

Towards a Knowledge Management
Methodology for Articulating the Role of
Hidden Knowledges



Simon Paul Smith

University College

University of Oxford

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Abstract

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Knowledge Management Systems are deployed in organisations of all sizes to support the coordination and control of a range of intellectual assets, and the low cost infrastructures made available by the shift to ‘cloud computing’ looks to only increase the speed and pervasiveness of this move. However, their implementation has not been without its problems, and the development of novel interventions capable of supporting the mundane work of everyday organisational settings has ultimately been limited. A common source of trouble for those formulating such systems is said to be that some proportion of the knowledge held by a setting’s members is hidden from the undirected view of both The Organisation and its analysts - typically characterised as *a tacit knowledge* - and can therefore go unnoticed during the design and deployment of new technologies. Notwithstanding its utility, overuse of this characterisation has resulted in the inappropriate labelling of a disparate assortment of phenomena, some of which might be more appropriately re-specified as ‘*hidden knowledges*’: a standpoint which seeks to acknowledge their unspoken character without making any unwarranted claims regarding their cognitive status. Approaches which focus on the situated and contingent properties of the actual work carried out by a setting’s members - such as *ethnomethodologically informed ethnography* - have shown significant promise as a mechanism for transforming the role played by members’ practices into an explicit topic of study. Specifically they have proven particularly adept at noticing those aspects of members’ work that might ordinarily be hidden from an undirected view, such as the methodic procedures through which we can sometimes mean more than we can say *in-just-so-many-words*. Here - within the context of gathering the requirements for new Knowledge Management Systems to support the reuse of existing knowledge - the findings from the application of just such an approach are presented in the form of a *Pattern Language for Knowledge Management Systems*: a descriptive device that lends itself to articulating the role that such hidden knowledges are playing in everyday work settings. By combining these three facets, this work shows that it is possible to take a more meaningful approach towards noticing those knowledges which might ordinarily be hidden from view, and apply our new understanding of them to the design of Knowledge Management Systems that actively engage with the knowledgeable work of a setting’s members.

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1. Introduction

1.1. The knowledge society

Since the beginning of the twentieth century there has been an ongoing reconfiguration of both the locus of productivity - from the outputs of individual workers, to those of project-based groups or '*The Organisation*'¹ as-a-whole - as well as the nature of the product itself - from material artefacts to those based purely upon information. This continuing metamorphosis has been informed by a range of factors, including the onward march of Globalisation, the great progresses made in the availability of high quality education to all sections of society, and the seemingly endless increases in organisational efficiency & productivity brought-about through the pervasive use of a burgeoning array of management methodologies (Drucker 1992, 1993). The ubiquitous nature of these transformations have lead to Western civilisation being increasingly characterised as a '*Knowledge Society*': that knowledge has taken over from land, labour and capital as the primary input of continued economic progress; and that the role of increasingly large, sophisticated, and powerful organisations is the efficient command & control of the knowledge possessed by their constituent members, applying their understanding and insight to the production of sustained 'organisational value' on its behalf. This shift represents a move away from a reliance on manual and service work for the generation of value - where knowledge is applied to the use of physical tools, processes or products - to what has become commonly known as '*knowledge work*' - where understanding is applied directly to human activity, the creation and management of information, as well as to the creation of knowledge itself (Scarborough, Swan & Preston 1999).

Within this paradigm notions of a '*Knowledge Economy*' have served to focus various agendas on the nature of knowledge work, and how Society, The Organisation, and their supporting infrastructures might be better adapted in order to maximise the contributions that they make to global economic development. The vision for this Knowledge Economy is for globalised, technologically mediated, project-based teams to replace physically co-

¹ The use of the term '*The Organisation*' is intended to stand in for the The Organisation as an institution in aggregate, as often referred to in the talk of its constituent members (e.g. references to the strategy of 'The Organisation', or the ways in which 'The Organisation' works through its processes and procedures), and in particular the ways in which The Organisation is assigned responsibility for what are ultimately the decisions and actions of individuals.

located groups of workers, in order that the right people can be applied to the most appropriate problems, and at the right time, in the eternal pursuit of generating organisational value. The ultimate expression of this vision is that the new information and knowledge produced by these novel configurations will lead to the creation of a feedback loop: the creation of new products, processes and organisational forms will, in-turn, lead to further development and expansion of the globalised, digitised, Knowledge Society. However, the full ambition for the Knowledge Society has often outpaced the availability of technological infrastructures able to meet these aspirations in terms of cost, capability, and ubiquity; with a succession of 'false starts' as both organisations and entire economies have attempted to push beyond what the technologies of the day - or our understanding of their appropriate application - were capable of delivering.

The primary productive unit of the Knowledge Economy is ultimately the '*Knowledge Worker*', someone who can be characterised as an employee whose major contribution depends on their applying their knowledge on The Organisation's behalf, rather than their physical attributes, such as muscle power and coordination (Drucker 2008). Further, the knowledge worker is an individual, someone who cannot be productive unless they find out who they are, what kind of work they are fit for, and how they work best. Kidd (1994) suggests that the knowledge worker's value to The Organisation lies not simply in their ability to manage the increasingly large volumes of corporate and technical information which are now part of our everyday working lives, but rather their ability to consume - and be transformed by - this information, applying this new understanding in pursuit of The Organisation's aims and objectives. Further, these workers are characterised as highly motivated individuals who expect to continue developing their expertise throughout their careers, and who are willing to align their own personal agendas to those of The Organisation on whose behalf they are currently employed (Amar 2004). Since its inception, the term 'knowledge worker' has become synonymous with the rise of the high-tech industrial complex of the late 20th century, but it can equally be applied to those who work in a broad range of well established professions, where the focus is on the contributions that knowledgeable individuals can make to creating sustained organisational value, in terms of their deep technical understandings, personal passions, and creativity - such as lawyers, architects and engineers - and whose primary outputs are informational constructs which stand in for their expertise, enabling them to act-from-afar.

1.2. Knowledge management

Within the context of professional groups, considered by some to be the archetypal knowledge workers, knowing