an overriding goal—the capture of state power over the entire country or part of the national territory." (p. 604). Hence, as he remarks himself in a footnote, "the model applies to the classical case of insurgency[; it] does not apply to movements organized with genocidal aims, state-led militias, or terrorist groups that demonstrate no interest in territorial control." (p. 604). And probably local defence groups could be added to this list. So, to make a commensurable comparison, the Modes groups should be subsetted to groups with territorial objectives only. And although one could wonder how much is explained by Weinstein's model when he excludes so many group types, it still remains to be seen whether the Modes theory is applicable to all types of armed groups as well. So that could be the first test: to what extent is Weinstein's theory applicable outside of 'classical insurgent' groups, and to what extent does the Modes theory differentiate within 'classical insurgent' groups, or all they all Doctrinal? Can both theories take each other's strengths on this point?

Second, Weinstein focuses on recruitment as a filter mechanism why group members stay in the group; the Modes theory focuses on ritual to explain why group members who are part of the group already stay in the group. Weinstein argues that rebel groups can select the right recruits in three ways: 1. Gather information about past behaviour of the recruits; hereto, rebel groups "establish links within the communities in which they operate that enable them to collect information about potential members" (p. 606). 2. Proposal of current, credible members of new recruits (vouching). 3. Costly induction; e.g. a sustained period of indoctrination and study of the group's ideology, or e.g. joining an attack unarmed. Although this third point does not discern the two theories strongly, the first two might; and although the first two are not conflicting with the Modes theory, they still are specific

predictions of Weinstein's theory and finding empirical support for specific predictions is generally seen as an argument in favour of as theory. So can these two mechanisms to find quality recruits be observed in the field? Moreover, Weinstein states in a footnote that coerced recruitment is possible, as "coercion tends to emerge as a strategy in contexts where the resources necessary to continue providing payoffs are cut off or where a sufficiently strong movement aims to limit the number of members to whom it needs to distribute rewards". That seems a difficult statement to test, but resources being cut off can be traced. Does coerced recruitment increase? Again, the prediction might be seen as sufficiently specific that when corroborated, it is an argument in favour of Weinstein's theory.

Third, and related to the previous point, Weinstein states that group leaders have an information problem when it comes to new recruits (see previous); the Modes theory assumes that groups can have an information problem when it comes to both recruits and existing group members and try to mitigate that problem with rituals, especially high-frequency / low-arousal rituals. A test could be whether there is an association or no association between the type of rituals and who is undergoing these rituals: recruits only, or all (rank-and-file) members? This is especially discerning in a resource-poor environment, because in a resource-rich environment the Modes theory might also predict that the rituals are not only high-arousal but also low-frequency, especially initiation rituals.

Fourth, Weinstein's mechanism for explaining cohesion seems to be the aggregate of individual desire for economic gain; the Modes theory explains cohesion by common rituals and shared negative experiences. It seems difficult to test a form of aggregate desire for economic gain or to create a measurement for self-sacrifice, and 'cohesion' seems not to have been operationalized in both theories, but for instance the rate of desertion could be linked to a prospect for -or estimates of actually obtained- economic gain, versus the intensity of rituals and/or shared

negative experiences. The current research has shown that it is in principle possible to gather data for the last two parameters.

Fifth, Weinstein presents participation in a rebel organization generally as a free choice; the Modes theory neither assumes nor denies free choice. Asking (former) group members could shed light on the issue here, but also data on whether and in which circumstances group members are coerced to join or not. That said, Weinstein can maintain that group members were coerced to join because leaders did not want to share all the spoils of war, or because there was a context where resources were cut off and leaders still wanted new group members.

Sixth, Weinstein gives a bigger role to rebel group leadership that does the recruiting; in the Modes theory, rebel group leadership plays no explicit role in Imagistic groups and in Doctrinal groups leadership is mainly engaged with proselytizing. Are there strong single leaders of groups in a resource-rich environment? Are there Imagistic-like groups that do explicit recruiting? What do the leaders do in both circumstances? And in resource-rich and -poor environments?

Seventh, Weinstein reasons that resource rich groups attract —no, are 'overwhelmed by' (p. 603, 605)— opportunistic recruits who do not commit to group objectives, and that resource poor groups attract committed recruits with long-term goals; the Modes theory assume that those groups that have a fitting ritualistic Mode with regard to their resource extraction have committed members whereas groups that have a misfit in their ritualistic Mode with regard to their collective action problem do not have committed members or at least don't survive in the end. Can we find the sequence `different resource availability` ➔ `presence or absence of ideology` ➔ `recruitment`? Whereby group members disengage with the group when the resources decrease? Or is it rather (or just as much) `group originating with a certain ideology` ➔ `different resource use + different recruitment`? And can we find a consistent pattern between resources and group type, whereby there is a higher rate of extinction of resource-rich + Doctrinal groups,

and resource-poor + Imagistic groups? Can we find a relationship between resource-richness (here: the type of resource extraction) and the number of potential recruits / growth rate, or between all other properties of the Imagistic or Doctrinal Mode and the growth rate (Imagistic: none or low, Doctrinal: high)?

Eighth, according to Weinstein, ideology may be as broad as "ethnic or class solidarity, nationalist sentiments, and local community ties to identify the recruits and resources necessary to effectively challenge the government" (p. 599). The Modes theory, on the other hand, sees ideology as an intricate, logically coherent doctrine, taught on a frequent basis, and would categorize 'local community ties' as being linked to Imagistic practices and fusion type of feelings or (in the latest increment) to 'ethnic psychology'— though it must be said, perhaps the 'local community' is quite sizeable in Weinstein's conception, as he is thinking about secessionist movements, not village defence groups.

Ninth and finally, Weinstein states that "[i]n resource-rich contexts, groups that organize around social linkages are crowded out as opportunistic insurgencies emerge quickly and gain the dominant position." (p. 605), suggesting he sees a form of group selection, whereby resource-rich groups get the upper hand. The Modes theory on the other hand would predict that in resource-rich environments all subtypes of Imagistic groups can get the upper hand, including the ones —perhaps especially the ones— organized around social linkages. Can we find groups based on social linkages that operate in a resource-rich environment? Are they predominantly Imagistic or not? Do they tend to be outcompeted or not?

7. Creating a data hub on war and peace

This study used mainly newly collected data. However, as indicated in Chapter 2 (Methodology), where necessary and possible, gaps were filled with third party

data. Using third party data, and even expanding the breadth of the dataset, could be taken a few steps further.

First, the agreement and consistency between various datasets could be tested. To give some examples, 'having a political wing (y/n)' could be tested against the same variable in NSAEX (Cunningham, Gleditsch, and Salehyan 2009); 'group size' against UCDP (Uppsala Conflict Data Program n.d.) and NSAEX; 'having a central command' (part of 'Doctrinal leadership') against NSAEX; various resource data against various resource databases, e.g. NSAEX (governmental support); 'outcome of the conflict' against NSAEX; language and race against CDC (Bartusevičius 2016).

Second, several other studies that deal with group conflict have been carried out. It is a quick win to utilize those data and use those extra variables as correction factors or additional hypothesis testing.

Third, armed groups were studied in relative isolation in the current research. However, armed groups have a (social) context: often they are representing an ethnic group, and ethnic groups reside in one or more countries. One could for instance investigate to what extent different ethnic groups with different values, rituals, culture, language, organization etc. within one political unit (state) increase the probability of civil war. Another option is to see the relation between the level of the ethnic group and the state as one of multi-level selection, which gives empirical input to evolutionary hypotheses regarding this aspect (see further below).

Fourth and most importantly, combining all disparate (academic) datasets around the world into one consistent, purged, unified grand database would stretch beyond the research directly related to this study or the Modes. Such a database would enable the entire research community to see the bigger picture, to do better controlled research on their own subject of interest and to maximize the return on investment. The database as created for this study is an excellent starting point for that; it already linked a few datasets in such a consistent, purged and unified way.

Nothing except lack of funding would prevent continuing that process and create a public good: a data hub on armed conflicts around the world.

Evidently, more expansions and directions are possible, but the above list seems to fit well to the research done in this study and to available literature. However, future directions also depend to a large extent on what one holds the Modes theory to be. This will be the subject of the next section.

Modes theory: *Quo vadis*?

At the moment of this writing, the Modes theory has a history of more than 20 years. What has remained constant in these decades is the component that rituals gravitate towards the two types low-frequency high-arousal (LF/HA) versus high-frequency low-arousal (HF/LA) rituals. Yet, the overall goal of the Modes theory and what it aims to explain seems to have shifted over the years. Some of the most important apparent changes, a critical evaluation and the consequences thereof will be discussed in the remainder of this thesis.

Is it a theory of religion?

As noticed in the theory chapter, the original context in which the Modes theory was developed was religion. Indeed, the first sentence of the Introduction of one of the main publications that set out the entire Modes theory ("Modes of religiosity", Whitehouse 2004) states: "This book sets out a testable theory how religions are created, reproduced, and transformed". Many if not most publications on the Modes explicitly referred to religion (emphasis added here): "Inside the cult: *Religious* innovation and transmission in Papua New Guinea" (Whitehouse 1995), "Arguments and icons: divergent modes of *religiosity*" (Whitehouse 2000), "Ritual

and memory: towards a cognitive anthropology of *religion*" (Whitehouse and Laidlaw 2004), "Theorizing *Religious* Past: archaeology, history, and cognition" (Whitehouse and Martin 2004), "Modes of *religiosity*: a cognitive theory of *religious* transmission" (Whitehouse 2004), "Mind and *Religion*: psychological and cognitive foundations of *religiosity*" (Whitehouse and McCauley 2005), "Modes of *Religiosity* at Çatalhöyük" (Whitehouse and Hodder 2010), "The cultural morphospace of ritual form: Examining Modes of *religiosity* cross-culturally" (Atkinson and Whitehouse 2011), "The role for simulations in theory construction for the social sciences: case studies concerning Divergent Modes of *Religiosity*" (Whitehouse et al. 2012), "Explaining Ritual" (Whitehouse 2012) in the book "A new science of *religion*", a contribution to the book section "The Cultural Evolution of *Religion*" (Bulbulia et al. 2013), "Modes of *Religiosity* and the Evolution of Social Complexity at Çatalhöyük" (Whitehouse et al. 2013), and "Explaining *Religion* and Ritual" (Whitehouse 2015). The Modes theory, then, was entirely rooted in the idea to explain the existence and working of religion.

Religious Modes and Armed groups

Suppose we were to remain for now with the idea that the Modes theory is a theory of religion. What type of research would follow if armed groups were studied? Suppose, for instance, that armed groups have negatively arousing practices; let's take the example of the ones used in this study: 'humiliation', 'disgust', 'being subjected to pain', etc. If we were to take the original theory face value, can we expect 'Spontaneous Exegetical Reflection' (Whitehouse 2004; p. 72, 84) as a consequence of these rituals? (Also see Jong et al. 2015; Kavanagh 2017; Whitehouse et al. 2017 for empirical findings regarding this outside the context of armed groups.) Or that the experiences are not verbally transmitted but are communicated in 'opaque, cryptic allusions and mythological narratives' (Whitehouse 2004, p. 117)? And that if an exegesis of these experiences is verbally transmitted, it is restricted to experts only (*id*., p. 72)? Should we expect that when these

experiences are remembered episodically, that each participant remembers who else went through the ritual with them (*id*., p. 73)? Should we expect that there is a belief amongst groups that perform low-frequency high-arousal rituals —in the form of rites of terror— that such rituals are believed to be essential for the continuation of the world of the groups that perform these rituals (*id*., p. 120-2)? Etcetera. As for the Doctrinal Mode, can we find that in most Doctrinal groups a repetition [of ideological teachings] can lead to reduced levels of motivation (labelled 'tedium effect') (*id*., p. 66, 87) and splintering of the group? Can we find differences in the 'tedium effect', and find that the larger the 'tedium effect', the higher the likelihood that major innovations occur (Whitehouse et al. 2012, 194)? That major innovations increase the chance that splinter groups will be formed (id., 194)?

If the answer to much of this is 'yes', then that can be a sequel to the current research as well. In general, although the Modes theory seems to have done away with its religious outlook —more on that below— it might be slightly too quick to discard the link between religion and armed groups altogether. To give a broad intuition why: First, many wars were instigated (partially) for religious reasons in the more distant past, for instance, in Europe alone there were the Crusades, the 1066 invasion of Britain, 80-years war of the Dutch Republic, 30-years war of Western Europe in the 17th century, the Civil War in Britain around the same period, etc; second, there are reasons to believe that religion is an evolutionary adaptation for war (D. D. P. Johnson and Reeve 2013); third, in modern conflict studies, duration of the conflict has been positively linked to the religiousness of it (Svensson 2007; Sheikh et al. 2012; Isaacs 2016), and incidence of war and the number of casualties positively linked to the existence of moralizing gods prior to European contact in Africa (Skali 2017). Such examples suggest that religion is meaningful when studying group conflict; hence, if the Modes theory wants to say meaningful things about group conflict, it may be a loss if the religious aspect is foregone. Yet, one could think that even if the Modes theory keeps its aim to explain the dynamics of armed groups in

terms of religion, it is still not the most fruitful way to study those dynamics. For example, there is evidence that splintering is the result of competing leaders and already existing differences regarding ideology or tactics, not the tedium effect (examples in Clark (1984) for the ETA, a more general theory in Tamm (2016)). In addition, the Modes theory, in its original religious form, concentrates on internal religious dynamics, not on broad out-group conflict. The internal dynamics focus on questions mentioned above, but especially if the answer to much of these questions is 'no', then the open-ended question can be raised which parts of the original Modes theory are no longer applicable, or even in existence?

Losing my religion

Around the start of the second decade of the 21st century, the Modes theory seemed to make a fairly big shift. Initially, the idea was that there were precisely two and only two Modes because human beings have precisely two types of long-term memory: episodic and semantic memory. They are, so was the thought, the basis for the Imagistic and the Doctrinal Mode respectively. Yet, after the publication of "Ritual and Memory" (Whitehouse and Laidlaw 2004), "Theorizing religious past" (Whitehouse and Martin 2004) and "Modes of religiosity" (Whitehouse 2004) —all in 2004— the emphasis on memory has decreased, albeit that the two types of memory (episodic and semantic) are still associated with the two distinct Modes (Imagistic and Doctrinal, respectively). Yet, the idea that there are two and only two Modes, and the explanation why, is now predominantly based on the idea that there are two psychological propensities that create two types of social glue: 'fusion' for the Imagistic Mode, and 'group identification' for the Doctrinal Mode (e.g. in Whitehouse 2013b; Jong et al. 2015).

One of the main publications to expound this more cohesion-based version of the Modes theory is that of Whitehouse and Lanman (2014), "The ties that bind us", with an update in Whitehouse et al. (2017), "The evolution of extreme cooperation

via shared dysphoric experiences". In Whitehouse and Lanman (2014), the authors criticize the conflation of sociological phenomena (e.g. repressive sanctions) with psychological phenomena (e.g. collective consciousness) and argue that both 'ritual' and 'cohesion' should be made more precise by breaking it up "into distinct, empirically tractable phenomena with particular effects on cohesion and cooperation", a process labelled 'fractionating'. In a section titled 'Cohesion' they do not really specify what cohesion is or what they take it to be, but instead work towards the difference between 'fusion' and 'group identification', and it can be inferred that the behavioural aspects of these two concepts are what they see as 'cohesion'. Regarding 'fusion', they argue that it is a psychological state with behavioural outcomes such as prompting the same defensive reactions as a personal attack or an attack on one's kin, and a significant willingness to sacrifice oneself for one's group. They contrast this with 'group identification', whereby individuals merely feel that they share certain prototypical features with other group members that are not essential to their individual, personal identities, whereby people who are identified but not fused "learn, follow, and enforce the social norms of larger, more anonymous communities and benefit from the cooperative dividends such norms provide, especially in times of uncertainty and threat". Whitehouse and Lanman argue that fusion is based on psychology of kin-recognition: whilst human beings cannot directly sample genes of others, it is possible to use proxies to know who is genetically related, such as having a shared history and having shared experiences, like one would have with siblings. Impressive, highly-arousing rituals can 'hijack' the kinship psychological propensities, by triggering episodic memory in a way that growing up with siblings would do, and such rituals can be perceived as a very meaningful experience in one's life. Other people that are present during those rituals and especially co-experience these rituals, so they argue, are placed in the same category as kin. Another way to trigger such kinship fusion is via shared negative experiences, such as can be experienced during war. In contrast, 'group

identification' is thought to be linked to 'coalitional psychology'. However, they write, "evidence suggests group identification is relatively weak in producing the extreme pro-group behaviours we see in war, suicide terrorism, and other forms of costly altruism" (p. 678). Nonetheless, it is possible that individuals are willing to sacrifice themselves "to further the interests of large-scale anonymous communities, such as nation or world religion" (p. 678) which could be the result of 'extended fusion', whereby relational ties can be projected to relatively large collectives without personal relationship. Regarding rituals, 'group identification' can be enhanced by performing frequently repeated rituals with "low levels of dysphoric arousal but heavily emphasizing credibility-enhancing displays for beliefs, ideologies, and values" to "produce at least baseline levels of group identification and thus sufficient trust to cooperate with strangers or relative strangers in ways required by centralized and often expansionary systems of governance, trade, and agriculture". Whitehouse and Lanman state that:

> "The fact that there are two modes of ritual cohesion is no accident. Viewed within an evolutionary framework, different societies require higher or lower levels of fusion or identification to fulfil their basic material and economic needs in diverse resource environments (Whitehouse and Hodder 2010; Whitehouse and McQuinn 2013), and the two ritual packages evolve, through a process of cultural group selection, to produce the required levels of fusion or identification" (p. 679).

They theorize that the 'fusion' rituals and dynamics reduce the risk of defectors in a high-risk environment like hunting big game and warfare, whereas the 'group identification' rituals reduce the risk of defectors in an environment where trust is required for taxation, large-scale farming, and a complex division of labour. Their "claim is that the two ritual packages evolve to support particular resource-acquisition strategies perhaps through a process of cultural group selection". This is supported by empirical evidence, such as the finding of an inverse correlation between rare, dysphoric rituals and levels of agricultural intensity (Atkinson and Whitehouse 2011) in pre-state non-pacified societies, and a broad picture that has

emerged from archaeological research on the transition from foraging to farming in central Anatolia and the Levant, and further research based on data in Seshat.

The aspect of 'fusion' has been updated in Whitehouse *et al*. (2017). There, a cursory reference not only to [group] identification, but also to 'ethnic psychology' is made, alongside with fusion. They mainly unpack shared negative experiences as origin of fusion, though not to the exclusion of highly dysphoric rituals. The update consists from a theoretical point of view mainly in noticing that the 'psychological kin' explanation for fusion is not completely satisfactory, because

> "First, it is difficult to imagine how biological mechanisms underlying the 'psychological kin' phenomenon could evolve given low genetic relatedness in ancestral human groups coupled with the high costs of self-sacrificial behavior. Second, mechanisms for kin detection in humans should act against perceiving unrelated persons as close biological relatives. Finally, in a recent survey of participants in the Libyan uprising of thousands of whom died in combat, frontline fighters were more likely to choose genetically unrelated fellow revolutionaries in preference to family as the group with which they are most fused." (p. 2)

They demonstrate via a simulation that fusion could have evolved, at least in principle, as a mechanism independent of genetic relatedness when there is enough group selection. The simulation showed that when cooperation and thereby solving Collective Action Problems (CAPs) was conditioned on prior shared fitness decreasing experience, generally of the 'us vs them' kind rather than 'us vs nature', a modelled gene for fusion could spread in the entire population. The article continues by presenting several correlational studies that show the positive link between reported fusion or reported self-defining shared experiences on the one hand and reported willingness to do pro-group action, and presented empirical evidence that 'us vs them' (them=terrorists) elicited more reported cooperation than 'us vs nature' (nature=natural disasters), and that the effects of shared dysphoric experience on the willingness to perform pro-group acts can be stronger than those of genetic relatedness.

There are several themes in this (summary of) Whitehouse and Lanman (2014) and Whitehouse *et al*. (2017), three of which will be addressed here and are interrelated: (1) The Modes theory seems to have shifted the focus from a by-product theory (Modes as the result of our two memory systems) and proximate mechanisms at an individual level, to an adaptationist theory (Modes as adaptation to CAPs) and ultimate explanations at a group level. (2) Much more emphasis has been put on 'cohesion' as mediator, either the 'altruism' of group members sacrificing their own lives for the group, or 'cooperation' between group members of predominantly large communities. (3) The claim is that the main CAPs are resource extraction (Whitehouse and Lanman, 2014) and fitness-decreasing experiences (Whitehouse et al., 2017). Indeed, more specific claims play a role as well in the development of the Modes theory, such as the development of orthopraxy and its link to the emergence of large polities and agriculture (Whitehouse, Francois, and Turchin 2015), but as it seems, the three points just mentioned are some of the major underlaying principles. They will be discussed one by one, a critical evaluation will be given where deemed necessary, and suggestions for further research —and theory development— will be made.

Is it a theory of cultural evolution?

As shown, in the more recent formulations the Modes theory makes stronger evolutionary claims. Then the demand is also to give stronger evolutionary proofs. This section tries to make suggestions how to improve the evolutionary research regarding the Modes theory, or perhaps even in the broad sense, in several other social science studies that try to explain changes via cultural evolution.

Much of the social science research that tries to explain social or psychological phenomena with evolutionary theory may not use that theory properly — or rather: rigorously enough. There is a risk of calling changes in time of social phenomena 'evolutionary' without addressing actual evolutionary mechanisms such as selection,

heritability, population structure, or ancestral lineages, to name but a few. As Gould and Lewontin (1979) argued, there are many more processes in evolution than design optimization (adaptation) that can also cause an evolutionary outcome. For example, mere chance plays a role (drift, migration), as well as population structure (which organisms contribute in what way to the gene pool), epigenetic effects (how genes influence each other), design constraints (e.g. it is too hard to change the optic nerves inside our retina to an outside wiring, or to separate the food inlet from the air inlet in mouths and throats) and the history of a species (e.g. was the trait already present, rather than a new adaptation). Moreover, some traits that seem clearly identifiable as such are nevertheless sheer by-products of an adaptation (e.g. our navels). It is up to biologists to find out if a trait is really an adaptation, and if so, for what. Usually, these two questions go together. If it is not well researched which processes exactly play a role in explaining why a phenomenon is there, the result might be 'just so' stories: a short story about how a trait developed during evolution without much (or any) empirical evidence ('And just so the tiger got his stripes…'; 'And just so we got our Modes…'). However, a seemingly logical story of evolution does not count as a justification of adaptation. Several other stories might appear just as logical. How do biologists decide whether a trait is an adaptation or not?

There is more than one way to enhance the grounding of the Modes theory, or any social science theory that claims cultural evolution, in evolutionary theory. Indeed, a notable step in this direction has been taken by Whitehouse's (2013a) book chapter on "Adaptive landscapes". In it, the metaphor from biology is presented that the steepness of slopes in a landscape can represent the steepness of selection forces; more 'shallow' landscapes give more room for environmental influences. Whitehouse proposes to place various landscapes on top of each other, namely the genetic, the developmental and the cultural landscape, to see how they match, and perhaps even to predict processes of cultural evolution. Although still being a

metaphor, he demonstrates that this 'landscape' approach can at least fruitfully lead to asking an array of research questions.

In what follows, two other methods will be added, to expand the toolset of assessing the completeness of an evolutionary explanation as used in biology. The first is the well-known evaluation now labelled *Tinbergen's Four Questions* (Tinbergen 1951, 1963). Indeed, the Modes theory and its related research are already explicitly using two of the four questions (*proximate* and *ultimate* explanations). The discussion given below will especially focus on one (*phylogeny*) of the two remaining (also *ontogeny*) questions. The second method is that of Brandon (1990). He came up with five interdependent criteria that should reasonably show that there is a valid proof of adaptation. Finally, a brief discussion of multi-level selection will be presented, because if the Modes were to be adaptive, it is at the level of the group; indeed, Whitehouse and Lanman (2014) claim so much by explicitly writing 'the two ritual packages evolve through a process of cultural group selection' (and see full quote above). If one were to substantiate such claims, what should the research look like? Discussion of multi-level selection is also important to highlight at which level an analysis will be done; most notably: is it the individual or the group level for which Tinbergen's questions are asked or to which Brandon's criteria of adaptation are applied? Suggestions for multi-level selection research will be made in broad strokes, partially because much of the prevailing literature on 'group selection' (and its critics) must be left out here for reasons of space and time constraints.

With such an overview of suggestions, it is apt to remember a statement made by Steve Jones: "Evolution is to allegory as statues are to birdshit". Not only is evolution a 'convenient platform upon which to deposit badly digested ideas', there is an issue of analogy here as well: purely an analogy —for instance between genes and cultural elements— is not a formal argument regarding the applicability of principles in the domain of genes to the domain of culture. Hence, what works in

biology might not translate for the full 100% to cultural evolution in what follows. But at least the statue may be a keystone.

Tinbergen's four questions

What has become known as "Tinbergen's four questions" are basically four ways to interpret the question "Why…?". More precisely, "why does some form of behaviour in any one species occur?" (Tinbergen was an ethologist). Tinbergen expounded that, first, there is a *proximate* explanation, that asks: What are the mental mechanisms that cause the behaviour? Second, the *ultimate* explanation asks what the behaviour is for, what is its function, and ultimately: how does it increase the chance on survival? Third, the *phylogenetic* explanation attempts to trace the evolutionary line of the behaviour. What are the origins, what is the primitive behaviour, how did it develop in time? This is required to see the starting point of evolution in any species or population. It can help to understand the potential constraints, as it can be hard or impossible to evolve to a more optimal solution if the pathway is via a less beneficial situation. And fourth, the *ontogenetic* explanation traces the development of an organism, which can be traced from gene expression in a developing embryo to a growing juvenile. This final question further adds to the resolution of evolutionary questions, since there are two ways of 'programming' an organism: the evolutionary interaction with the environment which results in changing the genetic instructions, and the interaction with the environment during ontogeny ('learning') that influences the room not taken up by, or even explicitly provided by, genetic evolution.

Tinbergen and the Modes

The Modes theory and its empirical research have paid relatively much attention to addressing the *proximate* explanation. After all, the Modes theory was

initially strongly grounded in two types of memory — a direct, proximate mechanism why the two Modes exist. Also, the additions of fusion and social identification are - with respect to the Modes- proximate explanations. This present study has not engaged with proximate mechanisms; that, combined with the fact that the study of proximate mechanisms in the Modes theory research seems to be the branch that got the most attention so far, leads to the idea that this thesis is not best placed to make further recommendations to improve the empirical *proximate* research.

In the Modes theory, *ultimate* explanations have gained less attention than the *proximate*, though as shown above, general remarks have been made on various places that Modes are an adaptation to solve especially resource extraction problems and group conflict. The present study —together with especially Atkinson and Whitehouse (2011) but also Whitehouse and Hodder (2010)— has shown a link between *some* Modes properties and resource extraction, but only correlational and not between an entire Mode and a type of resource extraction via a causal link. If the ultimate explanation is to be taken seriously, one of the main recommendations would be to be much more rigorous by *demonstrating* that the Modes are the result of adaptation. For instance, rather than investigating (cor)relations across groups (synchronic), changes in time should be followed (a diachronic study) using time-bound data. Research should address questions like: What adapts to what? How slow or quick is the process of adaptation? Is an entire Mode the adaptation, and if so, what constitutes a Mode? If not, what is a sufficient adaptation that can cope with the circumstances? Do environmental circumstances exist before changes in group culture can be observed? Such questions will be further unpacked and specified in the next section, *Brandon's criteria*, which is specifically aimed at establishing a more rigorous proof of adaptation.

The *phylogenetic* explanation has not gained as much attention in the Modes research as the previous two. Yet, the Çatalhöyük-related research (Whitehouse and Hodder 2010; Whitehouse et al. 2013) shed more light on possible origins and

gradual development of the Doctrinal Mode. In this study, it was asked 'where do the individual Modes properties come from', in terms of spatial and relational forms of autocorrelation. Do they come from other groups, and if so, via which type of relation? That research can be improved by including the time dimension as well, and with it also the direction of transfer (~diffusion): from which actor to which other actor? In doing so, the evolutionary lineages of ritual can be traced, and if done in an even more sophisticated way, mutation and extinction can be identified. It might be crucial to study the phylogeny trait by trait, rather than as a set of group properties transferred as a package; this study provided evidence that different traits have different pathways and strengths of transfer, and moreover, that Modes seem not to be attractor states, hence should not be expected to be transferred as a unified 'package' in all cases. As stated before, both time and direction of relation can be found in, or be inferred from, the data that has been collected for this study already. Finally, the Modes research has partially tried to address the *ontogenetic* explanation by researching how for instance ritualistic behaviour and ability develops during childhood (e.g. Herrmann et al. 2013; Watson-Jones et al. 2014). This is research at the individual level. At the group level, perhaps the *ontogenetic* explanation could be addressed by a question like: is there a standard direction in which a group develops? This is probably the least plausible analogy with the biological world, but it is worth thinking about. Perhaps there is no programmed pathway of development, but there could be a case that certain group properties need to be in place first before a group can develop to a next level or before it can achieve a goal or be functional or resilient.

Adaptation: Brandon's criteria

Yet, it would be advisable to unpack and fractionalize the entire concept of 'adaptation' (Tinbergen's *ultimate* question) even further. Despite Whitehouse's and Lanman's (2014) contention that "different societies require higher or lower levels of fusion or identification to fulfil their basic material and economic needs in diverse

resource environments" and their explicit quotation of Whitehouse and McQuinn's (2013) publication to support this statements, this study showed, with a much larger sample than Whitehouse and McQuinn (2013), that it is not as clear-cut. Even if there were to be a link between, on the one hand, different levels of fusion or identification, or two Modes of ritual cohesion, and on the other hand economic needs in diverse resource environments, then it is much too quick to state that 'these two packages evolve through a process of cultural group selection'. Do they? Of course, there's nothing against presenting such ideas as a series of research questions or interlinked hypotheses or even a research program. Let's put the statement about cultural group selection aside for now, and focus on adaptation. How can we know that the outcome —two Modes— is an adaptation, and not generated by something else?

Philosopher of biology Robert Brandon (1990) lists five criteria for a qualitatively sufficient explanation of adaptation based on natural selection:

> "(1) Evidence that selection has occurred, that is, that some types are better adapted than others in the relevant selective environment (and that this has resulted in differential reproduction); (2) an ecological explanation of the fact that some types are better adapted than others; (3) evidence that the traits in question are heritable; (4) information about the structure of the population from both a genetic and a selective points of view, that is, information about patterns of gene flow and patterns of selective environments; and (5) phylogenetic information concerning what has evolved from what, that is, which character states are primitive and which are derived." (p. 165)

He stresses that none of these five has precedence over the other; as long as the explanation of adaptation contains information from each of the five categories, it is complete. If none of the five categories is filled in, there is no proof. For adaptation to occur, there must be a (1) selection pressure; in order to establish the existence of selection pressure we need to be able to measure survival/death rates in a particular sample population. "It is one thing to know that selection has occurred, it is another thing to know why it has occurred. That is, we may know that one type is better adapted than another to a given selective environment but not understand the (2) ecological reasons for this." (Brandon, 1990: 166). What caused the

selection? A predator? A toxin? Lack of food? Can we observe this in the environment, related to the organism and the trait under study? This second criterion is an important one, because a large share of the critique of Gould and Lewontin (1979) of the 'adaptationist programme' comes from the problems associated with giving ecological explanations of selection. According to Brandon, "oftentimes, 'just so' stories are substituted for difficult ecological analyses." (1990, 167). Of course, for natural selection to have evolutionary consequences, there must be relevant genetic variation, and it must be (3) heritable. An empirical problem arises when selection has driven the relevant trait to fixation in the population; this can be solved by looking at other populations, hoping that there's still genetic variation left for the particular trait. Once established that the trait is heritable, it becomes obvious that the (4) population structure is important. For instance, it makes quite a bit of difference in reproduction of male genes when 'winner takes all' (harem) or when mating is more 'democratic' (evenly distributed). Group sizes and gene flow (migration) can radically alter the course of dispersal of genetic material. And that, on its turn, is important to decide to what extent a trait is an adaptation or the result of other evolutionary processes such as drift, which would lead to quite another explanation. Last, but perhaps even first, we need to know what has evolved from what, so we need to have (5) phylogenetic information. The claim that a trait is an adaptation entails that it evolved from one older phenotype (the primitive) to another, so showing this pathway is a major support of the claim. What has evolved from what, when? Brandon gives an example how these five criteria are met with the case of a heavy metal resistant grass species along mine shafts. Since Brandon's publication (1990), more research has been done (e.g. Terry and Bañuelos 2000), and all five criteria and all required information are reasonably met for heavy metal tolerant grass. That means that it is indeed possible to give a complete proof of adaptation according to Brandon's criteria, and that means that these criteria are not necessarily

overcharging. So what type of research should be undertaken to see how well elements of the Modes theory fare in this respect?

Brandon and the Modes

(1) Is there evidence that selection has occurred? Do some (armed) groups have greater longevity, higher growth rate, more offspring groups or higher chance of winning conflict than others? Is this linked to particular resource environments?

(2) What caused the selection? Is there a clear causal pathway from the environmental circumstances —in this case resources— to, say, defeat, disintegration, or other mechanisms that weed out groups? Can such selection be ascribed to the lack of Modes or parts of the Modes? Is there proof for that? Are other environmental circumstances that could be the selective force, such as state patronage, proximity to political centers, etc.?

(3) Is there evidence that the traits in question are heritable? This seems, *prima facie*, the easiest question to answer: human beings can in principle quite easily learn all sorts of cultural information and habits. But do they? How stable is the transfer of for instance ritual behaviour from one year to the next? From one generation to the next? From leaders to rank-and-file? From one group to the other?

(4) What is the information about the structure of the population from both a cultural and a selective point of view? For instance, to what extent does it matter that group members are exchanged, or that some young men in West Africa roam from one country to the other, in search for a new conflict to participate in (Human Rights Watch 2005)? And perhaps equivalent in the biological realm to a single (male) individual that has an above-average amount of offspring ('winner takes all', 'harem'): To what extent does leadership play a role in influencing the entire group? Could a certain *type* of leader also bring about a certain *type* of group in terms of Modes?

(5) In a given population of groups, what was the starting point of the evolution of the Modes or their properties? Suppose one wants to find out whether Modes are an adaptation to different types of resource environments. The explanation for certain Modes properties, for instance highly dysphoric rituals, would be vastly different when they are part and parcel of the local cultural heritage. More in general, the question is: What has evolved from what, which character states are primitive and which are derived? This point has of course clear links with the previous criterion (4), and with the *phylogenetic* explanation of Tinbergen.

Multi-level selection

As mentioned, Whitehouse and Lanman (2014) state that "the two ritual packages evolve through a process of cultural group selection" (p. 679), and later in the article a slightly more cautious statement when they write that "the two ritual packages evolve to support particular resource-acquisition strategies *perhaps* through a process of cultural group selection" (p. 681, emphasis added here). How can it be known that cultural group selection is at work here?

Group selection is supposed to be selection at the aggregate level of a group, that is, *as* group, human beings are selected for or against. Within a group, there can -and probably will- also be selection, namely at the individual level. That makes group selection a version of multi-level selection; the 'multi-level' refers in this context to the two levels of individual and group. More formally, multi-level selection occurs when the selection force is different in strength, type or direction on different 'levels' of aggregation; for instance, when there is different selection on individuals within a group compared to the individuals *as* group. Human groups do not seem to be an as natural category as, say, a body that consists of multiple cells that have foregone individual freedom and are now tied into a collective. In a body, the fates of the cells correlate for nearly a 100%, in human groups the fates of individuals correlate much less than that. A group member can leave or not be affected by the selective force,

whatever it is. Still, for those individuals whose fates are positively related as the result of a shared property with common descent, one can speak about 'a group' for group selection. Group selection was initially considered to be a mere fact in evolution ('for the benefit of the species'), then discredited for a few decades from the mid-1960s (Maynard Smith (1964) and onwards, culminating in the 'Selfish gene' (Dawkins 1976) outlook on selection), only to return in a much more sophisticated form roughly from the turn of this century (see Gardner and Foster 2008; Wenseleers, Gardner, and Foster 2010 for overview articles). One of the problems in social sciences, when on face value group processes are involved, is to resort too easily to the mere term of 'group selection' (West, Mouden, and Gardner 2011). As was argued in the previous sections of this thesis, social sciences might be willing to lend a listening ear to the biological sciences, to be more precise and to be able to fractionalize human interaction, including 'cohesion', 'altruism', and 'cooperation' in evolutionary terms.

Much of 'group selection' is in the end based on Hamilton's (Hamilton 1964) rule (Gardner, West, and Wild 2011; West, Mouden, and Gardner 2011). Yet, capturing 'group selection' more rigorously in evolutionary terms can be done in more than one way, the more because Hamilton's rule is a special case of multi-level selection (Wilson and Wilson 2007). Hundreds of models have been proposed, but after classification, some basic principles emerge (Lehmann and Keller 2006; Van Veelen and Hopfensitz 2007). Several of them are Price-equation (Price 1970, 1972) based (e.g. Collins and Gardner 2009; Turchin 2011), or game theoretical (e.g. Gardner and West 2006), and a notable branch focuses on cooperation instead of altruism (Lehmann and Keller 2006; West, Griffin, and Gardner 2007; West, Mouden, and Gardner 2011). Although the literature is much too extended to capture it all in this thesis, some suggestions can be made within this confined space how to beef up group selectionist claims regarding Modes amongst (armed) groups.

Multi-level selection and the Modes

The multi-level selection requirements come on top of the requirements for adaptation, not in place of it. A few suggestions how multi-level selection could be researched amongst armed groups could be:

- In standard multi-level models, costs are supposed to be at the individual level, benefits at (or via) the group level. However, benefits at the individual level are also possible. In the context of group conflict, costs at the individual level are typically in the form of losing life and limb, but that can be taken steps further, such as opportunity costs (e.g. not going to school or not earning money otherwise); costs in the context of joint resource extraction can be in the form of lost time for own gains, opportunity costs, and sometimes risk for life and limb as well. Yet, there are also benefits at the individual level, for instance when a rebel group does not attack the individual's family when that individual has joined that very rebel group; or getting individual protection in a lawless environment; or getting an opportunity to loot and/or have food and/or have status because of joining the group (being the 'warrior' archetype, being the strong 'bad boy', the mere fact of having a gun-equals-power). All these items are very difficult to measure, but still it is worthwhile to think carefully about these issues. Can we come up with a plan to collect data on this or make estimates? Because, without also knowing the *individual* benefit of joining an armed group, it is difficult to state that there actually *is* a collective action problem, or whether there is group selection, or how much of it. More on this further below, when fusion and group identification will be discussed.
- Turchin (2011) captures the multi-level selection aspect of the Price equation in the following words: 'evolution of prosocial traits is favored when genetic variability within groups is minimized, while between-group variability is maximized'. Can we find evidence that for instance groups with less within-variety of Modes properties or ritual attendance have a higher probability of winning or

surviving than those groups with more within-variety? Is there evidence that the conflict is more intense (e.g. number of casualties, atrocities, etc.) when the difference between the warring groups —preferably regarding the Modes, because that is the claim here— is bigger? Is there evidence that groups with higher within-group policing of norms tend to win battles, win the conflict, survive to the next year, or have a greater longevity? The present research already collected data on ethnicity and language; perhaps that for instance with language trees, the cultural or even genetic distance between groups can be traced (see e.g. Currie 2013; Currie and Meade 2014; Atkinson, Sookias, and Passmore 2016). That should provide an indication for between-group variance, but probably also within-group variance, as not all groups have group members from the same language. Whether it is possible to find the between-group and within-group selection force might be more difficult. Perhaps the strategy followed in this study could be applied: making a small range of assumptions/scenarios and see which one gives the best model fit.

- It might also be possible to add a next level *above* groups, namely the country (depending on the research questions). Questions that are applicable here are questions like: under what circumstances do groups give up their autonomy and submit to a state or (probably rare) merge into a larger group or state; do states win from other states when there is no longer within-state conflict, or has selection at the state level ceased to exist; etc. If individuals are no longer included in the multi-level selection model, that is, if only the group vs. state level is investigated, then the question why e.g. individuals are altruistically fighting for the benefit of the group cannot be answered. It would be very complicated to research a three-level-selection model, but modern Leviathan politics might be interested in knowing under what circumstances individuals untie from group-based politics and are willing to resort directly under the state. This could in principle be approached as a multi-level selection question.

- However, Okasha (2006) points out that under certain circumstances when using the Price equation, one can get the impression that a trait is subject to group selection, whereas it is in fact the result of individual selection. For instance, the property 'average length' of a certain group might go up, but this can also be the result of selection at the individual level that causes the length of the average individual to get higher. Without explaining why, Okasha mentions that the statistical technique of multi-level modelling (MLM) does not have this disadvantage. Probably that is because the Price equation can be used recursively, MLM in practice is not. The practical consequence for this research is that ideally it should be shown whether increase or decrease of Modes (properties) is based on individual selection or not, or at least to what extent. For instance, it is not *a priori* implausible that group members who are individually triggered to be more aggressive in a war have higher survival rates. That could have the side-effect that they treat newcomers in the group more aggressively —seemingly Imagistic rituals— so that the level of Imagisticness of the entire group seems higher, so that higher levels of Imagisticness seem to positively correlate with group survival whereas in reality it is the aggregate of individual survivals. Can such effects be detected and then corrected for?
- Finally, our conception of the Modes theory may change. It was conceived in the context of religion, with the thought that individual mental properties (two memory systems) would be the main selection force, giving rise to a host of dynamics *within* Modes. For instance, in its original form (see also Appendix 2, statement 2.11, 2.12), dynamic leaders could appear in the Doctrinal Mode as the result of semantic memory, which is the only type of memory susceptible for intricately developed oratory skills. In its opposite and reinforcing direction, if religious leaders really want to keep their religious leadership, their teachings must be monopolized by orthodoxy checks. However, if the selection force is at the group level, the causal chain may well change. Yes, leaders may emerge as

result of their oratory skills, but what counts in the end for being a leader for an armed group is successes on the battlefield, perhaps mediated by the operational skills of the leadership, or the delivery of goods to group members. Stated differently, many rebel groups try to challenge the state; that can only be done when there is enough organizational prowess, which is probably the first and foremost selection force for a group to be Doctrinal (or have at least these properties as well). In the case of militias, it remains to be seen whether the first driver for their existence is the existence of flash-bulb memory or fusion, or that just the enabling umbrella of a state army and state protection allows militias to exist in the first place, without needing much low-frequency rituals, as personal benefit in the form of looting might be sufficient to draw in and keep group members (see further down below).

Nonetheless, also in the latest form of the Modes theory one could maintain that internal dynamics serve external purposes: those groups that have attuned all components of the internal dynamics are a well-oiled machine and have a higher probability to survive and be successful. For instance, it may very well help that a group has a proselytizing dynamic leader, who with frequent repetition of preaching and teaching fills the semantic memory of group members with an appealing ideology, whilst orthodoxy checks increase the probability that all group members are on the same page. When done right, it could mean that the group is better able to meet its (or its leader's) strategic objectives. That, though, will depend on the environment. Multi-level selection brings to the fore that *as Mode* the Modes properties may be selected for or against in a certain environment, whereas in its original form the individual Modes properties were selected for or against. Questions could be: Probably it needs a high degree of organizational capacity to challenge a state, even if it is a failed state; do we see that secession

and government replacing groups are Doctrinal[1], or else fail? Are there contexts in which neither Mode gives a selective advantage? Or both Modes at the same time are required to give a selective advantage? Are some properties of the Modes in fact not that important to provide selective advantage? Which context is the most beneficial (gives the lowest negative selection) for either of the Modes? Etc.

Is it a theory of social cohesion?

What can be inferred from Whitehouse and Lanman (2014) is that cohesion comes in two forms: either displaying the same defensive reactions as a personal attack or an attack on one's kin with a significant willingness to sacrifice oneself for one's group, AND/OR following and enforcing the social norms of larger, more anonymous communities (and perhaps more, though not specified, but also not excluded). Importantly, they explain this from the idea that human beings have two main psychological states or propensities underlying cohesion, namely fusion and group identification, respectively. In this section, the dichotomous approach of cohesion that hypothesizes to two forms only and to two psychological mechanisms underlying it, will be critically discussed. It will be argued that fusion and group identification are under-developed constructs, that fractionating should be taken more seriously by recognizing that there are more psychological mechanisms underlying cohesion, and that there are also more social mechanisms that increase group participation. If that were to be true, then explaining two Modes from two psychological states is ultimately not fruitful. Alternatives for researching cohesion and Modes will be offered.

[1] It is not exactly specified in the Modes theory what it means to be 'Doctrinal' or 'Imagistic'. The frequency of rituals versus their emotional intensity can be held to be the core, but other properties play a role just as well (see e.g. tables 1.1 and 1.2 on pages 41 and 50). Maybe an index can be created to capture the 'Doctrinalness' or 'Imagisticness' of a group.

What is cohesion?

The answer to the question what the underlying proximate mechanism for 'cohesion' could be, depends on the interpretation of 'cohesion'. For instance, if cohesion means something to the effect of 'a mechanism that increases the probability of achieving a common goal' then, say, a group of fish can be extremely 'cohesive' if they align their direction of swimming to each other, based on a few simple rules of thumb. In doing so, they achieve a shared goal (e.g. minimizing predation) with highly precise coordination but without 'fusion' or 'social identification'. That example might illustrate in a few lines that 'cohesion' might be interpreted very differently from the descriptions in Whitehouse and Lanman (2014), and that 'fusion' or 'group identification' are not required for cohesion. Of course, one could still think that what applies to fish does not apply to humans or armed groups. So, in parallel to the fish example, people could easily discuss what they will do as a group, or vote, copy others, follow a prestigious individual, or other mechanisms to coordinate behaviour and have correlation in their individual fate as result of interaction between the parts that constitute the collective. For these coordination mechanisms, no fusion or group identification is required, but there still could be group selection. One might perhaps argue that 'group identification' is required for it, but that is at risk of circularity or non-falsifiability: the existence of group identification is inferred from those behaviours, and the existence of those behaviours is explained from group identification (=circular); OR, non-fused groups can only exist when there is group identification, so all group behaviour must be on the basis of fusion or group identification (=non-falsifiable).

It might be overdone at this point to give a complete overview of the different interpretations in the literature of 'cohesion' amongst human beings or armed groups, but it would already be sufficient to describe some of the various interpretations to get to grips with the breadth of what 'cohesion' could mean. After an obligatory general dictionary definition, in this case of Merriam-Webster's "the act or state of

sticking together tightly" (which might probably imply that 'social identification' is not 'cohesion' — but that groups of fusionless identification-deprived fish can be very cohesive), the table is cleared for interpretations that are more focused on the topic at hand. The article of Carron and Brawley (2000) on the conceptual understanding of cohesion of small groups explicitly grounds 'cohesion' in beliefs, attraction to the group, tasks at hand and social concerns. An empirical research on cohesion in small-units in the U.S. Army, (Griffith 1988) found that cohesion "can be represented by four general dimensions: (a) the quality of instrumental and affective relationships among junior enlisted soldiers, (b) the quality of relationships between junior enlisted soldiers and their leaders, (c) soldier internalization of Army values, and (d) soldier confidence in weaponry and leaders". Simonsen (2009) writes about 'cohesion' of the new armies of Iraq and Afghanistan, and states that "ethnically/sectarian mixed units may disintegrate because of weak horizontal cohesion; homogeneous units (particularly when recruited as groups and not individually) may splinter off because of weak vertical cohesion". Kenny (2010), writing about insurgent organizations, maintains that "cohesion refers to the creation and maintenance of cooperative effort toward the attainment of the organization's goals", and discerns that from 'structural integrity', which is, according to him, "the property of an organization remaining as a single intact entity".

Quite likely, there are more interpretations of 'cohesion' than given in this short overview, but this gives a hint that there are more interpretations possible than "willingness to sacrifice oneself for one's group", or "following and enforcing social norms". Some might want to remark that a few of these descriptions of cohesion also subdivide into two types: Are not the Modes and fusion plus group identification also subdivided into two types? Therefore, are not the examples such as these about 'horizontal' and 'vertical' cohesion talking about the same thing? But that needs a proof or good evidence that for instance —following Simonsen (2009)— lack of 'horizontal cohesion' is because of fusion, and lack of 'vertical cohesion' because of

group identification. That seems not correct; even when agreeing with the framework of fusion and group identification, both 'horizontal' and 'vertical' cohesion could be mended by either, and lack thereof could be caused by either. Therefore, the two types as given by Simonsen (2009) do not coalesce with fusion or group identification. Similar concerns can be voiced for other descriptions of 'cohesion' in the literature that seem dichotomous.

Summarizing these points and as suggestions for future research, it most likely helps to consider: (i) What is supposed to cohere? An army? A platoon? A non-state armed group? A religious community? A horticultural society? A hunter-gatherer band? And so on, *ad libitum*. All these groups may require different forms of cohesion, and more than two components or two main types of behaviour. (ii) Why is 'cohesion' —however defined— required, or what is it for? For instance, if maximization of resource extraction is the goal, then this could also be promoted by specialization combined with trade, and that would certainly help the entire society to function (better). Is 'group identification' required for that, or is it easier to install a Leviathan without further emotional buy-in from trading individuals, that is, can it indeed function without fusion and group identification? Etc. It is indeed not implausible that different group-level outcomes can require different types of cohesion, but again, it may be too quick to dichotomize types of cohesion in behavioural terms into fusion and group identification only. It may also be too quick to dichotomize the underlying psychology into two types only; that will be the topic of the next section.

Fusion, group identification and its discontents

Whitehouse and Lanman (2014) urge to fractionate conflated topics such as 'cohesion' and 'ritual' into its constituent parts. This thesis wholeheartedly supports that call. Reductionism is an important method or even attitude in science, which has brought great precision and insights. Yet, as will be argued, although Whitehouse and Lanman (2014) should be commended for their exhortation to fractionate

'cohesion' and the underlying psychologies, they did not take it far enough. More can and should be done to see which principles underlie cohesion, both with respect to social structures, evolutionary mechanisms, and psychological propensities. Not only can 'fusion' and 'group identification' be split up further —it may be presumed that Whitehouse and Lanman will agree— but it will be argued that these two mental concepts are also not sufficient to tackle 'cohesion', even within the context of resource extraction or inter-group fighting (the two main Collective Action Problems researched in this thesis). In addition, it will be brought forward that when 'fusion' is no longer based on kinship mechanisms, as Whitehouse et al. (2017) argue, and can be active both for small-scale communities and for large-scale *imagined* communities, as Whitehouse et al. (2017) also argue, then 'fusion' might no longer have explaining power for the Imagistic Mode, or the Doctrinal Mode for that matter, and hence be a redundant concept for the Modes theory (though not necessarily for cohesion).

I.

The Modes theory claims to be based on evolutionary theory, both for the underlying individual proximate mechanisms, and for the group-level ultimate mechanisms. Let's take a look at the different types of cooperation as recognized in evolutionary theory (West, Griffin, and Gardner 2007):

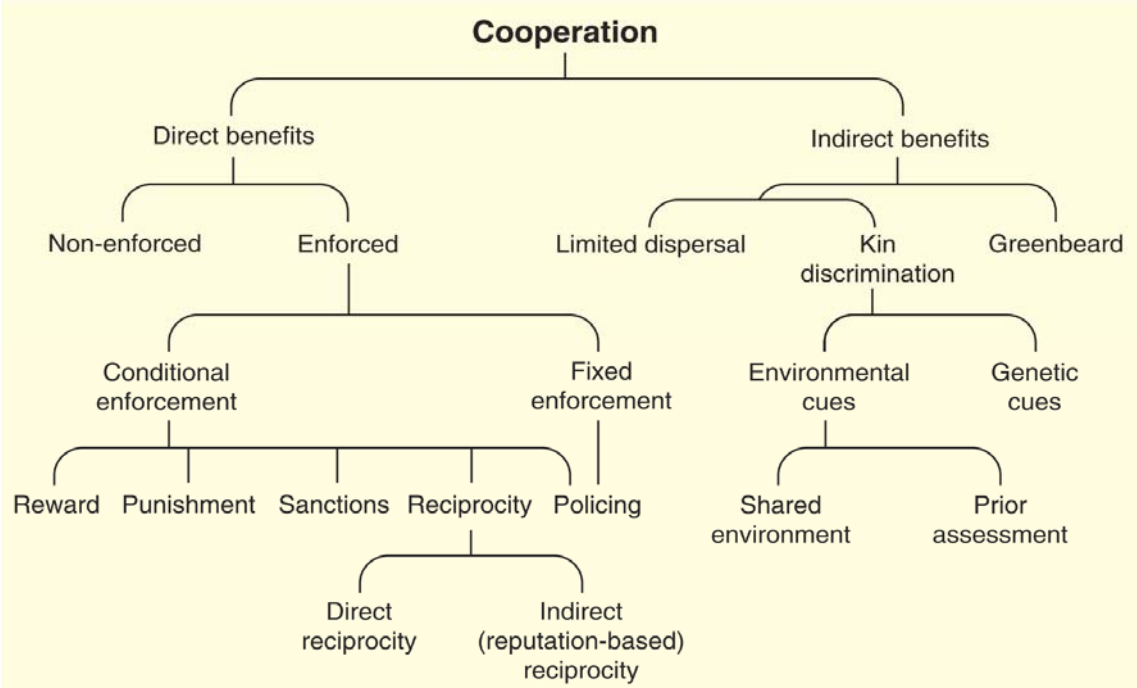


Figure 6.1 — Different types of cooperation as recognized in evolutionary theory (after West, Griffin, and Gardner 2007, R663).

Let's on the outset not step into the trap of seeing *two* main branches in this tree-like structure, and *therefore* equate that to *two* modes or *two* types of cohesion (there is no 'therefore' here). There are two options: either follow Whitehouse and Lanman (2014) and see fusion as based on kinship, or follow Whitehouse et al. (2017) and presume it is a separate mechanism. To start with Whitehouse and Lanman (2014), let's work from the bottom up, and match the evolutionary mechanisms as given in figure 6.1 to the descriptions of 'fusion' and 'group identification' as given in Whitehouse and Lanman (2014) in the most charitable way. Based on their description for fusion, which stated that fusion was based on the evolutionary mechanisms of e.g. environmental cues and genetic cues to recognize kin, much of the right 'branch' should constitute fusion. (At the same time, and as the flipside of the coin, that means of course that fusion is a container for a few mechanisms, and can be fractionated further to its evolutionary *ultimate* mechanisms.) Yet, as can be seen in figure 6.1, there are different evolutionary mechanisms not mentioned in

their account that do not necessarily point in the direction of fusion or LH/HA rituals. For instance, limited dispersal may just as well contribute to non-visceral forms of cooperation: tend to cooperate with people around you, and on average you will have an evolutionary benefit. That could mean fusion, but also group identification, or yet something else. If one buys into the framework that only fusion and group identification are responsible for cohesion, then Greenbeards[1] probably point more in the direction of social identification than fusion, because a Greenbeard can serve as an identificator, and can be mimicked by cultural markers such as dress, body paint or, indeed, green beards — which seem to be more in the Doctrinal domain. Yet, it is perhaps prudent not to make a too big point of Greenbeards, as it is uncertain that they play a big role in humans (Gardner and West 2009). Perhaps more challenging to reconcile with the Modes theory or the hypothesized underlying psychological mechanisms, is that hunter-gatherers were more mobile and migratory than agriculturalists; hence, one would expect *more* visceral feelings of oneness in the Doctrinal Mode, or in group identification based social systems, because the 'limited dispersal' mechanism is, again, a proxy for recognizing kin, i.e. genetic relatedness. But perhaps more severe would be the incompatibility of the type of underlying evolutionary mechanisms with the type of mechanisms in fusion and group identification. In figure 6.1 and according to Whitehouse and Lanman (2014), evolutionary mechanisms like environmental cues constitute the psychological propensity of 'fusion'. If that is true, and now turning to the left side of the tree ('direct benefits'), evolutionary mechanisms like 'sanctions' and 'policing' should constitute the psychological propensity of 'group identification'; but do they? There are three reasons to think not. First, most likely, all these mechanisms existed already in hunter-gatherer societies. Indeed, a Modes theory-based publication

[1] "Greenbeards are genes that can identify the presence of copies of themselves in other individuals, and cause their bearer to behave nepotistically toward those individuals." (Gardner and West 2009, 25)

(Whitehouse 2013b) mentions for fused groups that "when a transgressor is identified in the group they might be punished harshly but they are nevertheless welcomed back into the fold"; and indeed, it is hard to conceive hunter-gatherer societies without any form of reward, punishment, etc. Second, not only is nowhere in the theory made clear that such mechanisms underlie 'group identification', there is also no obvious link between, say, reward and reciprocity on the one hand, and losing personal agency as part of 'group identification' on the other. Third, and perhaps most importantly, the evolutionary mechanisms on the left-hand side all seem to be part of the *sociological phenomena* (Whitehouse's and Lanman's (2014) words) of the Doctrinal Mode, which is the *consequence* of the hypothesized psychological propensity of 'group identification'. If one wants to be consequent and not conflate sociological phenomena with evolutionary mechanisms that underlie a psychological propensity, then one of the two mappings is incorrect, i.e., at least one of the two psychological propensities (fusion, identification) in figure 6.1 does not match with the evolutionary mechanisms. Either fusion is not based on mechanisms such as 'environmental cues' or 'prior assessment' in the right 'branch', or group identification is not based on evolutionary mechanisms in the left 'branch', such as 'policing' and 'punishment' — or both are not based on these mechanisms. That means that there are more evolutionary mechanisms than fusion and identification can capture; and that means that there's more going on than fusion and group identification only to constitute cooperation and thereby cohesion.

The second option is to take Whitehouse et al. (2017) as starting point, and see fusion as a separately evolved psychological mechanism, which is indeed what they state (p. 7). That would result in a similar argument, though more pronounced: none of the mechanisms of figure 6.1 fits 'fusion' in that case (or 'group identification'), so more mechanisms should be taken into account if one wants to explain 'cohesion'. If the aim is not to explain cohesion, but the existence of the Imagistic Mode then it must be shown that fusion occurs (nearly) exclusively linked

to the Imagistic Mode, which seems not to be the case, according to Whitehouse et al. (2017) (more on this below). If the aim is not to explain cohesion, nor the existence of the Imagistic mode, but pro-group self-sacrifice, then there may still be challenges, because even voluntarily fighting for a group can be explained in different ways than purely by fusion (also more on this below).

II.

Coalition formation *beyond kin selection* might actually be a very old process in human beings; estimates are that it might have started with *Australopithecus* 4 million years ago (mya). Flinn, Geary and Ward (2005) start with the question why humans have such a big and versatile brain. After comparison with other species that showed that ecological circumstances still beg the question as explanation, they offer the hypothesis that after human beings had overcome most ecological difficulties to a sufficient extent, the biggest selection force on human beings became other human beings. That set in motion a cascade of adaptations to decrease within-group competition and increase the probability of stable coalitions, such as decreased sexual dimorphism (men and women work together more), concealed ovulation (less male competition for a fertile female), male childcare, stable partner bonds (less competition for reproductive capacity), theory of mind (knowing what others of the group are up to), foresight and scenario building (quite useful in group conflict), social emotions such as guilt and pride (keeping within-group deviations in check), language (useful for everything), menopause, age and sex based division of labour (within-group efficiency), extended childhood with continuing brain growth (improving much of the before), etc. The argument here is that cognate species like chimps and bonobo's also have small groups and kinship systems, but did not evolve the big brains and other properties just mentioned — nor did they have big wars. If this theory is correct, even partially, then it has, for the present purposes, several important consequences. The first is that multi-level selection is indeed important for

human beings, and engrained in our genes and entire being, much beyond ordinary kin selection. The second, and related to that, is that coalition formation and non-kin group formation might primarily be for intergroup conflict, not for addressing collective action problems "in an environment where trust is required for taxation, large-scale farming, and a complex division of labour", as Whitehouse and Lanman (2014) state it. Third, other psychological propensities than 'fusion', for instance guilt and a sense of honour or pride, predate any Doctrinal property by a wide margin. Hence, one can question whether fusion and group identification are the only two psychological bases for group cohesion — or one must claim that a psychological property like guilt has no consequences whatsoever for cohesion, or pride and honour for group conflict, which seems rather stark. Fourth, one might (therefore) question whether kin-psychology is the only psychological driver for getting individuals into war and risk their lives as act of altruism. It is not implausible that some of these other psychological propensities, including group aggression or group-thinking in general, have evolved over the course of 4 million years of inter-group competition that might just as well -or better- be suited to wage wars and risk lives. Hence, stating that 'without the power of fusion and psychological kinship, group identification produces committed citizens but not extreme self-sacrifice' might partially miss the point, as much of our uniqueness as human beings might be about coalitions and group conflict. Whilst the super-large societies of the last 10,000 years are interesting in their own right, in the light of the entire evolutionary story on coalition formation they might only be the last chapter of a long book. To reduce committed fighting to only fusion might therefore be so general that 'fusion' becomes a mere synonym for committed fighting, rather than truly explaining much.

III.

There is a range of arguments that war does not constitute the collective action problem the Modes theory holds it to be, and therefore, fusion and/or group identification may not be that necessary after all to wage war.

In an early article on the evolution of war, Tooby and Cosmides (1988) argue that although war —multi-individual coalitions of individuals engaging in aggressive competition— can be explained from individual benefits (mainly: access to (reproductive) resources) without necessitating kin-relations, a form of cooperation is still required. They note that only common chimps and humans engage in such coalitions, and that "cooperation depends on the ability to detect, identify, and exclude cheaters". Tooby and Cosmides note that

> "[i]t can be shown that given 1) certainty of victory, 2) the assurance of a random distribution of risk of death among participants, 3) the assurance of a relatively 'fair' allocation of the benefits of victory, and 4) efficiency in the utilization of reproductive resources on a zero-sum basis, *selection will favor participation in the coalitional aggression regardless of the existence or even the level of mortality (within broad limits)*. Within a polygynous system with certain formal properties [...], the deaths of some members of a coalition will not decrease the *average* reproduction of the members of the coalition, because the reproductive resources and opportunities within the coalition, or gained as the result of victory, will simply be reallocated among the survivors. [...Given that n]atural selection weighs decisions on the basis of their *average* consequences to individuals, summed over evolutionary time[...], these factors explain why males can so easily be induced to go to war, despite its lethal effects on many of them. (p. 6; emphasis theirs)

Hence,

> "[c]oalitions of males, when they assess the relevant variables indicating that they are larger or more formidable than any local competing coalitions, should appear to manifest an eagerness and satisfaction in initiating warfare and an obliviousness or insensitivity to the risk they run as individuals, in terms of their individual somatic welfare" (p. 6).

In other words, if their reasoning is right, then there is no CAP in terms of required motivation for self-sacrifice for the group and hence no requirement for fusion. Instead, pure self-interest will do.

These mechanisms have also probably been observed in the field; Chagnon (1988) reported that Yanomamo men of the Amazonas who have killed in coalitional blood revenge between villages have more wives and offspring than men who have not killed. Again, that is indicative that in original forms of warfare, there was a direct

individual evolutionary benefit to partaking in warfare. Played out over long durations of time and many generations, this may well have instilled men with a psychological propensity for war, again without needing self-sacrifice, fusion, or group identification or Doctrinal forms of organization.

Such patterns can also be observed in modern times. Kalyvas and Kocher (2007) argue that there may not be a collective action problem when individuals join an armed group. Joining a modern armed group is a wager; if the relative cost of joining is lower than not joining, then it is rational to join. The relative cost of not joining is higher when the state offers less protection or is more repressive, or when the armed group systematically targets those who are not part of the armed group or their families. They suggest that it is incorrect to assume that non-participation is costless. In addition, they argue, there are private selective incentives to join a rebellion, for instance opportunities to loot. Indeed, a Human Rights Watch report (2005 vol 17, no. 5 (A)) states that in West Africa there are what they call 'regional warriors' —which are all young men— who basically roam from conflict to conflict, country to country, and seek to join armed groups, just to make a living. That seems not at all to be a self-sacrifice for 'the group', at best for the direct family (same Human Rights Watch report, p. 16, 18), at worst simple selfishness. Indeed, Collier (2000) —in the well-known 'greed vs. grief' debate— argues that there is, first, overwhelming evidence that the incentives for groups to engage in civil war are predominantly economic, and secondly, that the reasons are that economic incentives by and large do not have the CAPs generally associated with 'grievance' rebellions:

> "There is no free-rider problem because the benefits of the rebellion can be confined to those who participate in it. There is no coordination problem because the rebellion does not need to be so large as to be victorious nationally in order to gain spasmodic control of some territory and so be predatory on the export trade in primary commodities. There is no time-consistency problem because if rebellions are able to cream off some of the rent from primary commodity exports during the rebellion, then rebel recruits can be paid during the conflict rather than be dependent upon promises." (p. 101)

The phenomena described in Kalyvas and Kocher (2007), the Human Rights Watch report (2005 vol 17, no. 5 (A)) and Collier (2000) again suggests that in many circumstances for the NSAGs this thesis is concerned with, there is no fusion or Imagistic cohesion required to draw in fighters, and the question of why group members are 'altruistic' towards the group does not apply. They simply are not altruistic towards the group. But also at group level there seems not to be much cohesion, and indeed not much Doctrinalness, at least in Africa. Ikelegbe and Okumu (2010) note: "[T]he majority of [non-state armed groups] are disorganised and undisciplined with loose control over operations and activities, poor leadership, organisational problems, control and command problems and factional fighting, and are prone to fragmentation or fracturing into diverse armed bands." (p. 14). That suggests one should not only expect absence of fusion or Imagistic practices, but also of group identification and Doctrinal practices. If that were to be true, it is not topical to approach armed groups with the instruments of fusion-identification or Imagistic-Doctrinal only — which is one explanation why the Modes were not clearly present amongst armed groups in the sample of the present study. Of course, it is an empirical question what proportion of armed groups follows this pattern; yet, to simply assume that fighting in armed groups requires at least fusion or group identification, or Imagistic or Doctrinal dynamics to solve a CAP, seems to miss the point.

That said, even -or precisely- in conjunction with the references just given, there could be a place for the Modes. First, going back to Tooby & Cosmides (1988), they write that "perception and belief in success play a crucial role in encouraging coalitions to initiate war" because one of the parameters in getting group members to fight is the idea that victory is close to certain. For instance, Imagistic practices could induce the belief that initiates are impenetrable for bullets (e.g. Dozo fighters from the Ivory Coast and the Kamajors from Sierra Leone, probably FNL from Tanzania/Burundi and the MFDC from Senegal, possibly Mai-Mai Padiri in Congo), and

Doctrinal ones could induce the belief that Allah will provide victory (e.g. Hezbollah, ISIS, etc.).

Second, sticking with the same publication, "successful defence is more of a 'public good', and insufficient participation in defence, as expected, does appear to be considered more reprehensible than insufficient enthusiasm for initiating a war (p. 9)". This is because offensive is by choice, and options can be weighted, whereas defensive is by necessity, and there is not much choice. If that is true, then it becomes a question whether most NSAGs are mounted for the offensive by choice, or for the defensive by necessity — or somewhere on a scale, as it may not be black and white. If, on its turn, most NSAGs are mounted for offensive reasons, then there is again less of a 'public good' to be expected. Whether offensive or defensive, it is at least a parameter that might be taken into account.

Third, Doctrinal properties may still be useful for waging war, regardless of motivation, because even if (large) numbers of group members are intrinsically motivated to go to war purely based on self-interest, then still it pays to have the same language, to have hierarchical coordination, to have large numbers, to have daily (military) training, to have designated roles, etc. In that sense, as it seems that much of the sample of this research displays at least some Doctrinal properties, it could be seen as meaningful because perhaps Doctrinalness is adaptive to fight and win wars — also without any necessity for altruistic 'self-sacrifice for the group'. Perhaps in future research, it would be useful to divide the dataset into two types — those pursuing political grievances (where the collective action problem remains high and the Modes theory may remain important), and those pursuing loot (where the collective action problem goes away and there is less need for organizational modes or cohering rituals etc.). Modes/rituals should be stronger in the former cases.

IV.

Whitehouse et al. (2017) offer the hypothesis that fusion is an evolved psychological propensity (proximate mechanism) as the result of group selection, and is now part and parcel of human beings, though it needs specific circumstances to be triggered. One of the main triggers, they argue, and the focus of their publication, is a shared negative experience. They explicitly mention that fusion can be triggered without the necessity of a kin relationship; their analytical mathematical model and individual-based computer simulation explicitly models genetic non-relatedness, they present experimental evidence where shared negative experiences with non-kin evoked more fusion and willingness to be altruistic towards non-kin than towards kin-related people with whom they did not have this shared experience. In addition, they give experimental evidence not only of small groups (e.g. veterans in a platoon, fraternities) but also of large anonymous communities (e.g. Americans, English Premier League football fans). Perhaps meaningfully, no references are made to the Imagistic or the Doctrinal Mode, and in that sense Whitehouse et al. (2017) is not a 'Modes' publication. Other publications, however, did link fusion to the Modes: as mentioned, Whitehouse and Lanman (2014) link fusion to Imagistic groups with intense cohesion, because Imagistic rituals basically simulate the shared negative experiences; Whitehouse, François and Turchin (2015) and Jong et al. (2015) make statements along similar lines.

Yet, taking into account the findings of Whitehouse et al. (2017) brings up some questions for the Modes theory. How is it that small-scale groups require highly dysphoric rituals to create and trigger fusion, whereas shared negative experiences are enough for non-related imagined communities? How is it that those groups that know each other in person apparently need more effort to create fusion than groups whereby the members on the whole are complete strangers to each other? How is it that shared negative experiences of the social kind ('us vs them') and of the warring kind can trigger fusion in large-scale imagined communities, but not enough fusion in small-scale communities?

Questions are not arguments, and of course, there could be answers to all of these questions. Yet, following Whitehouse et al. (2017), the picture emerges that if anything, fusion is (a) present both in small-scale personal and large-scale anonymous communities, and does not form the distinction between the two, and (b) more readily available in large-scale imagined communities than in small-scale personal communities, hence, more linked to the Doctrinal Mode than to the Imagistic Mode.

In conclusion, (I) it is not possible to map fusion and group identification on evolutionary mechanisms in a consequent manner. Hence, either the evolutionary claims should be foregone, with consequences for explanations such as rituals mimicking evolutionary environments or hijacking evolved psychological propensities, or a concession should be made that there are more mechanisms than fusion and group identification only that glue both small-scale personal societies and large-scale anonymous societies together. (II) Intergroup fighting and especially coalition forming seem to have been part and parcel of our evolutionary history, so much so, that one might like to be cautious to state that only fusion can generate the willingness to risk limb and life and that group identification can only generate committed citizens. Social emotions like guilt, embarrassment, aggression, contempt and pride are not part of the fusion-identification dichotomy, but are certainly useful for cohesion and/or getting individuals to fight for a group and can easily go beyond kin. (III) At least in Africa, it has been suggested that recruitment of several armed groups and the fighting of its members is not based on altruism towards the group, hence, it would be too simplistic to state that altruism is required for fighting — hence, that fusion is required for fighting. Whether evolution will weed out such groups remains to be seen; perhaps groups that recruit under force without investing in cohesion can freeride on human psychology: whatever emotions are there, like fear, greed, shared negative experiences or whatever else will do the job. (IV) If

fusion is a separate evolved mental propensity that can be triggered by shared negative experiences, then it is at least counter-intuitive that small-scale societies with personal ties need to explicitly trigger fusion by highly negatively arousing rituals, whereas large-scale anonymous societies can do without such rituals to enjoy fusion in circumstances of war, famine, and other challenges. That suggests that if anything, fusion is easier available in large-scale groups and not an explanation for the existence of the Imagistic Mode, or does not discern the Doctrinal from the Imagistic Mode. That would make 'fusion' redundant to explain the existence of the Imagistic and the Doctrinal Mode (without discarding the possibility of the existence of fusion *per se*).

Again, fusion and group identification may not be the only games in town to explain willingness to fight and engage in the collective action problem of war; or resource extraction, which will be the subject of the next and final section.

The third Mode

This section describes the 'Third Mode', which is a Mode this thesis theorizes to follow in history on the Doctrinal Mode. This section serves two main purposes: to further critique the Modes theory, and (or?) to vastly extend the theory with said Third Mode. As quoted several times, the ultimate reason why the Modes are thought to exist is as adaptations to different resource extraction problems. Generally, the examples of hunting dangerous large game and agriculture are given for the Imagistic and the Doctrinal Mode, respectively. In addition, it is made clear a few times in the Modes literature, in different wordings, that the Modes are idealized prototype endpoints on a scale (e.g. Whitehouse 2004, 75; and Whitehouse and Lanman 2014 describe (p. 680-2) how the Doctrinal Mode emerged over time), and that the Modes should not be seen as either fully existing or non-existing.

The consequence of seeing Modes as a gradient *and* seeing the Modes as adaptation to different resource extraction types is the implicit recognition that they don't need to be attractor states with most of the time most of the things in place as the result of reinforcement by other Modes properties. Instead, it could be the case that most Modes properties independently adapt to the type of resource extraction. All sorts of intermediate and partial states can exist, depending on the circumstances. That further questions whether we should perceive human beings as having two main types of cohesional social psychologies ('fusion' and 'group identification'). Instead, several cohesional psychological propensities (such as e.g. depicted in figure 6.1, or others) could underlie several social behaviours that could count as 'cohesion' or as 'adaptation to resource extraction problems'. Indeed, in this study, with relatively refined data compared to the historic record, no indications were found of two attractor states. Moreover, social-cultural inventions such as hierarchies, writing and oratory techniques which may well rest on very general capacities of human beings can also contribute to social structure and cohesion.

If we combine the following thoughts, all stemming from the Modes theory:

- although there is a gradient of group properties, we might be willing to sketch ideal types;
- different components of human psychology may be activated under different resource circumstances; perhaps two main psychological propensities, perhaps more, and even if only two, then they may be absent;
- social properties or even complete Modes are an adaptation to resource extraction problems, and are not necessarily meant to explain two main types of religion;
- we may characterize Modes as having a property or not (e.g. having a centralized leadership or not);
- the resource extraction types are taken to be very broad types, such as 'hunter-gatherer' and 'agriculturalist';

then we could ask what happens if we add a third broad type of resource extraction: fossil fuels in the industrial society.

The third Mode

In his book "Foragers, Farmers and Fossil Fuels", Ian Morris (2015) advances the theory that the main type of moral systems that human societies endorse, are ultimately the result of the broad type of resource extraction their society is based on. Although he was mainly concerned with morality (the subtitle was: 'How human values evolve'), much in the first two parts of the book —Foragers and Farmers— describe societies that resemble the two Modes. For instance, he describes how Foragers typically live in egalitarian societies (in Modes terms: e.g. low number of hierarchical levels, absence of institutionalized leaders) that are small, lack much personal property, and lack literacy. Farmers are described as having a steep system of hierarchical levels, a world governed by a transcendent god, an explicit ideological system that supports the status-quo, and permanent, institutionalized leaders. In addition, just like the Modes theory, the different societies were presented as main phases of humanity "after the ice". Importantly, he explains these phenomena, ultimately, by multi-level selection, just like the Modes theory does, and as adaptation to the type of resource extraction.

Yet, in contrast to the Modes theory that recognizes two ideal types, Morris discerns a third; one he labels Fossil-fuel societies. Given the resemblance between Foragers and the Imagistic Mode and Farmers and the Doctrinal Mode, it begs the question whether there is a third Mode — or in the further future perhaps a fourth, fifth, …? Can the categories for the Modes as expounded in e.g. Whitehouse (2004, 74) and Whitehouse and McQuinn (2012, 600), broadly speaking, be applied to the third phase Morris discerns, that of fossil-fuel based societies?

Various sources describe the 'hunter-gatherer' and 'agricultural' societies with more properties than the Modes theory does, most likely because the Modes theory

was (but probably no longer is) so much focused on religion — but nonetheless made links to hunter-gatherer and agricultural societies from the start. Such additional properties of the *societies* are, for instance, the differences in e.g. the mobility of individuals vs. sedentary lifestyle, exchange of individuals between groups, calorie intake and health, the homicide rate, the discount value of return on activity (immediate or delayed return), time orientation in general, and care provided for the incapacitated (Christian 2018; Dillehay and Kaulicke 2011; Harari 2015; Twiss 2007; Woodburn 1982).

The idea that there is this third broad phase the development of humanity is not new. Well known are the hunter-gatherer societies, and the agricultural societies. It has not eluded writers that a type of society labelled 'industrial' or 'modern' followed the agricultural society (Harari 2015; Christian 2018 for popular accounts). In history departments, standard courses on *Modernity* are offered[1], which discuss the joint rise of individualism, capitalism, rationalization, industrialization, urbanization, formal equality, the nation state, science, life expectancy, decrease in family size, increase in career-orientation, decrease in reverence for authority, and other inter-linked phenomena (Burger, Baudisch, and Vaupel 2012; Langlois 2001; Newson and Richerson 2009).

Newson and Richerson (2009) offer the hypothesis that "the switch from largely kin-based to largely non-kin-based social networks generates a strong cultural evolutionary force that is common to almost all modernizing societies" (p. 123). They argue that kin-based societies tend to favour kin-supporting "traditional" values, mainly to produce more offspring, whereas societies that generate more contacts outside the kin-group seek and find other commonalities, like career, political

[1] E.g. University of Cambridge, https://www.hist.cam.ac.uk/prospective-graduates/courses/mphil-earlymod/options/global-early-modernity; Yale University, https://campuspress.yale.edu/pericleslewis/files/2016/12/consciousness-syllabus-1cql029.pdf; Berkeley University, http://anthropology.berkeley.edu/courses/modernity-2; etc. etc.

orientation and education, resulting in a gradual decrease in emphasis on procreation. Smil (2004) gives a broad picture of the mechanics behind this change in contacts. He describes how fossil fuels, including electricity, pumped up agricultural productivity a manifold and freed up agricultural labour force, which could go into the service sector, away from jobs that *must* be done on a specific place (the land); the feed-in of agricultural population into cities, giving a population explosion in those cities with its larger chances on mobility and mixture; how fossil fuels decreased time and effort to travel distances and haul goods; and last but not least, how fossil fuels, including electricity, helped creating mass media and helped concentrating (military) power into fewer hands, 'imposing many structural uniformities onto the diverse world' (p. 557). To get an idea of the magnitude of this change, he notes that "[p]eak unit capacities of prime movers [like a single human being, a single horse, a single steam engine, a single nuclear submarine, etc.] that deliver sustained power thus rose approximately 15 million times in 10,000 years, with more than 99% of the rise taking place during the 20th century[1]." Also Burger *et al.* (2012) observe that the last ~100 years have been exceptional: they note that "human mortality has decreased so substantially that the difference between hunter-gatherers and today's lowest mortality populations is greater than the difference between hunter-gatherers and wild chimpanzees. The bulk of this mortality reduction has occurred since 1900 and has been experienced by only about 4 of the roughly 8,000 human generations that have ever lived." (abstract).

It would be strange if such massive changes would not have profound influence on societies. The move from predominantly agriculture to predominantly fossil fuels as main source of energy, resulting in more than 10^5 times increase in available energy per person nearly *must* result in a distinct typology for the entire

[1] Similarly: A modern thermonuclear weapon has a power release compared to a hunter-gatherer firing an arrow of roughly 15 million earths full of hunter-gatherers with the current 2017 population of ~7 billion all firing an arrow at the same time at the same goal (calculation of present author).

society. Yet, both Newson and Richerson (2009) and Smil (2004) emphasize the wider interrelatedness of social changes, and do not state that energy determines everything. For instance, Newson and Richerson note that "birth control technology is accepted by many social scientists and members of the public as a cause of a change in sexual mores". They contrast Britain and France, and state that although Britain was earlier in industrialization, France had a revolution at the end of the 18th century which disrupted traditional structures, suggesting that both industrialization and social processes can influence the change. In addition, in a brief way they describe how interacting processes, like urbanization —whereby many more non-kin can meet without much travel or effort—, transportation networks (railways and sail ships to start with) —disrupting local stasis and improving chances on migration—, newspapers —increasing diversity information— and factories —bringing non-kin together under one roof— all have their influence. Such interactions between various economic, social, technological, scientific and political processes and events could well be structurally equivalent to the transition from the hunter-gatherer to the agricultural society; not only that the primary energy source changed, but also many (social) technologies needed to be invented first before a full-fledged 'Doctrinal Mode' could be in place — inventions like agriculture itself (various degrees of sophistication exist, even before fossil fuels), writing, doctrines, technologies of control such as horse-mounted fighters, metallurgy, etc. But perhaps, in its deepest core -though this is clearly still in debate- it may well be that *energetic surplus* and *mobility* are two of the main drivers of societies. Energetic surplus because surpluses can be used for extra social complexity and more impactful power exertion; mobility because it is decisive for material ownership, genetic population structure, exchange of information and goods and -again- power exertion. Hence,

- if the Modes theory is not primarily about religion but about social structure;

- if the Modes theory claims that (a) the broad type of resource extraction is one of the prime selective forces for social structure, that (b) properties of societies are mutually reinforcing, and that (c) Modes are idealized endpoints on a scale;
- and if it is clear that the type and magnitude of resource extraction vastly changed in the last 200 years, as well as the societies,

then it is a compelling to extrapolate the general scheme of the Modes to the phase *after* agriculture was the predominant type of resource extraction.

In table 6.1 below, an attempt is made to capture the structure of these *three* types of societies, both in Modes terms as well as other properties that are a proposal of this thesis. The name 'Experiential' is also an invention of this thesis, in the spirit of the early Modes theory; it captures an important part of the third Mode in one word. Data in the table comes from either the Modes publications, Morris' book, or general knowledge. As can be seen, there are many differences between modern fossil-fuel societies and agricultural societies, and many differences between what has been labelled here the 'Experiential' Mode and the Doctrinal Mode, even for categories that stem from the Modes theory itself.

When this extrapolation is done, some questions for the Modes theory, are:

- If the broad type of resource extraction (or energy capture) is the driving force for group selection, and if modern societies are no longer recognized as agricultural societies, should we then not recognize that there is a third type of resource extraction and a third type of social organization?
- If this subdivision in three broad types of human organization is correct, and if two types of coherence psychologies underlie the social organization of Foragers and Farmers, then what is the third type of coherence psychology underlying Fossil Fuel societies?
- If there is no such psychology, then which of the following is incorrect: (a) Modern non-agricultural but fossil-fuel based societies exist, (b) the Modes are an

adaptation to resource extraction, or (c) distinct singular coherence psychologies underlie the Modes?

Variable	**Imagistic**	**Doctrinal**	**Experiential**
Resource extraction	Hunter-gathering	Agriculture	Fossil fuels
Energy consumption per person	Low; 2 kcal pppd	Medium; 5-8 kcal pppd	High; > 20 kcal pppd
Psychological features			
Ritual frequency and arousal	Rarely performed dysphoric ritual ordeals (with little or no doctrinal transmission)	Daily collective rituals (including doctrinal repetition)	Annually performed optional and hardly arousing rituals
Principal memory system	n.a.?	n.a.?	n.a.?
Ritual meaning	Meaning of rituals inferred independently	Transmission of exegesis to all members	Rituals disputed or absent
Techniques of revelation	Iconicity, multivocality and multivalence	Rhetoric, logical integration, narrative	n.a.
Socio-political features			
Social cohesion	Intense, based on relational ties (Whitehouse) or kinship-based (Newson & Richerson)	Diffuse based on categorical ties (Whitehouse) or kinship-based (Newson & Richerson)	Diffuse based on economic exchange; non-kinship based (Newson & Richerson)
Leadership	Passive/absent	Dynamic	Contested, non-hereditary
Inclusivity / exclusivity	Exclusive	Inclusive	Mixed
Spread	Slow or fragmentary	Fast, efficient, homogenous	Superfast, super-efficient, very channelled and competing
Scale	Small, face-to-face communities	Large "imagined communities" containing small face-to-face communities	Very large "imagined communities" without extended family ties, and anonymized mega-cities
Degree of uniformity	No standardized ideology / dogma	Standardized body of ideology / dogma	Individualised conceptions of the world, based on own chosen ideology

Structure	Authority exercised personally rather than institutionalized	Highly elaborated hierarchy with designated ranking of offices, minimal mobility	Highly elaborated hierarchy with highly elaborated horizontal spread of institutions, considerable mobility
Mobility	High around changing sedentary base	Low, sedentary	High around changing sedentary base
Morality			
Equality	Fairly equal (Gini <.25), mild inequality between women and men	Huge, continued and enforced inequality (Gini >>.35); inequality between women and men	Gradual developing equality (Gini .35-.25) as economy gets mature; also between women and men
Rate of homicide	High	Medium	Low
Main values	Surrounding nature, the tribe, ancestors, spirits	Serving, loyalty	Freedom, equality, rights
Redistribution	High	Low	Moderate
Private property	Nearly absent	Mildly present	Present
Slavery	Rare	De facto wide spread	Absent, or hidden in the form of tax
Ideology			
Truth	unfalsifiable	unfalsifiable	disputed, falsifiable
Authorship	no one	ideologues	everyone
Containment			
Encompasses	<none>	Imagistic Mode	Imagistic Mode and Doctrinal Mode

Table 6.1 — Properties of the Three Modes

Critical reflections on the Modes theory

In the theory sections, a series of 'take-away' points was singled out. These points capture some important tenets from the Modes theory, and they will be evaluated here one by one, in the light of the empirical findings of this thesis and the critical discussion given above. The tenets are given in *italics*. These tenets will be discussed under the assumption that they no longer apply to religion only, but to human collectives in general.

a. *There are two universal Modes of group formation, labelled 'Imagistic' and 'Doctrinal' (t 3.3).*

Ignoring labels, the three issues at stake here are: are there <u>two</u> Modes of group formation, are they <u>universal</u>, and are the indeed of <u>group</u> formation?

Starting with the issue of the number of Modes, it was argued above that there might be a Third Mode. Of course, one could deny there is a third Mode for various reasons, for instance that one should not think in separate Modes but rather in gradual processes of change in human history without conceptually solidifying various properties into a 'thing'. But such a counter-argument comes at the cost of negating the existence of other Modes as well. But if the existence of the Third Mode is even remotely accepted, then there are no longer *two* Modes.

The second issue is whether Imagistic or Doctrinal types are universal. Is there a range of groups or societies that do not have the (almost) full spectrum of either of the two Modes, or not such core properties as a HA/FL or LA/HF ritual? Do all human groups operate in a Mode anyway? For instance, large and efficient companies exist, but it is not *a priori* clear that they have repeated behaviour that is functionally opaque (i.e. that they have 'rituals'). One could even ask whether the latest iteration of the Modes theory is entirely internally consistent: if it is *fusion* that underlies the Imagistic Mode, and if fusion can be generated by all sorts of processes, like shared negative experiences, kinship, and negatively

arousing ritual, then the latter is not really required for armed groups, as shared negative experiences could do the job. Hence, the rest of the properties of the Imagistic Mode would not need to follow in response to the optional negatively arousing rituals. That makes the entire Mode unnecessary, and hence they should not be universal for theoretical reasons.

The third issue is that of *group* formation. What is a group, in this case? There seem to be two lines of thought in the Modes theory: one is about human history in general with the rise of what could be labelled 'Imagistic' and 'Doctrinal' practices; the other is about synchronically operating identifiable groups, for instance non-state armed groups post-1945, which are supposed to be either 'Imagistic' or 'Doctrinal'. If the Modes theory would indeed describe matters of fact that are universal *and* if the causal chain in both human development and synchronic groups were the same, then this difference should not matter. As argued above, both of these prerequisites may be questioned.

In conclusion, if the aim is to explain ritual types or religions that are passed on as traditions, perhaps then there are two universal Modes. The switch of the Modes theory to domains outside of religion has made this more questionable.

b. *b. The Imagistic Mode has small groups, few hierarchical levels, high-arousal low-frequency rituals, no standardized ideology, no central leader, and what ideology there is cannot spread quickly (t 3.1)*

A tenet like this first of all begs the question: 'how small?', 'how few hierarchical levels?', 'how high should the arousal be?', etc. In addition, do all criteria need to be met, or some? Is there a necessary and sufficient property, and if so, what is it? As far as known to the present author, this has not been specified in print; instead, what *has* been specified in print is the opposite, that there are no hard and fast rules for the criteria (Whitehouse, 2004: "…attractor positions

around which ritual actions and associated religious concepts cumulatively *tend* to cluster" (p. 74, emphasis added here); "what the theory of modes of religiosity sets out to explain […] is the *tendency* for religious systems to gravitate toward divergent attractor positions" (p. 75, emphasis in original)). That makes it more difficult to say whether there are Imagistic groups or not in any sample; and again, it makes it more difficult to falsify something. Simply maintaining that *some* groups in the sample have such properties to varying degrees would not be much of a theory: if there is enough variation amongst a research object (which typically is the case amongst humans and human groups) and there are not that many properties, then there is always some amount of that research object that has such properties in varying degrees. (Test: pick random properties of human groups, e.g.: mean age 23, blue eyes, speaking an Indo-European language, … do groups exist that have these properties in varying degrees?). Whilst the theory is true in such a case, it is doubtful whether it is a fruitful or useful theory. However, a much more interesting theory —and arguably the Modes theory is claiming that— is when those properties are causally related, and when there are a few clusters of the research object with either this set of properties, or one or a few other sets of properties, but not much in between and not much else. However, the empirical evidence of this research was not majorly in support of those latter, much more interesting claims. Most correlations between the Modes properties were, after Holm corrections, not significant, suggesting the Imagistic Mode properties are not highly correlated or causally related. For many groups, some Imagistic properties were present, others not, suggesting again that most Imagistic properties were not strongly correlated. In addition, it was not found that there are two clusters of groups. What remains is: (a) this research was not done properly, (b) the operationalization should have been different, or (c) tenet 3.1 is questionable in the context of armed groups.

c. *The Doctrinal Mode has large groups, several hierarchical levels, low-arousal high-frequency rituals, a standardized ideology, a central leader, and the possibility of a quickly spreading ideology (t 3.1)*

The thoughts for the Doctrinal Mode's properties are similar to those for the Imagistic Mode: how precise are these criteria, and to what extent are these criteria required or not? What constitutes a Mode? In addition, the theoretical concerns are similar as well: surely at least *some* groups can be found in this world that comply to all criteria. It must be said that the impression from this research emerges that more armed groups tend to be quite or even fully Doctrinal than Imagistic, and that some of the Doctrinal properties were in line with the hypotheses. This *could* indeed be for a selectionist reason; for instance, in the context of war, size matters. That is because the probability of victory is positively (though perhaps not linearly) related to group size (D. D. P. Johnson and MacKay 2015); and given that Doctrinal properties enable to manage larger groups more effectively and efficiently, one could infer that in the context of war, Doctrinal groups should outperform Imagistic groups. Hence, fully Doctrinal groups can perhaps be found more often — and therefore, a sample of armed groups typically consists of Doctrinal armed groups. A second explanation for the skew towards Doctrinalness could be phylogeny: the world is by and large at least Doctrinal now (if not Experiential). The wheel does not need to be reinvented in a pool of group-competitive experiments; the social technology is already there, including hierarchically organized armies. If the phylogenetic explanation makes any sense, then it remains to be seen to what extent the underlying causal dynamics of 'mutually reinforcing properties' is the right explanation. Instead, habit and copying successful organizations might be a shorter, more applicable explanation. So, this tenet might be by and large correct; but in isolation it is easier to find support for it than in the context of the larger body of the Modes theory with its causal claims.

d. *There is an inverse correlation between ritual frequency and ritual arousal (t 3.10)*

For the Doctrinal semantic worldview-spreading rituals, this was indeed found in this study, and in Atkinson & Whitehouse (2011): higher frequencies are much more prevalent. The inverse relationship was not found for the high-arousal euphoric rituals; rather, all sorts of frequencies seemed to occur, although there seemed to be a tendency that annual frequencies could occur more often for some of the euphoric rituals, again quite like the findings in Atkinson & Whitehouse (2011). For the dysphoric rituals, the inverse relationship was not found in this study, in contrast to Atkinson & Whitehouse (2011), where it was found very clearly. Some remarks have been made regarding the question on ritual frequency as used for this thesis, as this question may have been misinterpreted by some experts. Hence, this study cannot be held as strong counter-evidence against tenet 3.10, and given the findings in Atkinson & Whitehouse, it is probably best to see this tenet still as supported by empirical evidence.

e. *The internal features of the Modes are mutually reinforcing; as a result, there is hardly any overlap between the two Modes (t 3.8)*

The first part of this tenet could be questioned because of the reason already mentioned, namely that not many properties were correlating in the first place *if* one wants to take Holm corrected significance of correlations as a guide. Regarding the second part of the tenet, in the context of armed groups no evidence was found that there is hardly any overlap between the two Modes. That could of course be because the methodology followed was not appropriate. A more interesting explanation is the one mentioned before: if armed groups tend to be Doctrinal anyway, then the sample largely exists of Doctrinal-like groups, and the variation in the sample consists more of various degrees of Doctrinalness than of two distinctive Modes. That would of course decrease the relevancy of the more

niche-oriented thesis that *armed groups* are either Imagistic or Doctrinal; if by far most of these groups are organized along the lines of some form of Doctrinalness anyway, then the international community would better get to grips with those groups —which are most groups, and also the most important groups— and by the time the big civil wars are understood, prevented, solved and over, perhaps focus on the local Imagistic skirmishes. But that would render the Modes theory not very fruitful or helpful to understand non-state armed groups; other theories might have more to say about the bulk of the groups.

All in all, neither the mutual reinforcement of Modes properties, nor the lack of overlap between the Modes has become apparent in this research.

f. *The Modes are in practice rarely purely Imagistic or Doctrinal (t 3.9)*

This tenet on its own introduces the risk of unfalsifiability of the theory, hence it must be seen in the context of the wider Modes theory. The risk of unfalsifiability is materialized if the tenet was interpreted like this: "the two Modes are attractor states with little overlap, but if we do find overlap, then we predicted it too because that is one of the tenets". This research has shown -to the extent that the exact criteria for the Modes are clear- that at least armed groups are indeed rarely purely Imagistic or Doctrinal. What the Modes theory could do is to clarify the extent to which overlap is acceptable, and what degree of mixture counts as a falsification. The Modes theory could also become clearer on when and where non-mixed but also non-complete Modes can be expected, and where the border would lie between seeing interacting Modes to operate at the same level, or seeing the Imagistic Mode as an indication of subgroups, or when Imagisticness is an indication of 'projection' of local fusion on a larger (Doctrinal) group.

g. *Interacting Modes can exist when large Doctrinal populations are composed of many locally distinctive Imagistic ritual communities (t 3.16)*

This might in practice be an important tenet for future research (see further above), to see whether more Imagisticness can be detected in subgroups or platoons. In addition, now that the Modes are no longer explicitly about religion, there is also a possibility of interacting *Doctrinal* Modes, for instance of state, religion and university. By extension of the current Modes theory principles, it should also be possible to see the Third Experiential Mode being composed of many Doctrinal and Imagistic communities, for instance when a liberal state gives room and even funding for different religions, worldviews, walks of life, etc., but also Ju-Jitsu clubs, fraternities and potlatches. So this tenet (3.16) may be correct but may also need to be extended.

h. *Of the Modes properties, there is no independent variable driving the rest, but they should be seen as a clustering set (t 3.14)*

One could wonder whether this tenet is still as important as it was when the Modes theory set out to be a theory of religion, based on two types of memory systems as primary driver. The memory systems are still part of the theory, but probably have been taken over in importance by fusion and group identification. In the later versions of the Modes theory external drivers like group conflict and resource extraction have gained in importance as well. All that does not preclude that the *Modes* properties are not the independent variables, and it does not preclude that the *Modes* variables still are clustering. However, when the domain is no longer religion *sec*, but rather adaptation to resource extraction or group conflict, the question can be raised whether the same Modes variables are still applicable or whether they should be updated as well, in response to new types of external drivers.

The following three points are taken together:

i. *The psychological state of 'fusion' exists, and leads individuals to sacrifice themselves for the group with whom they are fused (t 4.8)*

j. *Fusion is the basis for the Imagistic Mode, because fusion can be triggered by shared dysphoric rituals and shared dysphoric experiences (t 4.16, 4.19)*

k. *When group members are fused, the collective action problem of war and high-risk high-reward resource extraction are mitigated because fusion decreases the chance on free-riding and increases the chance on self-sacrifice for the group (t (5.1-)5.3).*

These three tenets, discussed here in conjunction, were not empirically tested in this research but rather scrutinized on theoretical grounds. To recap, the main problems here are: First, is fusion the only psychological state that leads to self-sacrifice, or are there more? If there are more, then it might be too quick to infer that one Mode (here: Imagistic) is associated to, and the result of, this one psychological state. Second, is it expedient to simply assume there is a collective action problem in war and resource extraction of [freeriding versus] self-sacrifice, or is it more often a personal cost-benefit balance to participate in war? Under which circumstances is there this CAP? Third, is 'fusion' itself falsifiable when it is caught in behavioural terms? The state of 'fusion' is inferred from behaviour (currently the *reported* willingness to sacrifice oneself for the group), but behaviour is explained by fusion. This has a risk of being circular (though it does not need to be: if there are various types of behaviours that *correlate*, then not only those behaviours need to be explained, but also the correlation; the less factors explain that correlation, the more plausible it is; fusion could be such a singular explanation).

l. *Through cultural group selection, a positive correlation exists between warring and high-risk high-reward resource extraction on the one hand and the Imagistic Mode on the other (t 5.4)*

Regarding the positive correlation, that was hardly found in this research (see chapter 5). As always, that could be due to methodological reasons, but the findings could also be onto something meaningful. Perhaps there is a difference, as touched upon above, between the development of humans in history, and contemporary groups. After all, findings in Atkinson and Whitehouse (2011) and Whitehouse and Hodder (2010) and Whitehouse e.a. (2013) indeed suggest there *is* a link between at least resource extraction types and a Mode of organizing a society. All of these are probably better placed on the scale of 'human history' than 'synchronically competing groups in the modern world'. The positive correlation with warring might be better treated in the context of group selection:

As for the group selective part of this tenet, these were not subjected to empirical test in this thesis, but this thesis did discuss at some length the challenges to substantiate evolutionary claims: First, group selection may work on more cohesive mechanisms than fusion and group identification only, e.g. people could discuss what they will do as a group, or vote, copy others, follow a prestigious individual, or other mechanisms to coordinate behaviour. Where are these in the theory? Are they not required to understand the patterns we find in real nature? Second, cultural group selection requires a rigid proof of adaptation. This was discussed at greater length above in this thesis, so this will not be elaborated here any further. All in all, this tenet needs much work in the future to gain in credibility.

Similar to the 'Imagistic side', the following three points are also discussed in conjunction:

m. *The psychological state of 'group identification' exists, and leads to a feeling of shared beliefs, values and goals (t 4.17)*

n. *Group identification is the basis for the Doctrinal Mode, because group identification can be nurtured by regular and consistent spreading of standardized group values, beliefs and practices (t 4.22)*

o. *When group members are group-identified, the collective action problem of war and gradual resource extraction —when seeking to pool small amounts of resource from individuals in a much larger population so as to create a large, centralised resource in the form of charitable donations, legacies, tax or tribute— are mitigated because trust between group members is increased because behaviours of group members can be more effectively monitored (t 4.17.2, 4.23-4.24, 5.11).*

Critique to these three points is of similar nature as the critique on fusion (point i, j and k above). In addition, and as noted before, if maximization of resource extraction is the goal, then this could also be promoted by specialization combined with trade and property rights. Group identification may not be required for that, but instead a Leviathan that does not require emotional buy-in from trading individuals. Indeed, the Leviathan may be Doctrinal, but the issue here is whether 'group identification' is required for that; if not, or not predominantly, or even completely, then this [set of] tenet[s] is much less powerful.

In addition, the Modes theory emphasizes self-sacrifice (Imagistic) and trust (Doctrinal), but the advantages of the Doctrinal side for war, and perhaps also resource extraction, might at least be expanded with -again- size matters. In an environment of group selection, groups are, on the whole and certainly in the modern world, better of with an increased span of control and increased numbers dedicated to the task. This is precisely what the Doctrinal Mode may have to offer. Hence, the proposal is to re-formulate these tenets with that in mind.

p. *Through cultural group selection, a positive correlation exists between warring and low-risk low-reward resource extraction on the one hand and the Doctrinal Mode on the other (t 5.11)*

In this research, this tenet was tested empirically. The evidence in support of this tenet perhaps did exist, but minimally so (see chapter 5) — a synchronic link between *some* low-risk low-reward resources and *some* Doctrinal properties. As for the group selective part of this tenet, see point l (~L) above.

Summarizing and in conclusion, the overwhelming impression is that many tenets of the Modes theory require further refinement and even an update, not in the least because of the 'adaptive turn'. Losing one's religion is a major event; the consequences may only become apparent many years after.

Contributions of this thesis

This thesis made contributions in the empirical domain, in the domain of theory development, and the domain of methodological techniques.

Empirical contributions

- A test of whether the Modes are present at the level of the entire group amongst non-state armed groups. This study was the first to investigate the distribution of all main Modes properties amongst modern-day groups, and the first to see whether two non-overlapping modes can be found at the level of the entire group in modern-day groups.
- A test to determine in what way resource extraction and Modes are related. This study was the first to investigate the link between Modes properties of modern groups and their type of resource extraction.
- An investigation of the pathways of cultural transfer (diffusion). This study presented a relatively rare combination in one research project of investigating

multiple pathways of transfer -which makes comparison between those pathways possible-, and a description of a network that consisted of modern groups instead of individuals within groups.

- Tests of the effects of autocorrelation. This study was a first to show that some Modes properties are very likely to be strongly autocorrelated, whereas other Modes properties are not.

Theory development

- A theory of ROI and Risk. This thesis expanded the concept of ROI with that of Risk. It was argued that Risk should be added to ROI to get a more realistic picture of what it is that human beings respond to when it comes to choosing resource types: Expected Reward. However, it must be said that the first empirical test as done by this study is not indicative that ROI, Risk or Expected Reward have great descriptive or explanatory power when it comes to armed groups.
- A formal description of the Modes theory, as given in Appendix 2. This study was the first to encode the entire Modes theory in statements that should either be empirically testable on their own, or are a logical consequence of previous statements. Within the philosophy of science, there are two broad directions regarding what a theory should comply to: Foundationalists and Coherentists (Morton 2003, 77–79). Foundationalists state that a theory should have good foundations, whereby certainty of belief comes first. Coherentists state that a theory should have logical coherence whereby the network of beliefs will evolve towards an increasingly accurate description of reality. These approaches are not unlike the Frequentist and Bayesian schools of statistics. Both approaches can be satisfied with the formal description of the Modes theory as provided by this thesis. These statements can be used for future research on the Modes theory: statement by statement, they can be tested and analysed, as was partially done in this thesis.

- A critical discussion of the question what the Modes theory aims to explain. The possibilities of religion, cultural evolution and social cohesion were treated one by one, and challenges and theoretical problems, but also research possibilities were charted.
- The introduction of the 'Third Mode', which both critiqued but also extended the Modes theory.
- A critical discussion of some of the tenets of the Modes theory, to provide an updated understanding of the status of the theory.

Methodological advances

- A relational database with data on armed groups. This database offers both the data itself, and a platform. The relational database is expandable with other datasets, which is demonstrated by the fact that some missing data were imported from third party datasets.
- A conceptual method and working software that can calculate a PCA on imputed datasets.
- A vast code base in R. Around 10,000 lines of code were developed to analyse data. Many of these lines of code have the form of a reusable function for many other types of research. For instance, functions have been created to handle imputed datasets (create histograms, means, merge with non-imputed datasets, calculate correlations, etc.), and for general utilities (matrix processing like inversions, serializations etc., as well as pivot table aggregates, etc.). Most of the rest of the code is more specific to the research at hand, but is highly reusable should there be a next iteration of this research, for instance with more cases and extra variables.
- Proposals to operationalize ROI and Risk.

- Proposals to do further research on the Modes theory, in particular to research subgroups within armed groups, in search of more Imagistic properties; to improve data quality by using more data sources per group and more assessors per conversion (e.g. from resource type to ROI); to do a similar study in other types of groups, for example on historic non-pacified societies in the eHRAF dataset; to expand the research on relations between groups, that is, to focus on "Galton's asset" rather than "Galton's problem"; to improve the resource research, for instance by including local resource availability and by making more explicit links with existent research on resources and armed groups; to compare the Modes theory in the context of armed groups with other theories that try to explain the dynamics and structure of armed groups in relation to resources, most notably Weinstein's (2005) recruitment theory; and to expand the database created for this project into a data hub for all datasets concerning War and Peace.

These contributions should constitute a firm launching pad for future iterations of research on Modes amongst armed groups, armed groups on their own, the evolution of culture, and/or the research of social cohesion.

Final remarks

This thesis tested the presence of the two Modes among non-state armed groups, and the link between the two Modes and resource extraction. In broad strokes, it became apparent that some correlations between individual Modes properties could be found, but not the two Modes as attractor states. It also became apparent that some Modes properties are more autocorrelated than others, especially in the Doctrinal domain. In the domain of resources, ROI and Risk appeared to be concepts with little empirical content. After corrections, only rarely were correlations between resource types and Modes properties found. These findings raise questions concerning the methodology that was followed in this study, and/or the applicability

of the Modes theory to armed groups. Various recommendations were made to improve the current research, and some aspects of the Modes theory were critically discussed, especially the move to secularize the Modes theory and the Modes theory's ideas about cohesion and underlying psychologies.

Having done so, this thesis has made various contributions in the empirical, theoretical and methodological domain of the Modes theory, armed groups and human culture in general, and set out lines for future research in these domains.

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Appendices

Appendix 1 – Question list

This appendix shows the last version of the question list that was used to collect data. It is version 1.4, as used for most experts. Answers to earlier versions of the question list were also used in the research. These earlier versions mainly contained a few less items, but not substantially different wording etc.

- -

How to answer the questions?

While recognizing that answers to these questions may require much more detail and nuance, we would like you to answer these questions in a way that provides an accurate but general assessment of the situation without getting stuck on fine details and minor exceptions.

Most of the questions are about the non-state armed group (hereafter "armed group") as a whole, including its fighting and non-fighting elements. There is, however, one exception: question 4 concerns just the customs and experiences of the *fighting* elements of the armed group, rather than the group as a whole. These are the elements of the armed group that engage directly in violent armed action. You will be reminded of the appropriate level of description throughout the questionnaire.

You will be asked to provide ratings for things like the frequency with which a particular event occurs or the strength of relationships between armed groups. These questions do not require you to precisely quantify the traits (e.g., frequency). Rather, we ask for well-informed estimates that allow us to compare across items in each section. To illustrate, if we were to ask people to rate the surface areas of various countries, they would not be able to provide precise numbers for Russia's or

Belgium's surface areas. However, they would be able to provide ratings such that Russia is rated larger than Belgium. In the cases where even such ratings are impossible or inapplicable, but where the phenomenon (e.g. event, relationship) is present, just put a tick [✓] mark in the space provided.

1a. Basic information about the group

This question concerns the entire armed group, including both fighting and other elements. When asked for dates, please give the month in letters (e.g. 11 *March* 1998) instead of numbers (11-03-1998) to avoid ambiguity. If the exact day or month in unknown, please provide as precise an estimate as possible (e.g., first quarter of 1998). NB: If a splinter of the group continues after a conflict settlement, that splinter group is considered to be a new group and not the same group that agreed to the settlement; hence, that splinter group would no longer be part of this questionnaire.

Group name	
Alternative group names	
Date of origin[1]	
Date of first act of armed violence	
Date of end as violent group	("n.a." if still active)
Home base (town, region)	

[1] Date of origin refers to the date the group was formed under the name specified, regardless whether the group was violent or non-violent at the time of formation. If the group merely changed its name but without meaningful change in group structure, organization, size, strategy etc., it is held to be one and the same group for this research.

Country of origin	
Main country/countries of activity	
Majority ethnicity/race(s) in group	
Language mainly spoken in group	
Other languages spoken among group members	

1b. (If group is not active anymore:) *How or why did the group end?* [tick as many options that apply]

[ ] unknown;

[ ] no or low activity;

[ ] ceasefire;

[ ] peace agreement;

[ ] victory;

[ ] defeated;

[ ] merged with another group;

[ ] other, please specify …

2. Changes in armed group and/or fighting troop size

This question concerns *both* the overall size of the armed group (including fighting and non-fighting elements), as well as the size of just the fighting elements of the group. If the entire group engages in armed violent action, please just write "SAME" in the space provided for 'size of fighting elements'.

Recall that the overall size of the armed group may include political wings, welfare organizations, propaganda offices, and other non-fighting elements of the group. The fighting group size excludes such elements, and refers only to the portion of the group that engages in armed violent action. In both cases we are only interested in how big the group itself it, which does not include supportive non-members, such as family members who may occasionally supply food or sympathetic locals who occasionally provide shelter.

In some cases, it may be difficult to estimate the size of the group. If so, you may provide a range, such that you are 90% confident that the size of the group falls within that range.

We are interested in how the size of the armed group and its fighting group members has changed over time, from the beginning of the armed group's violent activities until the end of its violent actions (or, if still active, until the present time). Please start a new period whenever a change in group size occurs.

year or period	overall size of armed group	size of fighting elements	comments (if any)

[add rows as needed]

3a. Ideology

This question concerns the ideology of the armed group as a whole. The group ideology is a set of ideas that constitute the goals, narratives, beliefs, and/or rationale for the group and its violent actions. The ideology of the group does not need to be entirely unique to the group, but may overlap or be derived from other groups (e.g., the local population from which the armed group originated). This question only requires 'Yes' or 'No' answers.

Does the group have its own *written* and /or *published* ideology?	
If not, does the group nevertheless have an *explicit* ideology?	
If not, does the group have some rationale for its existence widely shared by its members?	
Are influential preachers or ideologues present?	
If there is an ideology or rationale:	
Is the ideology based on historic key book(s) (e.g. Bible, Koran, *Das Kapital*, etc.)?	
Does the ideology give preference to one or more specific ethnicities or races?[1]	

[1] The ideology may emphasize the uniqueness or rights of a certain ethnically or racially defined group, perhaps in conjunction with ideas of rectifying the wrongdoings of another ethnically or racially defined group. If (a part of) the ideology is stating that one or more ethnic or racial group(s) should benefit from armed struggle, and especially if the armed group is of that particular ethnicity or race, then answer 'yes'. If on the other hand the ideology references to ethnicity or race, but in a way that emphasizes the equality of all ethnic or racial groups, then answer 'no'.

If there was no preference to specific ethnicities or races, was there nevertheless preference implemented in practice?	
Is the ideology linked to territory?	
Does the ideology offer a theory on the course of history?	
Does the ideology offer a (metaphysical, causal) worldview in which the group's violence is interpreted?	
Does the ideology offer a prescribed set of values for behavioural conduct in everyday life?	

3b. If there is an explicit ideology, is it religious, secular or mixed? [tick one option]

[ ] not applicable, because there is no ideology

[ ] fully or predominantly religious

[ ] mainly religious, but with clear influences of a secular ideology

[ ] mixed; both religious and secular

[ ] mainly secular, but with clear religious elements

[ ] fully or predominantly secular

4a. Conventional practices or customs of fighting group members

This question concerns the conventional practices and customs of the fighting elements only; that is, the members who engage in armed violence.

If the custom or practice occurs for a notable number of fighting group members, then please provide a frequency and a brief description; otherwise, leave blank. Note that we are only interested in practices and customs that are linked to the group identity. (For example, we are not asking how often people attend weddings that have no special association with the group, but only weddings that have a strong link to the identity of the armed group.) In addition, we are interested in **the *actual* practice**, not just what was formally or officially prescribed or prohibited. Practices in training camps should be included here too.

The practices listed in the left column may be interpreted loosely. If you are unsure about the frequency, please pick the minimal frequency you may be certain of, and make a note of this in the Description section.

Please add new items to the list if you think the group displays other conventions, practices, and customs that are not yet listed. If there is a marked change in the occurrence of a conventional practice or custom, please mention this in the description.

Group conventional practice or custom	**Frequency** (tick 1 per row): how often does a typical group member perform the practice or custom on average?	**Description** Please add a description of the practice or custom

	Often = from several times a day to weekly Sporadically = monthly, seasonally, or annually Rarely = a few times per life or once per generation					if the frequency is other than 'Never' or 'Unknown'. Please make it a few lines per practice or custom instead of a few words, so that we get an impression of the practice.
	Often	Spora-dically	Rarely	Never	Un-known	
praying						
blessing						
divination						
initiation (i.e., a practice that starts a new phase for an individual; such practices are usually similar across multiple group members)						
sacrifice						
healing ritual						
installation ritual (i.e., a practice to install someone in a formal or						

distinguished *role*; such practices are usually distinctive to the role)						
ritual inversion (e.g. women dress as men or the lowly exchange places with the powerful)						
taking drugs						
drinking alcohol						
feasting						
orgiastic sex						
dancing						
rhythmic / synchronous movement (e.g. marching)						
singing, chanting						
celebrations						
festivals						
weddings						
religious, spiritual or ideological gatherings						
memorial gatherings						

funerals						
fasting						
(be subjected to) sleep deprivation						
sexual harassment						
humiliation						
disgust						
poisoning/dysphoria-inducing drugs (e.g. vomiting)						
(being subjected to) pain						
being forced to do an action with risk of wounds						
oath taking						
stating obligations to each other's families						
similar clothing (e.g. uniforms)						
similar body ornaments						
similar permanent body markers						

having to kill a family member						
having to kill a friend						
ritual punishment (punishing someone without actually finding that particular person guilty)						
ritual killing (killing someone or a few with behavioural elements that are not efficient or conducive to the actual killing)						
sexual violence						
military training/drills						
endurance test						
indoctrination						
ideological teaching						
other, please specify…						

4b. Shared negative experiences of members in fighting elements

This question concerns the negative experiences shared by members of the fighting elements of the armed group; that is, those members who engage in armed violence.

If you are unsure about the frequency, please pick the minimal frequency you may be certain of, and make a note of this in the Description section.

Please add new items to the list if you think the group has experienced any other kinds of negative experiences that are not yet listed.

Experience	**Frequency** (tick 1 per row): the best estimation of how frequently the majority of group members (or the modal group member) undergo(es) the experience on average. The scale is the same as above.					**Description** A few lines of description of the shared negative experience. See clarification of 4a.
	Often	Sporadically	Rarely	Never	Unknown	
fighting with chance of dying						
witnessing a family member killed						
witnessing a friend killed						

witnessing own community member killed						
having to kill own community member						
house destroyed						
property looted						
being forced to migrate						
being subjected to sexual violence						
witness the rape of significant other						
being physically mutilated						
being forced to do an action with risk of death (this is different from fighting, e.g. here it concerns actions during initiation, training, a mission, etc.)						

5. What is the organizational structure?

This question concerns the entire armed group, including both fighting group members and non-fighting group members (e.g., service organizations, political wings, politburo, propaganda office).

a. What is the number of hierarchical levels?

We ask you to provide the number of hierarchical levels, without being specific about persons or departments. For instance, if a group consists only of a commander and soldiers, the number is 2. If a group has a central politburo (1st level), underlying service organizations (2nd), and a military wing (2nd) led by a general (actually in charge of the military, so 2nd, as he takes orders from the 1st level only), under whom are commanders (3rd) and finally soldiers (4th), the number of levels is 4. If there are known changes over time with regard to the number of hierarchical levels, please specify the number per time period. Especially during the start-up phase of armed groups, there may be rapid changes, so if applicable (and possible), please specify the number per month or other appropriate time unit.

year or period	number of hierarchical levels	comments (if any)

[add rows as needed]

b. What is the type of leadership of the group?

Please pick one of the following options, if applicable per time period (the type of leadership may change over time):	
1	Factionalized/competing leaders
2	Weak or decentralized leadership
3	Strong ruling council
4	Strong single leader
unknown	No basis for judgment

year or period	type of leadership	comments (if any)

[add rows as needed]

c. (Optional:) Could you provide an organizational chart, either below or on a separate sheet, or give a clear description in words?

6. Relation with local population

This question concerns the entire armed group, including both fighting and non-fighting elements. Only 'Yes' or 'No' responses are required.

Does the armed group have a political wing?	
Is a social or charitable organization linked to the group?	
Public works created by armed group - schools	
- public buildings	
- roads	
- hospitals	
- other, namely…	
Does the group install a judicial or legal system?	
If so, is this judicial or legal system experienced as being just or fair by the local population?	

7. What are the sources of income of the armed group?

This question concerns the sources of income of the entire armed group, and how these sources of income change over time.

Please indicate how reliant the group was on a given resource during a given time period. The degree of reliance should be coded as **none**, **minimal**, **moderate**, or **substantial** (see hypothetical example). If you know that a certain resource was available to the group but not whether the group was reliant on it to a minimal, moderate or substantial degree, then please fill in '**present**'. If you are neither sure about the degree of reliance nor about its presence, but suspect that a resource type functions as an income, please fill in '**rumoured**'.

In the first column (*Year or Period*), please specify the period you are describing. Although reliance on different sources of income may change at different rates, please specify the periods in such a way that meaningful comparisons can be made across all income sources.

Year or Period → Resource ↓	1987-1990	1991-2004	Etc.
official regime of country	none	substantial	
wealthy citizens of own country	minimal	minimal	
foreign regime	none	present	

Year or Period → Resource ↓						
official regime of country						

wealthy citizens of own country [1]						
foreign regime						
wealthy citizens of foreign country *						
diaspora contributors						
protection money/extortion of locals						
taxation of local population						
local support / voluntary contrib.						
running corporations						
running 'charity' organizations						
booty/looting of civilians						
booty/looting of corporations						
hostage taking						
human trafficking						
extortion of aid organizations						
drug trade / smuggling						
weapon trade						
oil						
surface diamonds						

[1] This includes both voluntary and involuntary (e.g., forced) contributions.

timber						
minerals						
plantation (e.g. rubber, shares of palm oil, etc.)						
other, namely…						

8. Is there a notable relation to any another armed group or state?

This question concerns the entire armed group, including both fighting and non-fighting elements.

If there is no known relation, skip this question.

NB: The 'Period of relation' may sometimes be best interpreted as a period of influence. For example, in the cases of splitting off from another group, the period of "relation" is not applicable because we are not interested in how long the split took to occur. Rather, we are interested in how long the previous group existed before the split. This may be meaningful because it indicates the extent to which the new group is influenced by its predecessor.

For other categories or situations, the 'Period of relation' cannot be given or is not applicable. In such cases, you can leave the column empty.

Relation type	*Other armed group name* ***or state***	*(Other armed group's) country*	*Strength of relation 1=hardly / minor; 2=some; 3=medium / several / a few important ones; 4=much / most; 5=all / intensely' n/a = not applicable*	*Period of relation*
split off from				
copied ideology from				
copied tactics from				

explicitly inspired by				
got group member(s) from				
got leader(s) from				
merged with				
gave birth to				
predecessor of				
successor of				
encompassed faction of				
was a faction of				
closely worked with				
trained by				
was mentor for				
did business with				
fought against				

Appendix 2. The Modes theory — formalized

In this appendix, the Modes theory is presented as it is in its current (mid 2017) form in a series of formal statements. The statements should either generally be accepted to be true, and/or empirically testable, and/or a logical derivation of previous statements. (In that sense, it is a "Wittgenstein I" version of the Modes theory.)

This form of presentation of the Modes theory has three benefits. First, over the past two decades, many increments of the Modes theory have been proposed and much empirical research has been conducted. Changes in the understanding and extensions of several claims have been the result, though in disparate publications. This chapter aims to give a precise and combined description of the Modes theory in its current state. Second, scientific theories should have a good foundation, a good internal coherence and should preferably cohere with other scientific theories as well. This chapter tries to bring the Modes theory in line as much as possible with these desirable properties. Third, given that the Modes theory is continuously in development, it is very useful to have a complete description in one place that can serve as a starting point for future additions and empirical work. That is important not least because this thesis aims to test some of the predictions of the Modes theory.

The process was as follows: in consultation with the originator of the Modes theory (Whitehouse), key publications were chosen that best described the Modes theory. From those publications, sentences were extracted that formed the statements. An attempt was made to remain as close to the original wording as possible, to avoid over- or misinterpretation as much as possible. Only in some cases, the statements deviated from the original when the context or parsimony gave clear reason to do so. When (parts of) statements were inferred from the context, they were placed between square brackets ('[…]') as much as possible. References to other publications outside the primary Modes theory literature were removed. Every

statement got a summarized reference to one or more source Modes publications (see list below). Every statement got a leading number to be able to refer to specific statements by a number, either internally in the description below, or later on in the discussion.

Selection of the statements and the wording was done with moderate charitability towards the theory. That means that an attempt was made not only to give a fair description but also to make links that perhaps were not explicitly stated in the original texts but could reasonably be inferred from the context. However, in accord with the principles of science, a critical stance was also taken: no attempt was made to 'improve' the theory if for instance explanations did not form a closed argument. Finally, most scientific theories, including the Modes theory, are in debate with other theories. However, this description is mostly without references to other (e.g. competing) theories but in the original publications such references were certainly there.

The following abbreviations are used for the literature references:

Jea15: (Jong et al. 2015)

W04: (Whitehouse 2004)

W12: (Whitehouse et al. 2012)

WL14: (Whitehouse and Lanman 2014)

Wea15: (Whitehouse, Francois, and Turchin 2015)

Formal description of the Modes theory

Preamble

0. The Modes theory aims to be a testable theory how religions are created, reproduced, and transformed (W04: 1).

0.1. Religion is a distributed phenomenon, such that recognizably similar thoughts and feelings can be present in a group of more than one interacting individual, and several forms of religion presuppose different tasks for different people, making it even more a distributed phenomenon (W04: 16).

0.2. If specialist knowledge is possessed by different categories of officiants, then the reproduction of religion will depend on cooperation (W04: 16).

0.3. The main aim of the theory –explaining religion- is therefore explaining a particular type of distributed cognition (W04: 16).

0.4. [Many religious concepts, ritual and myths are shaped by evolved psychological propensities, which make the occurrence of some religious concepts, behaviours and thoughts more likely than others.]

0.5. Evolutionary processes shaped the genetic make-up of human beings, which partially shaped the psychological make-up of human beings (W04: 17).

0.6. The psychologically make-up of human beings, generally and individually, constrain and thereby shape cultural data (W04: 17).

Concepts

0.7. Some religious concepts are easier to generate, encode, memorize and recall than a range of alternatives given the human psychological make-up; hence, unrestrained by non-psychological factors, such religious concepts will prevail or originate more quickly. In general, the concepts that are easiest to generate, understand and/or recall –as compared to all others– are said to be at the *cognitive optimum* or be in an *attractor position* (W04: 17, 29)[1].

[1] Two examples, which are not formal part of the Modes theory, can serve as illustration: (1) Theory of mind in the form of the HADD (Hyperactive Agent Detection Device) is evolutionarily useful: it

0.8. Hence (from 0.6 and 0.7), also for religious traditions it is the case that their scope, form and dynamics are constrained by the psychological make-up of human beings (W04: 7, 17-22).

Ritual

0.9. Ritual procedures activate powerful mechanisms aiming to reduce risk of contaminants (W04: 33-4).

0.9.1. Reducing risk of infection has clear evolutionary benefit. A system that reduces that risk and links emotion to contamination avoiding behaviour and is relatively easy to learn is adaptive (W04: 34).

0.9.2. From (0.9) it is only a small step to conclude that people are naturally susceptible to learning and copying ritual procedures (W04: 34).

0.10. Ritual procedures that address supernatural agents trigger tacit intuitive judgements about the appropriate forms that rituals should take and for instance make use of the Theory of Mind*, which is an evolved cognitive inclination (W04: 33, 38-40).

0.11. Hence (from 0.8 and 0.10), [some] ritual actions are also easier to generate and learn than a range of other actions (W04: 33-4).

Myths

0.12. People have a natural and pronounced tendency to pay attention to causal stories, also ones that (i) relate to states of affairs that are not actually

---

is evolutionarily less costly to infer the presence of a potentially harmful agent when there is no such agent present than not to infer such a presence when it may be lurking; hence, humans are prone to over-detect agency, including supernatural agency, in their environments (W04: 32). (2) Minimally counterintuitive concepts are salient and therefore easy to recall, however not so implausible as to be discarded right away; hence, minimally counterintuitive concepts —such as minds that can know your intentions intimately or minds that are separate from bodies— are easy to generate and recall (W04: 31).

observable realities in the present and (ii) are capable of driving inferences about other situations via analogic reasoning (W04: 44).

0.13. Some stories are easier to recall than others, based on (i) being organized in schematically simpler units, each of which connects a very few causes to a very few effects, and (ii) being structured such that they supply a source narrative for a seemingly limitless range of target situations on the principle of analogy or parable. Many stories within stories increase the chance there will be a source—target analogy possible (W04: 44).

0.14. Many myths around the world cluster rather obviously around the cognitive optimum as described in (0.13) (W04: 45).

0.15. [Implied: All in all, religions are at least partially shaped by cognitive capacities that favour some concepts over others (cognitive optimum), an evolved propensity to learn (certain type of) rituals relatively easily, and a human interest and ability to listen to stories with causal concepts, even if they do not represent an actual observable state of affairs.]

Domain of the theory

1. Religion is more than a cluster of cognitively and behaviourally optimal concepts; religious traditions also often incorporate conceptually challenging bodies of knowledge, which are amongst the highest valued ones by the adherents of the particular religious tradition (W04: 46).

1.1. Many societies all over the world have, all at the same time, ritual/narrative clusters concerning (i) fictional constructs that are regarded by normal adults as imaginary and nothing more, (ii) relatively unelaborated constructs that are experienced as really existing and join minimally counterintuitive concepts, simple rituals and loose, simple stories, and (iii) constructs that demand very substantial cognitive investment for them to be adequately grasped and transmitted (W04: 50-55).

1.2. Rituals are actions that are irreducible to technical motivations (W04: 3-4, 114).

1.3. Rituals are actions that are irreducible to intentional states of individuals (W04: 166).

1.4. Hence (from 1.2 and 1.3), the why of such rituals is not obvious from the rituals itself (W04: 56); they are said to be 'causally opaque' (WL14: 675).

1.5. Rituals can be costly in several ways, the most important being labour, time and energy (W04: 58-9; WL14: 674) and material resources (WL14: 674).

1.6. Hence (from 1.4 and 1.5), rituals invite exegesis and interpretation (W04: 3-4, 114, 166).

1.7. When rituals are emotionally costly in the sense of being a traumatic episode, they trigger long-lasting memory effects (W04: 56).

1.8. Often, such rituals are not explained explicitly but an individual undergoing them generally assigns meaning to such rituals that is cognitively difficult to grasp and can be understood only after long-term rumination and repeated observation of such rituals from a second or third person perspective (W04: 53, 56).

1.9. There are other rituals that are not emotionally taxing but are repeated frequently. They can constitute a cognitively difficult web of meanings by explicit teaching, woven into the fabric of such rituals (W04: 56-8).

1.10. Hence (from 0.15, 1.5, 1.8 and 1.9), on the one hand, aspects of religious thinking are along the lines of the cognitive and behavioural optimum, with little investment in cognitive or behavioural resources for the transmission of these concepts; on the other hand, aspects of religious thinking are massively more complicated, requiring much investment in cognitive or behavioural resources for the transmission of these concepts (W04: 58).

1.11. This theory [the Modes theory] concerns the second aspects only. Hence, this theory makes no statements about all types of rituals or religious concepts

available in humanity, as they may be part of the first aspect (WL14: 691).

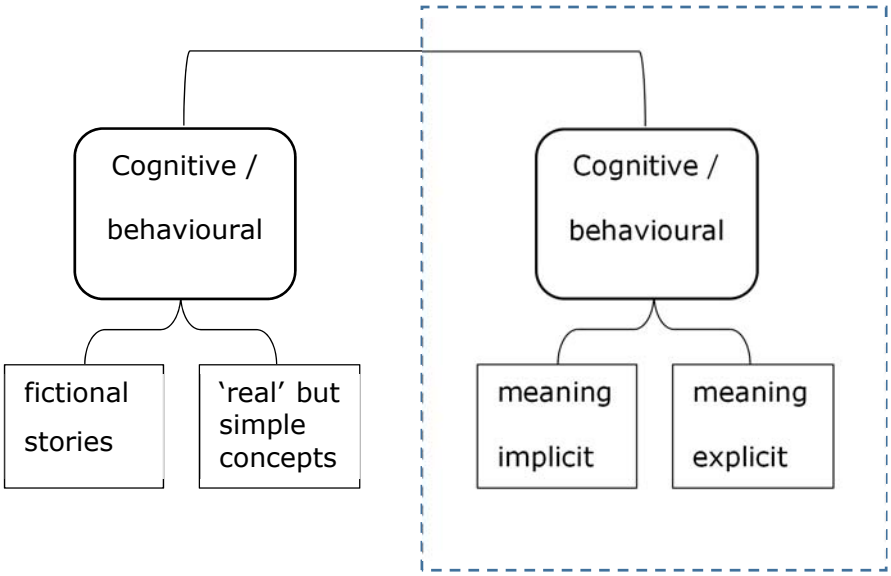

Figure 1. 2 - The domain of the Modes theory

Memory

2. The structure of human long-term memory is at the root of the existence of two types of religion, and it comes in two types, *viz*. episodic and semantic memory (W04: 70). [This is the *proximate causation* of how and why two types of religiosity emerge and spread.]

2.1. The memory of human beings can be subdivided into distinct, hardly overlapping categories with different properties; two such categories are episodic memory and semantic memory. Episodic memory is long-term memory that remembers specific events in an individual's own life with particular memories about e.g. location and people present when the memory was formed. Semantic memory is long-term memory that remembers general non-

personal facts about the world without necessarily knowing when and where the fact was learnt (W04: 65).

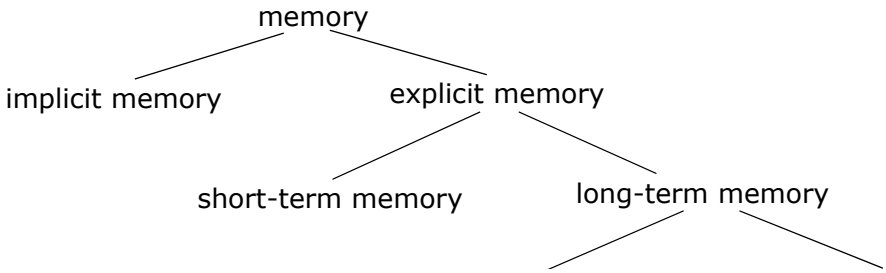

Figure 1. 3 - Types of memory (in W04: 64 - figure 4.1)

The Doctrinal Mode

2.2. Frequent repetition of religious teachings allows for the establishment of explicit and intricate verbal knowledge in semantic memory (W04: 66).

2.3. Special oratory techniques established over a long time through a process of selection cast religious teachings in a highly persuasive fashion (W04: 67). A highly persuasive fashion is commonly achieved by:

2.3.1. A logically integrated theology,

2.3.2. based on absolute unfalsifiable principles,

2.3.3. larded with poignant narratives that can easily be related to personal experience,

2.3.4. high repetition in itself increases their accessibility and relevance in everyday settings [reinforcing loop 1] (W04: 67),

2.3.5. rhetoric (W04: 67, 82, 99) and

2.3.6. plausibility (W04: 82).

2.4. When teachings are cast in such a highly persuasive fashion, people [tend to] believe them (W04: 67).

2.5. Routinized religions tend to be associated with highly developed forms of rhetoric, a logically integrated theology, and absolute and unfalsifiable principles (W04: 67).

2.6. [Hence (from 2.2 to 2.5), teachings of routinized verbal religions tend to be stored in long-term semantic memory, and long-term semantic memory is a necessary though not sufficient condition for the establishment of routinized verbal religions.]

2.7. Repetition [of religious teachings] can lead to reduced levels of motivation (labelled 'tedium effect') (W04: 66, 87) and splintering of the tradition.

2.7.1. If the content of the teachings are believable and contain supernatural sanctions and/or supernatural incentives for when teachings are not followed, the tedium effect is mitigated and people remain endorsed w.r.t. the religious tradition (W04: 66-7).

2.7.2. The larger the 'tedium effect', the higher the likelihood that major innovations occur (W12: 194)

2.7.3. Major innovations increase the chance that splinter groups will be formed (W12: 194).

2.7.4. In some cases —generally where the goals of the splinter groups appear to be unachievable— the splinter groups return to the mainstream tradition with their motivation levels rejuvenated; in other cases —groups that present teachings capable of sustaining their credibility indefinitely— the splinter groups may become a permanent offshoot of the mainstream tradition, in some cases eventually even overtaking its tradition of origin (W12: 194).

2.8. Insufficient repetition can lead to poor acquisition and patterns of decay and distortion of the orthodoxy (W04: 87).

2.8.1. The orthodoxy is particularly prone to distort towards the cognitive optimum and intuitively held beliefs (W04: 129, 132) and innovations

that are pleasing, such as local festivals and cults. In other words, the orthodoxy is perpetually vulnerable to reformulation as a set of simpler concepts (W04: 129, 133-4).

2.8.2. When there are too many distortions of the orthodoxy, the stage is set for reformations that seek to re-establish the fundamentals of the original orthodox doctrine (W12: 194).

2.9. The further the doctrinal concepts are removed from the cognitive optimum, the quicker the decay and/or the higher the chance on decay (W12: 198). In other words, the intrinsic content of the doctrinal beliefs and practices does have an influence on the rate of decay (W12: 198, and following from 2.3).

2.10. Despite the tedium effect, adherents or at least a sub-section of a religious tradition that is based on high-frequency low-arousal rituals can remain highly motivated, because:

2.10.1. (see 2.3, and)

2.10.2. The doctrine has apparent relevance for daily life (W04: 99).

2.10.2.1. Human beings are –under the right conditions– very capable of thinking in analogies: applying the structure and solution of a source problem to the structure of a target problem (W04: 100-102).

2.10.2.2. The corpus of religious doctrine is seen by its adherents as a special set of source problems with solutions that are applicable to indefinitely many target problems and hence their solutions in the real world (W04: 102).

2.10.2.3. The set of source problems from the religious doctrine is perceived to be special because they seem to be stipulated in advance rather than creatively generated by the adherent (W04: 167-8), and to come from a higher power (W04: 102).

2.10.2.4. They are perceived to come from a higher power because adherents are being told so and because the origins of the doctrine are intrinsically obscure (W04: 102); no rival explanation [of its origin] can be given (W04: 104).

2.10.2.5. The invulnerability of the source concepts to processing or updating makes their applicability to everyday situations seem rather impressive (W04: 103).

2.11. Semantic memory for religious teachings and the presence of religious leaders are mutually reinforcing features [reinforcing loop 2] (W04: 67).

2.11.1. Semantic memory for religious teachings→religious leaders: Where religious ideas are expressed in words, it is likely that the orators themselves rise above the common herd. Indeed, the world over there are many types and categories of religious leaders, which is in itself an indication of how important the phenomenon is (W04: 67).

2.11.2. Religious leaders→semantic memory for religious teachings: The pronouncement of religious leaders provide the central tenets of a belief system and the deeds of the religious leaders become the basis for recounted religious narratives (W04: 67)

2.12. The presence of religious leaders implies a need for orthodoxy checks (W04: 66).

2.12.1. Where religious leaders are upheld as the source of authoritative religious knowledge, their teachings must be seen to be preserved intact.

2.12.2. The credibility [of the teachings of religious leaders] depends on adherents *agreeing* what the teachings are (the 'principle of agreement') (W04: 67).

2.12.3. Agreement depends partly on effective detection of unauthorized innovation and subsequently on its effective obstruction and suppression (W04: 67).

2.12.4. The chance on *detection* is increased by routinization of religious *teachings*, because standardized versions of the teachings become widespread and accepted through regular public rehearsal and reiteration; once this has happened, the chance of detecting innovation increases vastly (W04: 68).

2.12.5. The chance on *suppression* of innovation is increased by routinization of religious *rituals.* That is because

2.12.5.1. ritual performances that are performed daily or weekly rapidly become processed to a considerable extent in procedural or implicit memory (W04: 68); and

2.12.5.2. when people perform rituals on autopilot it will decrease the chance that they will reflect on the *meaning* of what they are doing (W04: 68, 113); and

2.12.5.3. processing of routinized rituals as implicit procedural schemas really opens the way for religious authorities to tell worshippers what to believe, especially when it comes to the meaning of their rituals (W04: 68).

2.12.5.4. Hence (from 2.12.5.1-2.12.5.3), the interpretation of frequently performed religious rituals becomes frozen or as taught (W04: 5).

2.12.5.5. Hence, new insights in religious traditions based on frequently performed rituals become a matter of creative application of previously stipulated principles (W04:5).

2.12.5.6. Hence, the more rituals are repeatedly experienced by all individuals of a group, the less likely innovations in interpretation will become (W04: 5).

2.12.6. (from 2.12.5.3) Implicit memory for religious rituals enhances the survival potential of authoritative teachings stored in sematic memory. Note that this principle describes a strong trend, not an all-or-nothing scenario; frequent enactment of rituals leads to rates of unauthorized innovations that are relatively low as compared to the Imagistic Mode (W04: 68).

2.12.7. If worshippers are not told about the meaning of routinized rituals, they fill in the gaps with explanations more close to the cognitive optimum, which is a mutation of the orthodoxy (W04: 119, 161).

2.13. The need for orthodoxy checks encourages religious centralization (W04: 69).

2.13.1. The principle of agreement (see 2.12.2) simply requires that innovation is seen to originate from authoritative sources and is accepted or observed by all loyal followers (W04: 69).

2.13.2. As soon as a routinized religion becomes well established, there is a tendency that a central authority emerges, and there will often be a proliferation of sanctions for unauthorized innovation and heresy (W04: 69).

2.14. The presence of religious leaders is conducive to the religion spreading widely (W04: 69).

2.14.1. Religious leaders spread the religion in an oratory way, hence the teachings are readily transportable and an efficient spread of the content is possible (W04: 70).

2.14.2. All large-scale religions incorporate routinized religious forums [platforms with audiences] (W04: 97)

2.14.3. Religious practices with high frequency rituals maintain their group size partially by fear embedded into the doctrine (W12: 194).

2.15. Semantic memory for religious teachings leads to anonymous religious communities (W04: 69).

2.15.1. Given that with frequent repetition of beliefs and practices such religious knowledge is organized in semantic memory, that knowledge itself becomes separate from particular episodes in which it was acquired (W04: 69).

2.15.2. Religious communities may be(come) too large for any member to know all other individual followers (W04: 69).

2.16. Hence, adherents of a certain tradition who regularly partake in religious congregations are not part of a particular group but participate in a ritual scheme and belief structure that anonymous others also share (W04: 69).

2.17. (2.2) to (2.16) form the features of the Doctrinal Mode (W04: 70).

The Imagistic Mode

2.18. Rituals can be performed rarely. On the long run, rarely performed rituals that survive tend to involve high levels of arousal (W04: 71).

2.18.1. Religious practices that are infrequently repeated and have a low arousal are unlikely to be passed on: people will rapidly forget the procedures and their meanings (W04: 71, 147).

2.18.2. A high-frequency, high-arousal ritual has no chance of survival at all (W04: 147):

2.18.2.1. either habituation would drive it toward the low-arousal attractor position,

2.18.2.2. or it could persist in its high-arousal form, but that would require a massive reduction in its frequency,

2.18.2.3. or it could simply become extinct.

2.18.3. Infrequent repetition and high arousal are stored in episodic memory [which is long-term memory] (W04: 70, 105-6).

2.18.3.1. A well-developed long-term memory for especially traumatic experiences with personal consequences probably has major evolutionary benefits (W04: 107).

2.18.3.2. High ratings for personal consequentiality are a *necessary* condition for the activation of episodic memory if it has the form of Flashbulb Memory, which stores a rich memory of the arousing experience (W04: 108).

2.18.3.3. Although Flashbulb Memories can become richer over time with subsequent narrative rehearsal (W04: 107), evidence suggests that especially the conditions during primary encoding of Flashbulb Memories set the strength and vividness of such memories (W04: 108-9).

2.19. (From 2.18.3) It is reasonable to expect that people undergoing ritualized violence in a one-off, traumatic episode, can recall many aspects of such an episode for a long time (W04: 111).

2.20. Climactic rituals are stored in episodic memory (W04: 72).

2.21. Episodic memory is explicit memory (W04: 72).

2.22. Hence (from 2.20 and 2.21), rare climactic rituals are processed at a conscious level (W04: 72).

2.23. (From 1.2 and 2.19 to 2.22) Climactic rituals trigger Spontaneous Exegetical Reflection (SER) (W04: 72, 84).

2.24. Even if –perhaps especially if– the memory of the traumatic ritual event is stored disjointedly in memory, gaps are filled and a narrative about the ritual

is formed through subsequent presence as spectator or officiant during next cycles of the ritual (W04: 111-2).

2.25. This (2.19 to 2.24) eventually results in elaborate, idiosyncratic, individual exegetical knowledge stored in semantic memory (W04: 9, 72).

2.26. Hence (from 1.6 and 2.25), the importance of elevated arousal in low-frequency rituals is not that it contributes to recall for ritual *actions*, but that it sets in motion a search for ritual *meanings* (W04: 113).

2.27. The fact that low-frequency high-arousal rituals are not verbally transmitted but instead are communicated in opaque, cryptic allusions and mythological narratives, should not be understood as the absence of exegetical knowledge (W04: 117).

2.28. (From 2.25) SER (see 2.23) leads to a diversity of religious representations [when religious traditions are based on rituals that are low-frequency high-arousal] (W04: 72).

2.28.1. The principle of agreement (see 2.12.2) applies [when religious traditions are based on rituals that are low-frequency high-arousal] only to the ritual procedures themselves and not to their meanings (W04: 72).

2.28.2. If exegesis is verbally transmitted [when religious traditions are based on rituals that are low-frequency high-arousal], it is restricted to 'experts' whose adherence to the principle of agreement may well be asserted but seldom demonstrated (W04: 72).

2.28.3. [Hence (from 2.28.1 and 2.28.2), when religious traditions are based on low-frequency high-arousal rituals, there is no doctrine to be passed on explicitly or from a central source.]

2.28.4. Hence (from 2.25 and 2.28.3), it follows that (2.28).

2.29. SER and representational diversity inhibit dynamic leadership (W04: 72).

2.29.1. If a leader tried to come forward at rare, climactic rituals to advance an intricate and coherent body of doctrine, people would very rapidly garble or forget what they had been told, and their own inspirational ideas are likely to be more compelling than the content of a single oration (W04: 72-3).

2.30. Lack of dynamic leadership, lack of centralization and lack of orthodoxy are mutually reinforcing (W04: 73).

2.30.1. Each group member experiences inspiration as coming directly from gods or ancestors, hence, no mediator or central authority is required. Given that there is no orthodoxy, there is nothing over which an authority may preside (W04: 73).

2.31. High arousal fosters intense social cohesion (W04: 73).

2.32. Intense cohesion combined with episodic memory foster localized, exclusive communities (W04: 73).

2.32.1. Where rituals are remembered episodically, each participant remembers who else went through the ritual with them (W04: 73).

2.32.2. Groups [whose religious tradition is founded on low-frequency high-arousal rituals] are based on memories for shared episodes, in which particular co-participants feature (W04: 73).

2.32.3. Hence (from 2.32.1+2.32.2), people cannot be a member of the religious community unless people remember someone as part of a previous cycle of religious activities (W04: 73).

2.32.4. For groups whose religious tradition is founded on low-frequency high-arousal rituals, someone cannot easily be excluded once (s)he is in (W04: 73).

2.33. Exclusive communities and lack of dynamic leadership inhibit spread or dissemination (W04: 73).

2.33.1. Religious understandings [when based predominantly on low-frequency high-arousal rituals] are inspired by collective ritual performances (W04: 73).

2.33.2. Hence (from 2.33.1), the unit of transmission [of religious knowledge when based predominantly on low-frequency high-arousal rituals] is the entire ritual group (W04: 73).

2.33.3. Hence (from 2.33.1 or 2.33.2), the spread of religious traditions which are based on low-frequency high-arousal rituals is inefficient and costly: a local group must perform its rituals with another group to pass them on (W04: 73).

2.33.4. [Low-frequency high-arousal ritual] practices get mutated as soon as they are passed on (W04: 73-4), because

2.33.4.1. There are no leaders or religious hierarchies [w.r.t. the low-frequency high-arousal rituals] capable of policing an orthodoxy (W04: 74), and

2.33.4.2. Each community [based on low-frequency high arousal rituals] is likely to be fiercely exclusivist and therefore will tend to emphasize local distinctiveness over regional unity (W04: 74).

2.34. [Inferred from the context:] [(2.18) to (2.33) form the features of the Imagistic Mode.]

2.35. The elders of groups whose religion is based on low-frequency high-arousal (terrorizing) rituals believe these rituals really work, are essential to continue the circle of life, and believe that the survival of their world depends on performing the terrorizing rite(s) (W04: 122).

2.36. Hence, given the perceived importance of performing the ritual, the parent generation in groups with rites of terror is willing to put the lives of the next generation at risk (W04: 122).

2.37. The belief that low-frequency high-arousal rituals in the form of rites of terror are essential for the continuation of the world of groups that perform these rituals with such attached beliefs is the source of religious motivation [in the Imagistic Mode] (W04: 120-2).

2.38. It is the Spontaneous Exegetical Reflection that mainly contributes to motivational states [in Imagistic groups to transmit the religion] (W04: 150). (Jea15: It is the SER that mainly constitutes identity fusion, such that individuals are willing to sacrifice some or all of themselves for the group.)

2.39. Yet, highly *positively* arousing rituals may also be the distinctive form of ritual in Imagistic (splinter) groups (W12: 188-9).

2.40. Cohesion in societies whose religion is based on low-frequency high-arousal rituals is fostered by two principles: (i) group members have a sense of sharing a common stock of memories, i.e. common episodic memory, and (ii) group members commonly assume their common experience gives them access to deeper meanings that are unavailable to those who have not similarly suffered, i.e. think they have shared semantic knowledge which is special and highly valuable, worthy of passing on to the next generation but too valuable to share with out-group members (W04: 135).

2.41. For both the Imagistic (ref 2.38) and Doctrinal Mode (ref 5.19 — taught doctrine is the basis for personal revelation), explicit religious knowledge is crucially important in motivating transmission (W04: 151).

General properties of the two Modes

3. The clustering of cognitive properties, ritual frequency/arousal and social properties as described under (2.2 to 3.8) are called a *Mode* (W04: 74).

3.1. Condensed into one table, the Modes theory reads as follows (W04: 74 — Table 4.1, order of Imagistic and Doctrinal column swapped):

Variable	**Imagistic**	**Doctrinal**
Psychological features		
Transmissive frequency	Low	High
Level of arousal	High	Low
Principal memory system	Episodic / flashbulb memory	Semantic schemas and implicit scripts
Ritual meaning	Internally generated	Learned / acquired
Techniques of revelation	Iconicity, multivocality and multivalence	Rhetoric, logical integration, narrative
Socio-political features		
Social cohesion	Intense	Diffuse
Leadership	Passive / absent	Dynamic
Inclusivity / exclusivity	Exclusive	Inclusive
Spread	Slow, inefficient	Rapid, efficient
Scale	Small scale	Large scale
Degree of uniformity	Low	High
Structure	Non-centralized	Centralized

Table 1.1 — The main properties of the Modes

3.2. Religious practices commonly satisfy at least one or other of the two sets of psychological conditions specified in the table directly above (W04: 75).

3.3. Imagistic and Doctrinal Modes constitute universal features of group formation (Wea15).

3.4. The activation of the psychological conditions as given in the table directly above provides the underlying causes of the socio-political features of religion (W04: 75).

3.5. It would make no sense to try to single out any one of the psychological causes as somehow prior to any of the others (W04: 75).

3.6. There is no independent variable [from the list of the table directly above] driving the rest [of the variables from the table directly above], only a set of conditions that some patterns of human activity manage to satisfy, thus accounting for their cultural success (W04: 75).

3.7. Hence (from 0 and 0), a Modes variable on itself with a value as specified in one of the two Modes columns (see table above) cannot be said to be either Doctrinal or Imagistic (W04: 75).

3.8. The features [of both Modes] are [within a Mode] mutually reinforcing (W04: 70).

3.9. In the real world, religions are rarely [or precisely, only] Imagistic or Doctrinal in terms of all features as specified by the Modes theory (W04: 75). For instance, a religious tradition that incorporates all the elements of the Doctrinal Mode can also exhibit some of the features of the Imagistic Mode. Or some rituals may be low-frequency low-arousal, other rituals may be frequently performed but lack exegesis. Or the doctrinal corpus is largely confined to elites, etc. Instead, the Modes theory sets out to explain that there is a *tendency* for religious systems to gravitate towards divergent attractor positions [(Modes)] (W04: 75-6).

3.10. There is an inverse correlation between levels of frequency and arousal of ritual across religious traditions (W04: 143).

3.11. Ritual frequency and ritual arousal are –in the end– shaped, if not determined, by principles of selection (W04: 74, 148), whereby the selection force is the structure of human memory (W04: 17-22, 144-8).

3.12. Mechanisms driving the selection that shape the two Modes are psychological (memory, learning, arousal, and [the consequences for personal life that an individual assigns to a certain experience]) (W04: 7).

3.13. Some rituals are not concerned with generating revelatory religious knowledge capable of motivation subsequent transmission; a particularly good example would be wedding ceremonies, which often have more to do with recalibration of social relations than with the propagation of religious meanings (W04: 149).

3.14. Modes of religiosity constitute attractor positions around which ritual actions and associated religious concepts cumulatively tend to cluster (W04: 74).

3.15. Religious traditions founded on interacting Modes of religiosity exist (W04: 76).

3.16. Religious traditions founded on interacting Modes of religiosity consist of large populations which are composed of many locally distinctive ritual communities (W04: 76).

3.17. The cohesion of locally distinctive communities [the Imagistic Mode] may readily be projected onto a wider religious community [the Doctrinal Mode] (W04: 76).

3.18. Innovations in revelatory knowledge or of the distinctive social morphology of religious traditions cannot survive when they are remote from the attractor positions of the Modes (W04: 74).

Fusion and Group identification

4. [Fusion is a social-psychological state that increases the chance that an individual will make sacrifices as if certain others are genetically highly related[1]

[1] Whitehouse remarked (pers. comm.) about statements 4.1 to 4.6: "In a more recent paper (Whitehouse, Harvey, Jonathan Jong, Michael D. Buhrmester, Ángel Gómez, Brock Bastian, Christopher M. Kavanagh, Martha Newson, Miriam Matthews, Jonathan A. Lanman and Sergey Gavrilets (Submitted). "The

and this is the basis for social cohesion in the Imagistic Mode; group identification is a social-psychological state that increases the chance that an individual will favour certain others that are categorically similar and this is the basis for social cohesion in the Doctrinal Mode.]

4.1. Many cases of altruistic behaviour can be explained by inclusive fitness theory, which shows that self-sacrifice can evolve under natural selection if it produces an increase in the frequency of the altruist's genes. For this to occur, the degree of genetic relatedness of the altruist multiplied by the benefit to the recipient must be greater than the reproductive cost to the altruist (LW14: 676).

4.2. One way to ensure the altruism is directed toward relatives is for the would-be altruists to have some way of detecting their kin (LW14: 676).

4.3. Since the genetic makeup of individuals cannot be observed directly without sophisticated scientific apparatus, evolved solutions to this problem are likely to involve cues that reliably correlate with genetic relatedness (WL14: 677).

4.4. In the case of humans and many other species, perceptions of phenotypic similarity, along with familiarity, serve as kin recognition heuristics and play an important role in governing altruistic behaviour (WL14: 677).

4.4.1. We may behave more altruistically, and are less sexually attracted, toward individuals who look more like ourselves;

4.4.2. Humans also appear to use shared mental attributes, such as certain attitudes, to detect and favour genetic relatives.

4.5. Humans are very adept at imitating the body decorations and fashions of others and learning the beliefs and behavioural conventions of those around them (WL14: 677).

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evolution of extreme cooperation via intense shared experiences". PLoS Biology) we suggest that this may not be the only or even the most important evolutionary explanation for fusion. But this is an area in which quite a bit of theory development is underway".

4.6. Hence, an innate tendency to perform more costly altruistic acts toward individuals who are mentally similar to you without discriminating between domains of similarity carries a great risk of exploitation, since the insignia of group membership can be faked, and declarations of belief could be insincere (WL14: 677, 680).

4.7. Human beings do not entirely fall into that trap: while perceiving shared social norms will result in intuitions of shared group membership and trustworthiness, it will not trigger kin recognition systems and the resulting state of "psychological kinship" (WL14: 677).

Fusion

4.8. Individuals can experience 'identity fusion' — a psychological state that has the following properties (WL14: 676):

4.8.1. Social identity becomes an essential part of the individual's self-concept;

4.8.2. When a group member is threatened, it prompts the same defensive reactions as a personal attack or an attack on one's kin;

4.8.3. Since social identities are essential parts of fused individuals' personal self-concepts, physiological arousal of the individual translates into pro-group action; and

4.8.4. Fused individuals demonstrate a significant willingness to sacrifice themselves for their group.

4.9. It is hypothesized that two psychological processes underlie identity fusion and its ability to explain costly altruistic action: (1) kin detection through phenotypic matching, (2) shared negative experiences (Jea15), and (3) the construction of self-concepts through episodic memory (LW14: 676) and .

4.10. The "self" template used in phenotypic matching may involve not only cues of facial resemblance and similar major histocompatibility complexes but also cues of shared experience and personal essence (LW14: 676).

4.11. (From 2.32.1 and 2.32.2:) Episodic memories play a central role in the constitution of individual self-concepts, such that experiences and particular elements of those experiences —such as identities, persons, and objects— can become defining, essential aspects of one's personal identity (LW14: 676).

4.12. (From 4.10 and 4.11:) The perception that one shares with others' important, self-defining experiences encoded in episodic memory produces a powerful sense of psychological kinship since sharing such essential, self-defining experiences serves as a fairly reliable marker of genetic relatedness (WL14: 677)

4.13. Essential components of one's autobiographical self that can be perceived as shared with others in a group are, amongst others: the formative experiences of childhood, sharing the traumas of frontline warfare, and undergoing "rites of terror" (WL14: 677).

4.13.1. A significant body of evidence suggests that highly dysphoric experiences, such as front-line combat and "rites of terror", work to rewrite individual self-concepts and produce psychological kinship among those undergoing such experiences together (WL14: 677).

4.13.2. Experimental evidence shows that fusion indeed evokes thoughts, feelings and language that points to kinship mechanisms being triggered (WL14: 677-8).

4.14. Hence (from 4.9, 4.12 and 4.13), for a fused individual, group members are not perceived as mere co-operators; they are psychological kin (LW14: 676).

4.15. Cognitive dissonance and costly signalling theories cannot explain the existence of most rites of terror (WL14: 679).

4.15.1. The theory of cognitive dissonance explains why paying a more severe cost for joining a group should produce increased "liking" of that group and its members (WL14: 679);

4.15.2. The theory of costly signalling explains that participation in such costly acts should serve as a reliable signal of group commitment and allow group members to trust one another enough to cooperate (WL14: 679).

4.15.3. These theories assume that participation in 'rites of terror' is voluntary: if participants in initiation rituals freely chose to undergo acute traumas in order to join the group, this might indeed lead them to conclude that group membership is worth the price and likewise, participation in the rite of terror can then serve as a convincing signal of commitment to the group. However, (i) in all or most of the initiation rituals described by anthropologists, participation is coerced; and (ii) rites of terror constitute a much wider category including vision quests, cargo cults, millenarian rituals, possession cults, and rites of contrition, expiation, and penance (WL14: 679).

4.16. (From 4.13-4.15:) It is not cognitive dissonance or costly signalling, but shared ritual dysphoria generates identity fusion via the perceived sharing of memorable and personally salient experiences (WL14: 679).

Group identification

4.17. Individuals can experience 'group identification' — a psychological state that has the following properties (WL14: 676):

4.17.1. Individuals feel that they share certain prototypical characteristics with other group members, such as the group's beliefs, practices, and values; those features are not essential to their individual, personal identities (WL14: 678).

4.17.2. Group identification involves categorical rather than relational ties with others (WL14: 678). Hence, when one is identified with a group, one is not relating to other members as unique individual persons, but simply as anonymous members of the same social category who share the prototypical beliefs, practices, and values of the group (WL14: 678).

4.17.3. Group identification can be amplified by perceptions of threat and uncertainty and by witnessing others displaying strong commitment to the prototypical norms of the group (WL14: 678).

4.17.4. Group identification can produce prejudice and preferential cooperation (WL14: 678).

4.17.5. Group identification differs from fusion in a few respects (WL14: 676):

4.17.5.1. External threats to the community are not seen as threats to one's family;

4.17.5.2. Physiological arousal does not produce pro-group action;

4.17.5.3. Increased levels of group identification fail to predict extreme self-sacrifice in Trolley Dilemmas; and

4.17.5.4. Increased levels of group identification offer less power for predicting individuals' expressed willingness to fight, sacrifice, and die for one's social group.

4.17.6. Hence (from 4.17.5.1 to 4.17.5.4), group identification is relatively weak in producing the extreme pro-group behaviours we see in war, suicide terrorism, and other forms of costly altruism. Without the power of fusion and psychological kinship, group identification produces committed citizens but not extreme self-sacrifice (WL14: 678).

4.18. Mathematical models and cross-cultural experimental studies suggest that humans evolved further biases to (WL14: 678):

4.18.1. preferentially cooperate with individuals sharing prototypical/categorical group norms,

4.18.2. punish altruistic group members violating these norms, and

4.18.3. commit more strongly to these norms in the face of threat (WL14: 678).

From fusion to the Imagistic Mode

4.19. Through participation in collective dysphoric rituals, personal and group interests and destinies are aligned, and threats to the group are experienced as threats to self. In the course of cultural evolution, collective rituals involving shared dysphoria hijacked this mechanism favouring the survival of groups with an "imagistic mode of religiosity" facing collective actions problems (e.g., on the battlefield or hunting ground) involving high risk and strong temptations to defect (WL14: 683).

From group identification to the Doctrinal Mode

4.20. Since rituals are not tightly constrained by ordinary causal reasoning (see 1.4), they can assume a potentially infinite range of forms (WL14: 675).

4.21. Given the diversity of forms rituals can assume (see 4.20), rituals can also serve as admirable group markers (WL14: 675).

4.22. The Doctrinal Mode heavily emphasizes credibility-enhancing displays for beliefs, ideologies, and values. This Mode works to produce at least baseline levels of group identification and thus sufficient trust to cooperate with strangers or relative strangers in ways required by centralized and often expansionary systems of governance, trade, and agriculture (WL14: 679).

4.23. The creation of large anonymous communities presents problems of cooperation that [kinship] psychology is not sufficient to address. These are

largely problems of how to monitor the reputations of others and decide whom to trust (WL14: 680).

4.24. External mnemonics (e.g., writing and record keeping), the postulation of morally concerned and punitive deities, and the spread of more costly credibility enhancing displays can address the problem of monitoring the reputations of others and decide whom to trust (WL14: 680).

4.25. The spread of beliefs in morally concerned and punitive deities only increases levels of pro-sociality and trust necessary for cooperation if those beliefs are held sincerely, motivate behaviour, and are signalled reliably to others (WL14: 681).

4.26. The transmission of otherwise difficult-to-accept beliefs, such as the existence of omnipresent supernatural watchers, is facilitated by the performance of seemingly costly behaviours —which are credibility-enhancing displays (CREDs)— by models or teachers. These are behaviours that a model would be unlikely to engage in unless sincerely committed to the belief in question (WL14: 681).

4.27. Such an evolved bias, allowing learners to avoid manipulation by teachers, is harnessed by doctrinal religions by virtue of routinization—frequent attendance as religious ceremonies is in itself an influential CRED (WL14: 681).

4.28. When doctrinal traditions compete, routinization alone may not be sufficient to provide the "edge" in between group competition, possibly leading to the evolution of ever more costly CREDs (e.g., fire walking, sacrifices, circumcision, and celibacy) (WL14: 681).

Group selection

5. Modes of religiosity are adaptations to varying ecological conditions, often including competition with other cultural groups for scarce resources. This is

the *ultimate causation* of how and why the Modes of religiosity emerge and spread (W12: 193).

5.1. It is hard to imagine why a band of peaceful hunter-gatherers would have reason to experiment with the extremely costly patterns of behaviour needed to get the development of the Modes underway. Indeed, egalitarian foraging bands seem to make do with relatively simple rituals and concepts of the supernatural clustered around the cognitive optimum position (W04: 77).

5.2. When there are increasingly harsh conditions that require dangerous strategies of resource extraction, it is possible that more cohesive units formed through communal performance of low-frequency, high-arousal rituals would outcompete other units with less cohesion (W04: 77-8).

5.3. Some resource-acquisition strategies present individuals with strong reasons to defect and free-ride on the risky actions of others. Hunting large and dangerous game and warfare are two prime examples of such strategies (WL14: 682). Big-game hunting and warfare require steadfastness for success and, if a society dependent upon such strategies is to flourish, it must possess some method by which to produce intense, kin-like cohesion among the individuals engaged in these strategies (WL14: 682).

5.4. Hence (from 5.1-5.3), there might be group-selectionist reasons why the Imagistic Mode exists (W04: 78).

5.5. Hence (from 5.4), the features that comprise the divergent Modes of religiosity probably do not coalesce in the absence of some triggers located outside the Modes dynamics itself (W04: 77).

5.6. There is an inverse correlation between rare, dysphoric rituals and levels of agricultural intensity, suggesting a link between a society's mode of resource acquisition and the frequency and emotionality of its rituals (WL14: 681).

5.7. Taxation, large-scale farming, and a complex division of labour may reduce certain risks of defection while increasing others that require a sense

commitment to the 'imagined community'. If individuals with no experience of one another are to trust each other enough to cooperate, then shared beliefs, values, and other identity markers are required. If societies dependent upon such strategies are to flourish, they must possess some method by which to transmit these shared norms (WL14: 682).

5.8. Large-scale agricultural societies with seasonal labour and an increasingly complex nature of social cooperation may well have fostered the routinization of ritual and the centralization of religious authority, allowing other core elements of the Doctrinal Mode to coalesce (W04: 78).

5.9. With the invention of agriculture, larger and denser populations no longer needed costly dysphoric rituals to bind together bands of brothers for the purposes of defence, bride capture, or hunting. The groups that flourished and spread were those that could overcome local divisions by eliminating or tamping down imagistic tendencies and cultivate instead a sense of shared identity on a much larger scale (WL14: 683).

5.10. The Imagistic Mode is thought to be adaptive for groups that need to stick together in the face of strong temptations to defect—for example, when engaging enemies on the battlefield or large prey on the hunting ground.

5.11. The Doctrinal Mode is thought to be adaptive for groups seeking to pool small amounts of resource from individuals in a much larger population so as to create a large, centralised resource in the form of charitable donations, legacies, tax or tribute – for example, when competing coalitions are organized via categorical ties of caste, race, ethnicity, or belief (Wea15).

5.12. Different societies require higher or lower levels of fusion or identification to fulfil their basic material and economic needs in diverse resource environments, and the two Modes evolve, through a process of cultural group selection, to produce the required levels of fusion or identification (WL14: 679). Some

resource-acquisition strategies require (or are greatly facilitated by) fusion, others require (or are greatly facilitated by) group identification (WL14: 681).

5.13. Hence, Imagistic and Doctrinal practices have evolved to produce the cohesion necessary for societies to be successful in different resource ecologies (WL14: 681).

5.14. The selection force is resource extraction (WL14: 681).

Modes and war

5.15. Most of the traits common to war and religion are characteristic of the Imagistic Mode only: intense cohesion or solidarity, encounters with novel or unknown situations, extreme coercion, deep and extensive reflection on issues of meaning and exegesis (W04: 124-5).

5.16. Roughly half of all contemporary rebel groups disband within 6 months of their first appearance, but those that endure (in some cases for decades) rapidly develop patterns of ritualization and group formation that are optimally adapted to the challenges of resource extraction and protection that prevail in their particular political environment (WL14: 682).

5.17. The pace of ritual innovation and adaptation may be accelerated in rebel groups due to the intense evolutionary pressures created by government military and political campaigns (WL14: 682).

5.17.1. In rebel groups, Imagistic formations create tight-knit relationships among a defined group of individuals (WL14: 682).

5.17.2. Larger rebel organizations use routinized rituals to codify political and ideological commitments in a standardized fashion across entire ethnic groups (WL14: 682).

5.17.3. Rebel groups may also pursue both methods of group formation, although preliminary research suggests that groups usually rely more heavily on one or another modality (WL14: 682).

5.18. Explicit transmission of the doctrine in following the high-frequency low-arousal scheme often seems to falter when it comes to risk-taking (W04: 123).

5.19. Verbal persuasion is, on the whole, not a strong motivator for risk-taking behaviour or sacrificing one's life (W04: 123-4). What really motivates people to take risks and sacrifice one's own life in Doctrinal types of transmission is personal insight into the meaning of the doctrine, a form of revelation (W04: 124).

5.20. Doctrinal traditions can give rise to such personal revelatory moments (W04: 124), because:

5.20.1. they encourage, from time to time and regarding specific subjects, moments of personal reflection;

5.20.2. they contain with some regularity low-frequency high-arousal rituals (like miraculous healings, possessions, epiphanies, etc.),

5.20.3. low-frequency high-arousal experiences under the hood of doctrinal orthodoxies are often solitary events or not shared by people in the crowds around them — as a result of which there do not give rise to full-blown Imagistic experiences.

5.21. Hence, the Doctrinal Mode in itself is probably not capable of generating group cohesion at the level that group members sacrifice their lives for non-[direct-]kin (W04: 124).

5.22. Willingness to sacrifice self to further the interests of large-scale anonymous communities, such as nation or world religion, has been described as "extended fusion". There may be multiple ways in which extended fusion comes about, but recent empirical research suggests that the priming of familial sentiments and the sharing of dysphoric experiences, such as wars and national disasters, "pulls people together," motivating altruistic behaviour even toward strangers (WL14: 678).

6. Predictions

6.1. High-frequency, low arousal rituals and (if only within elite sections of the tradition) conceptually complex, verbally transmitted doctrine are necessary —though not necessarily sufficient— conditions for the occurrence of diffuse cohesion, dynamic leadership, inclusivity, efficient dissemination, large scale membership, high degree of uniformity and centralized structure in a society. A falsification of this prediction is when one or more societies with these socio-political features exist but without the high-frequency low arousal rituals transmitting a verbal doctrine (W04: 157-8).

6.2. The prediction is *not* that high-frequency low-arousal rituals with verbal doctrine are a sufficient condition for Doctrinal socio-political features, i.e., it is *not* that high-frequency low-arousal invariably lead to such societies. However, the prediction is that they *typically* do so (W04: 158).

6.3. If a given [religious] tradition were based exclusively on low-arousal rituals in the absence of any corpus of conceptually complex teachings, then such a tradition would not exhibit the numerous features of social morphology associated with either of the two Modes. A falsification of this prediction is when there is a tradition of religious revelation that incorporates only low-arousal rituals, lacks any elaborate ideology, yet is *either* widespread, centralized and hierarchical *or* localized, uncentralized and intensely cohesive. (Note, however, that low-arousal non-doctrinal rituals may exist as *part* of either of the two Modes.) (W04: 160-1)

6.4. When low-arousal non-doctrinal (i.e conceptually simple, non-verbally transmitted) rituals occur outside either of the two Modes, they can survive only if the concepts necessary to reproduce them are centred around the cognitive optimum position, regardless of the rate of transmissive frequency. A

falsification of this hypothesis would be when [societies] could be found that have low-arousal non-doctrinal rituals only whilst those rituals lack intuitive procedural or exegetical characteristics (W04: 161).

6.5. High-frequency high-arousal rituals that are closely connected to complex verbally transmitted teachings are instable as a combination because the high-arousal impedes memorization of the teachings. Hence this ritual combination will evolve into one of the three directions: (i) either the frequency will be reduced so that eventually dynamics of the Imagistic Mode will occur, even if the teachings are read out loud with low-frequency intervals —which would not be sufficient to give orthodox meaning to the rituals; or the levels of arousal will drop, (ii) whilst the verbal teachings are transmitted so a foundation for the Doctrinal Mode of religiosity is created or (ii) the teachings will not be memorized, hence the rituals develop more cognitively optimal attributes or become extinct (W04: 161-3).

6.6. Low-arousal low-frequency rituals which contain verbal exegesis can only survive in that form if some external form of mnemonics is used (W04: 163, 165).

6.7. Societies that survive and flourish will possess rituals clusters (Imagistic or Doctrinal) that increase the success of the resource-acquisition strategies of that society (WL14: 682).

6.8. Dysphoric rituals correlate with small-scale armed groups, intra-elite conflicts, military revolts, and separatist rebellions. That is because dysphoric rituals lead to local fusion and willingness to fight and die for the relational group—thus increasing the incidence of small-scale intergroup conflict, revolt, or revolution. The 'H0' hypothesis is that dysphoric rituals have no effect or a negative effect on the incidence of intergroup conflict, revolt, or revolution (Wea15).

6.9. Intensification of agriculture leads to routinization and orthopraxy. That is because agricultural intensification increases the frequency and scale of

cooperative activity and, therefore, leads to ritual routinization and standardization. The 'H0' hypothesis is that routinization and orthopraxy are triggered by factors unrelated to agriculture (e.g., warfare, trade, status inequality, polarization of economic classes, etc.) (WL14: 682).

6.10. Routinized rituals enabled the emergence of larger polities. That is because routinized rituals are necessary for the first appearance of large-scale, anonymous, hierarchical, centralized communities. Thus, they appear before such large-scale polities. The 'H0' hypothesis is that large-scale, anonymous, hierarchical, centralized communities arose first (e.g., due to warfare) and routinized rituals emerged subsequently to help maintain social cohesion (WL14: 682).

6.11. Widespread orthopraxy makes polities more stable and long-lived. That is because widespread orthopraxy leads to shared identity and deference to a common authority so the more widespread and routinized the polity's rituals are, the more stable and enduring its political system. The 'H0' hypothesis is that widespread orthopraxy has no effect on or reduces the stability and longevity of the polity (e.g., because orthopraxy implies rigidity and risk of predation by more agile competitors) (WL14: 682).

6.12. Routinization & orthopraxy lead to the expansion of political dominion and trade. That is because ritual routinization and standardization produce stable group identities that spread efficiently, they precede the expansion of political systems and trading networks and increase the area and group size in which there is sufficient mutual trust. The 'H0' hypothesis is that routinization and standardization obstruct assimilation, syncretism and cultural pluralism, inhibiting both political and commercial expansion (WL14: 682).

6.13. (From 5.15) (W04: 125):

    6.13.1. Where [(civil) wars] flare up, entrenched manifestations of the Imagistic Mode will be found to be at work.

6.13.2. Where evidence of the Imagistic Mode is lacking, so too is large-scale religiously motivated violence.

6.13.3. [Runner-up:] Victims of religious attacks form intensely cohesive bonds in much the same manner as participants in high-arousal, low-frequency rituals. This cohesion may well be linked to cycles of orchestrated violent reprisal (W04: 126).

Appendix 3 – Construction of weight matrices

a. Weight matrix per relation type

(see page 178)

The data is in the following form:

Group	Relation type	Other actor	Strength of relation	Period start date	Period end date
Dozos	got leaders from	FNCI	4 = much/most	2002	2011
Dozos	got supplies from	MJP	3 = medium / several	2002	2011

The 'weight matrix' that is used in the calculation of Moran's I has the following form:

	Dozos	FNCI	MJP
Dozos	0	<some number>	<some number>
FNCI	<some number>	0	<some number>
MJP	<some number>	<some number>	0

These columns and rows represents all groups in the sample. The intersection of two armed groups is called a 'cell'; the value in the cell represents the strength of the relation between the two groups (row x column). The higher the number in the cell, the more similar.

Whilst the diagonal is always 0, some mechanism needs to be devised how to get from the recorded data in the dataset to numbers (all cells with <some number>) in the weight matrix. The <some number> in every cell of the weight matrix is the summarized weight —or degree of relation— between the two groups that constitute the cell. The upper right of the weight matrix is exactly the same as the lower left. For the conversion of the records in the dataset to the weight matrices, two issues need to be addressed:

- Should the 'Strength of the relation' be reflected in the weight matrix, or just be ignored? The stance was taken that these data were directly provided by the sources, so they can be converted straightforwardly without having to make additional assumptions or interpretations. It seemed plausible that they represent more or less a linear relation from 1…5, hence, they were used 'as is'.
- Should the duration of the relation ('Period start date' to 'Period end date') be factored in, or not? In this research, the period duration, while recorded, was not used to avoid further complexity in constructing the weight matrix; more sophisticated versions are left for future studies.

For every Relation type, a Relation type weight matrix was created. It is probably easiest to visualize that all cells per Relation type weight matrix are initialized with all cells set to 0. Thereafter, per Relation type weight matrix, numerical values were inserted into the cell that represents a certain group combination. To give an example, suppose the records were:

Group	**Relation type**	**Other actor**	**Strength of relation**
A	closely worked with	B	4 = much / most
A	copied ideology from	C	3 = medium / several
B	copied ideology from	C	2 = some

then two weight matrices were constructed; one for every relation type:

closely worked with

	A	B	C
A	0	4	0
B	4	0	0
C	0	0	0

copied ideology from

	A	B	C
A	0	0	3
B	0	0	2
C	3	2	0

In these matrices, the 'strength of relation' is the average of all data sources.

Per Relation type weight matrix, all values were divided by their maximum relation strength, which is 5 in this research (see table 4.1). That makes the values:

closely worked with

	A	B	C
A	0	4/5=0.8	0
B	4/5=0.8	0	0
C	0	0	0

copied ideology from

	A	B	C
A	0	0	3/5=0.6
B	0	0	2/5=0.4
C	3/5=0.6	2/5=0.4	0

Finally, every weight matrix was normalized by dividing it by the maximum number. In these examples, 'closely worked with' would be divided by 0.8, and 'copied ideology from' by 0.6. These final matrices were used in the functions for Moran's I:

closely worked with

	A	B	C
A	0	1	0
B	1	0	0
C	0	0	0

copied ideology from

	A	B	C
A	0	0	1
B	0	0	0.667
C	1	0.667	0

b. Combined weight matrix of all relation types, only direct relations

(see page 184 and further)

Every Relation type got a number on a five-point Likert-scale, which was interpreted linearly (the number right at the start of the 'Relative contribution…' column in the table below). Those weight scores may be debateable, but the least that can be done is that they are made explicit here with a brief rationale (further

text after the dash '—' in the 'Relative contribution…' column), as given in the following table (note, [child], [mutual] and [parent] in the Relation type column will be discussed later, for the 'all relations' weight matrix):

Relation type	Relative contribution for matrix construction
split off from [child]	5 – a split is expected to be an important influence on both (parent and child) group, as two more or less 'same' groups continue, but then smaller.
copied ideology from [child]	4 – a copy of the ideology has important influences on ideological properties, but not all properties of the group; important, but less than full-scale.
got group member(s) from [child]	3 – group members carry with them knowledge of all kinds of behaviour, like rituals, ways to extract resources, ideology, etc. However, it quite strongly depends on the receiving group how much of a chance such new members get to do anything with that, hence, a middle score
gave birth to [parent]	5 – similar reasoning as for 'split off from', an all-inclusive similar group is expected
closely worked with [mutual]	3 – this suggests an exchange of practices and ideas; nothing in 'working with' an actor enforces similarity, but in practice it will, esp. given the closeness, evoke attuning group properties to each other
fought against [mutual]	1 – in the long run, groups adapt to each other's fighting techniques. Culturally, however, this is not expected to be very important for direct cultural transfer.
copied tactics from [child]	2 – a clear statement of tactical similarity. However, not very important for properties as researched in this study.

trained by [child]	3 – this usually means considerable influence, e.g. in how to set up a fighting group, hence command structures, military training (a ritual in this research), etc. Not a full-blown copy though.
got supplies from [child?] [mutual?] [chosen for this research: child]	1 – a mild influence for group properties, suggesting some contact, probably suggesting some similarity given the usability of the supplies
explicitly inspired by [child]	4 – inspiration can often be ideological, sometimes even with regard to group structure and tactics (e.g. Mao as influence)
got leader(s) from [child]	4 – leaders (with their cultural repertoire) can exert considerable influence on the group and its structure
merged with	… (see text)
was mentor for [parent]	1 – mentoring is an activity of support when there is demand of the mentored. The mentored can continue relatively unaltered like before, but certain influences are there.
did business with [mutual]	1 – for incorporating the other actor's culture or group organization, doing business with an actor is not that important, but at least more than nothing.
successor of [child]	(5 ÷ 2, see text) – being the successor of a group suggests a strong inheritance link, having the same locality, contacts, ethnic background etc.
predecessor of [parent]	(5 ÷ 2, see text) – see 'successor of'

was a faction of [child]	(4 ÷ 2, see text) – having been a faction suggests intimate knowledge of a former containing group; however, the fact that it was a faction and that it split off suggests there was incompatibility, hence, less than a maximum cultural relation
encompasses faction of [parent]	(4÷ 2, see text) – see 'was a faction of'
total (N):	46

Table A.3.b — Relative contribution per Relation type for the construction of the weight matrix

The following assumptions and principles were utilized for calculating each cell in the overall 'direct relations' weight matrix:

- For direct links between groups in the sample (the 'direct relations' matrix), the direction of the relation (e.g. 'copied ideology from', 'got group member(s) from') is not relevant: whether B got group members from A or the other way around, in both instances the similarity resulting from the exchange of group members is the same. In terms of network topology and terminology, the links between groups are taken to be symmetrical and undirected.
- When there was more than one period per group for the same type of relation with the same other actor, the non-weighted average was taken (only 2 instances).
- When more than one expert gave the same link for the same actor but with a different strength, the average was taken (also only 2 instances).
    - If two or more data sources (mostly: experts) gave different influences from other groups for a particular group, all these records were part of the relations for that particular group and hence used for calculating the overall weight matrix. No preference was given to any data source over another, and the number of data sources indicating the same relation did not influence the weight that was given to those data.

- If for two groups relations of different types were recorded between those groups and the relation for one group was not recorded for the other, all relation types were used for both groups. So suppose the records were (and note there's only one row linking PARC-FAAL to FNL):

Group	**Relation type**	**Other actor**	**Strength of relation**
PARC-FAAL	closely worked with	FNL	4 = much / most
FNL	closely worked with	Mai Mai Padiri	2 = some
Mai Mai Padiri	closely worked with	FNL	3 = medium / several

then these records would translate into the 'closely worked with' weight matrix as:

	PARC-FAAL	FNL	Mai Mai Padiri
PARC-FAAL	0	4	0
FNL	4	0	2.5
Mai Mai Padiri	0	2.5	0

In this matrix the two records for FNL vs. Mai Mai Padiri were averaged, and the single record for PARC-FAAL vs. FNL was mirrored both horizontally and vertically. (The given numbers are further divided by the maximum of the 'Strength of relation', as specified above, and multiplied by the relative contribution of the 'closely worked with' relation, to factor this matrix into the overall relations matrix — again, as specified above. The point here is the averaging of the 'empirical' records into this specific Relation type matrix.)

- A special case is the relation type 'merged with'. Sometimes a merger means that the group has ended its existence. For instance, the Dozos merged with various non-state armed groups into the official army of the Ivory Coast, thereby effectively ceasing to exist as a non-state armed group. In other instances, the group continued its existence after a merger, for instance the

ADF. If a group effectively ended its existence, the 'merged with' was neglected for constructing the weight matrix. If a group continued its existence, the 'merged with' was interpreted as 'got group member(s) from'. This was decided on a case by case basis.

- Some relations are reciprocal and deliver effectively the same information about the same phenomenon: 'B successor of A' and 'A predecessor of B' denotes the same; similarly, 'was a faction of' and 'encompasses faction of' are reciprocal. To avoid double counting these links, they were averaged (added and divided by 2 — this is wat is meant by for instance '4÷2' in table 4.3 in the last few rows). However, no matching records were found in the current version of the dataset (e.g. when 'B was a faction of A' existed, then 'A encompasses faction of B' was never found). For future versions of this dataset, that might be different. Scripts were already developed for this situation, anticipating future research and future extensions of the dataset.

All values in every Relation type weight matrix were multiplied by the relative strength of the Relation type and divided by the sum of the relative strengths ('total (N)' at the bottom of table 4.3). Dividing by the sum of relation type weights was done to compensate for the subsequent combination technique: a simple addition of all Relation type matrices into one. When all are divided by the total N, the maximum becomes 1 again if all Relation types are present (Simpson and Oksanen 2016, 35). To give an example, suppose the example of the previous research question is continued here; the starting point are the non-normalized weight matrices:

closely worked with

	A	B	C
A	0	0.8	0
B	0.8	0	0
C	0	0	0

copied ideology from

	A	B	C
A	0	0	0.6
B	0	0	0.4
C	0.6	0.4	0

When the weights per Relation type are added into the equation, the weight matrices become:

closely worked with (weight = 3)

	A	B	C
A	0	0.8 x 3/46 = 0.052	0
B	0.8 x 3/46 = 0.052	0	0
C	0	0	0

copied ideology from (weight = 4)

	A	B	C
A	0	0	0.6 x 4/46 = 0.052
B	0	0	0.4 x 4/46 = 0.035
C	0.6 x 4/46 = 0.052	0.4 x 4/46 = 0.035	0

Finally, all Relation type weight matrices are added to create one overall relations weight matrix:

	A	B	C
A	0	0.052	0.052
B	0.052	0	0.035
C	0.052	0.035	0

c. Assumptions and rules for creating a weight matrix with indirect relations

(see page 185 and further)

The following assumptions and calculation algorithms were used to calculate the weight matrix that also includes the indirect links between groups:

- For indirect links via a 'third' actor, and in contrast to the direct links, the type of relation and the direction of influence *is* relevant *up to a certain point*. Suppose that A and B are groups in the sample, and C is one or another actor in the relations table (maybe in the sample, maybe not). Further suppose that A gave birth to C (A→C), and B was mentor for C (B→C); in that case, all relations point to C as both A and B were a 'parent' of C. In that case, C functions as a 'sink' and there is no effective link between A and B. But now suppose that A was explicitly inspired by C (A←C), and B got group members from C (B←C), then there *is* an effective link between A and B (C functions as a 'source' for both A and B). Additionally, if A closely worked with C, and B closely worked with C, then C functioned as a 'conduit' or 'serving hatch'. So in that sense, 'source' and 'hatch' situations are relevant here, but not the 'sink' relation. However, as it happens, there is only one 'sink' relation structure: when both A and B are a 'parent' of C. Even when only one of the two groups (A or B) is a parent for C, there is still a correlation between A and B; for instance, A gave birth to C (A→C), and B closely worked with C (B↔C), then there is an influence of A on B via C (A→C↔B). Whether relations are 'child', 'parent' or 'mutual' is given in the table above (table in Appendix 3b). Again, for this research it is important that there are influences (correlations) between groups; the directionality is only used to see whether there is an influence at all. In more statistical terms, it is about weights that certain observations get in the analyses, and weights are directionless.
- Several indirect links were of a different type, for instance, group A could trade with group C, and group B was inspired by C. This is a main reason why indirect relations were all placed in one matrix and cannot be split out to different matrices (like in research question 1 above). Even if the two relations of the indirect link were of the same type (e.g. A and B both 'closely worked with' C), then it is still

conceptually a stretch when the link between A and B is placed in the 'closely worked with' matrix, because A did not closely work with B; they each closely worked with C, but not with each other. Hence, only one matrix can be created that captures all indirect relations, and for this the same overall matrix was used as the one for the direct relations — the values were added.

- Some links led to 'nowhere', that is, gave data on a relation with another actor that was not a group from the sample dataset and that did not have a link back to the groups in the sample dataset. Such relation records were neglected for constructing the weight matrix for indirect relations.
- To calculate the cell value, both link strengths and link type weights are multiplied. The calculation was: cell value = (relation strength 1 / maximum of relation strength) * (relation type weight 1 / sum of all weight organizational) * (relation strength 2 / maximum of relation strength) * (relation type weight 2 / sum of all weight organizational). For example, when group A was inspired by Mao ('source') at strength 2 and group B at strength 3, and given that the 'inspired by' link has a weight of 4, the 'inspiration' strength between these two groups was (2/5 * 4/46) * (3/5 * 4/46) = 0.0018. As indicated above, the division by 5 is because that is the maximum score, both for the links and for the weight of every link type, and the division by 46 is because it is the sum of all relation type weights. The intuition behind the double multiplication is that a certain percentage (0-100) of a group's properties is passed on via a certain relation. When this is done in two steps, it is a percentage of a percentage.
- Groups can also be linked via a third group from the sample. For instance, in the table given above (Appendix 3b) there is a connection between PARC-FAAL and Mai Mai Padiri via FNL. Such instances are handled in the same way: the two links are multiplied *if* the third group is not a 'sink'. In this example, the relationship was 'closely worked with', which is mutual, so mutual exchange is possible. The calculation would give (4/5 * 3/46) * (2/5 * 3/46) = 0.0013.

- All calculated values for indirect relations are added to the applicable cell in the overall weight matrix. The intuition behind addition is that every extra relation type 'adds' to the influence between two groups; a multiplication would -given the algorithms above- lead to a decrease in autocorrelation, which is the opposite of reality. A seemingly disadvantage is that weight values can get higher than 100% in that way, but that was solved by dividing the values in the final weight matrix by the highest value to normalize all values to the range 0…1 (incl.). The seemingly disadvantage of normalizing to unity is if all groups only have a minimal relation with each other, it looks as if they have a very high correlation with each other (e.g. if the highest value is 0.1, then the division by the highest value effectively gives quasi-correlations of 1 after dividing by 0.1). Nonetheless, this drawback is no more severe than what is done in other methods to create weight matrices, where the values are standardly divided by the highest value in the matrix to obtain normalized values (e.g. all 12 matrices developed in Eff 2004; and as used in Dobson and Gelade 2012). In addition, the functions used in R (see main text) also normalize in and of themselves.
- Indirect links are second-order relationships. In principle, it is possible to calculate third-order, fourth-order etc. relationships. (E.g. A was influenced by C, C was influenced by D, D was influenced by B, hence, there was a third order relationship between A and B.) That was not done here for simplicity, the more because the influence asymptotically decreases to 0 for every higher order.
- Again, although time periods of the relation were recorded, and although in principle the relations can be placed –perhaps even followed- in time, time was not used in (this iteration of) this research. Whereas for direct links between groups in the sample time is not as important for the existence of the relation, for indirect links it can be important: when group A is first inspired by C, and then group B is mentor for group C, then there is no relationship between A and B. Conversely, when B is first mentor for group C and then group A is inspired by C,

then there is a relationship between A and B. This issue was neglected here, and probably not very influential, but it is brought forward here as a potential caveat, and something that could be improved in future research.

Appendix 4 — Conversion of resource data

(see page 253 and further)

Let's start with an example of the resource data as provided by experts:

Start month	Start year	End month	End year	Resource type	Degree of reliance
January	1993	December	2005	foreign regime	substantial
January	1993	December	2005	diaspora contributors	minimal
January	1993	December	2005	hostage taking	substantial
January	2006	December	2009	foreign regime	minimal
January	2006	December	2009	diaspora contributors	minimal
January	2006	December	2009	hostage taking	moderate

When the ratings of table 5.1 (in the main text) that convert Resource types into ROI and Risk are added to these primary data, the data is enriched to:

Start month	Start year	End month	End year	Resource type	Degree of reliance	ROI	Risk obtain	Risk lose
Jan	1993	Dec	2005	foreign regime	substantial	high	low	low
Jan	1993	Dec	2005	diaspora contributors	minimal	medium	low	low
Jan	1993	Dec	2005	hostage taking	substantial	high	medium	medium
Jan	2006	Dec	2009	foreign regime	minimal	high	low	low
Jan	2006	Dec	2009	diaspora contributors	minimal	medium	low	low
Jan	2006	Dec	2009	hostage taking	moderate	high	medium	medium

The ROI and Risk data can be converted to numerical data by creating dummy columns (only ROI shown here):

Start month	Start year	End month	End year	Resource type	Degree of reliance	ROI low	ROI medium	ROI high
Jan	1993	Dec	2005	foreign regime	substantial	0	0	1
Jan	1993	Dec	2005	diaspora contributors	minimal	0	1	0
Jan	1993	Dec	2005	hostage taking	substantial	0	0	1
Jan	2006	Dec	2009	foreign regime	minimal	0	0	1
Jan	2006	Dec	2009	diaspora contributors	minimal	0	1	0
Jan	2006	Dec	2009	hostage taking	moderate	0	0	1

It is quite intuitive to assume that when a group utilizes a high-ROI resource substantially then its overall ROI is higher than when the group would have used that same resource type only minimally, other things being equal. Hence, it makes sense to devise some sort of weighting for the different 'Degree of reliance's. That was done in this research by creating four different weighting scenarios, collectively labelled 'Reliance weight'. There are four scenarios to reflect the uncertainty what the 'right' translation would be from the 'Degree of reliance' to some numerical representation. There is a base scenario where all Degrees of reliance get the same weight (effectively nothing changes with regard to the dummy columns), and three other scenarios that increasingly emphasize the difference between the Degree of reliances. The 'rumoured' weight was set to 0.3 in all three alternative scenarios, and the 'present' category was set equal to the 'minimal' category, namely 1. From 'minimal' via 'moderate' to 'substantial', either a slight difference was modelled (1→2→3), a moderate increase (1→3→5) or a strong increase (1→4→7). Hence, in total there were four scenarios for the Reliance weight, each individually labelled according to their weights (e.g. "R_0.3_1_1_2_3"), etc. These four scenarios do not have absolute meanings, but should rather be seen in comparison to each other to get an indication whether Degree of reliance matters at all or not.

	R_1_1_1_1_1	R_0.3_1_1_2_3	R_0.3_1_1_3_5	R_0.3_1_1_4_7
rumoured	1	0.3	0.3	0.3
present	1	1	1	1
minimal	1	1	1	1
moderate	1	2	3	4
substantial	1	3	5	7

Table 5.5 — The different weights of the 'Degree of reliance', labelled 'Reliance weight'

An example of the Reliance weight conversions would be:

dummy data and R_1_1_1_1_1 R_0.3_1_1_2_3

Degree of reliance	ROI low	ROI medium	ROI high
substantial	0	0	1
minimal	0	1	0
substantial	0	0	1
minimal	0	0	1
minimal	0	1	0
moderate	0	0	1

Degree of reliance	ROI low	ROI medium	ROI high
substantial	0	0	1*3=3
minimal	0	1*1=1	0
substantial	0	0	1*3=3
minimal	0	0	1*1=1
minimal	0	1*1=1	0
moderate	0	0	1*2=2

At the left, there is basically no conversion (R_1_1_1_1_1), at the right an example is given of the most moderate increase in weighting (R_0.3_1_1_2_3).

Continuing this example, the total data for this group for the R_0.3_1_1_2_3 scenario would then be (with again Risk left out, and the 'w' after ROI denoting it is weighted):

Start month	Start year	End month	End year	Resource type	Degree of reliance	ROI w low	ROI w medium	ROI w high
Jan	1993	Dec	2005	foreign regime	substantial	0	0	3
Jan	1993	Dec	2005	diaspora contributors	minimal	0	1	0
Jan	1993	Dec	2005	hostage taking	substantial	0	0	3
Jan	2006	Dec	2009	foreign regime	minimal	0	0	1
Jan	2006	Dec	2009	diaspora contributors	minimal	0	1	0
Jan	2006	Dec	2009	hostage taking	moderate	0	0	2

Appendix 5 — ROI and Risk versus Modes properties

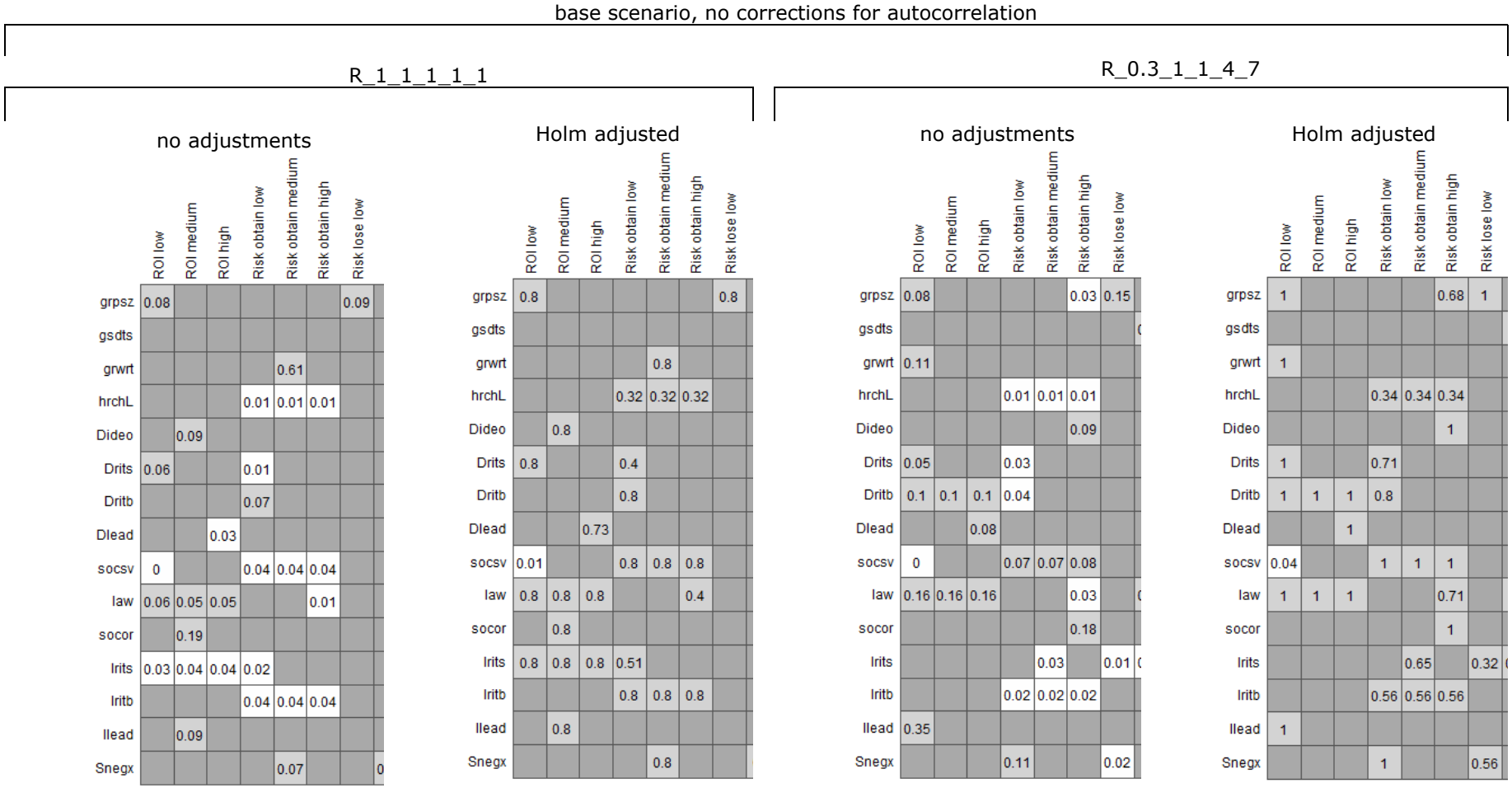

Figure A5a — The relationship between Modes variables (rows) versus ROI and Risk (RRR, columns) without corrections for autocorrelation. The left two panels are from the RRR weight scenario whereby all Degrees of reliance got an equally strong weight (R_1_1_1_1_1), the right two of the RRR weight scenario whereby increasing Degrees of reliance got more weight (e.g. 'substantial' more than 'moderate', R_0.3_1_1_4_7). Every left panel per Reliance weight is without adjustments for multiple comparisons, every rightpanel is Holm adjusted. Represented in the figures are those combinations of RRR variables that had the lowest AIC per Modes variable, with those RRR variables highlighted in the row that were part of the IVs in the model. The numbers in the cells are p-values of these RRR variables. Dark grey cells: the RRR variable was not part of the model. Light grey: the

RRR variable was part of the model with the lowest AIC, but not significant. White: idem, but significant. The abbreviations as used for the Modes variables is the same as in chapters 3 and 4.

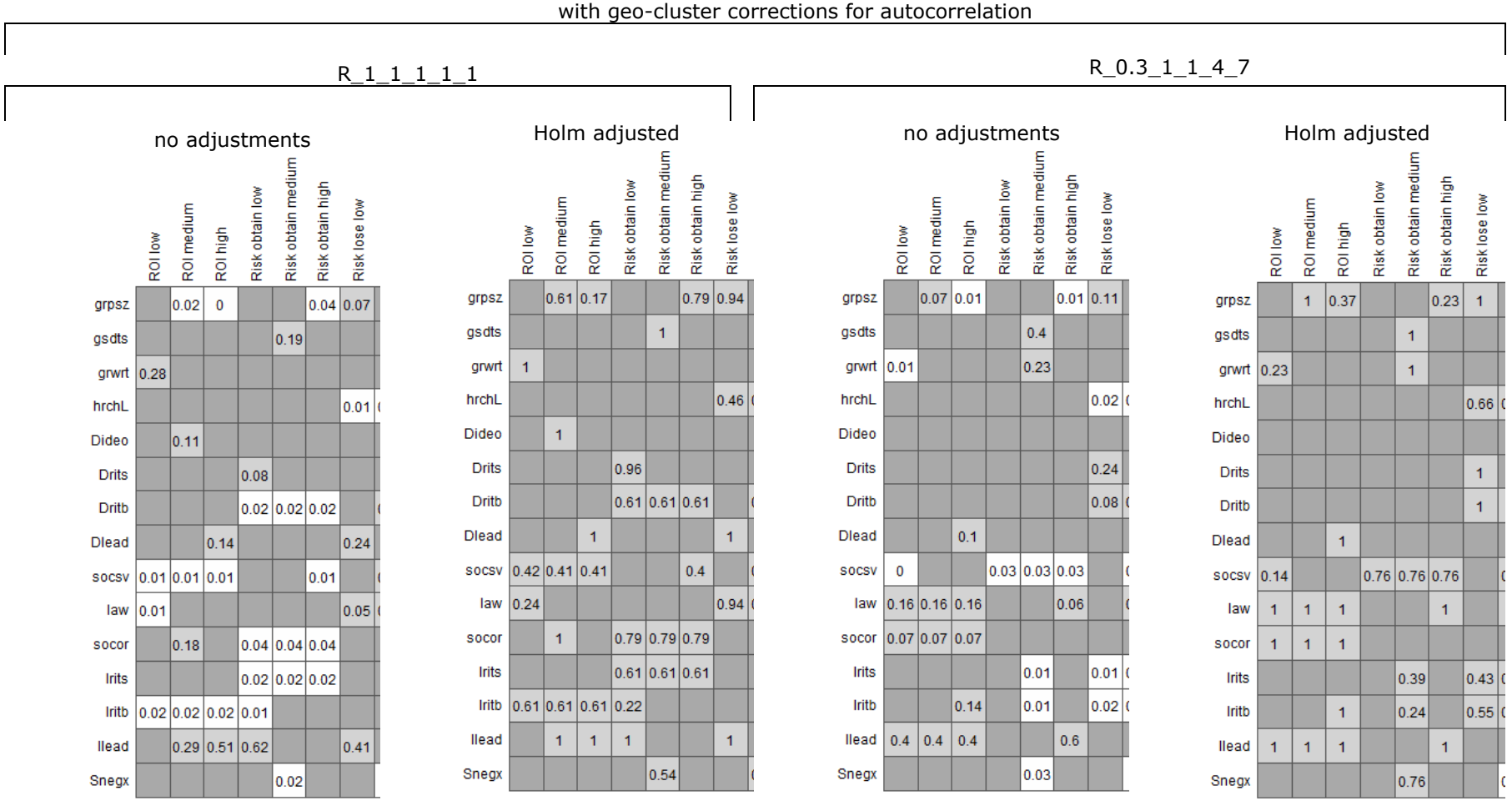

Figure A5b — The relationship between Modes variables (rows) versus ROI and Risk (RRR, columns) with corrections for autocorrelation via the geo-cluster covariate. For further specifications, see figure A5a.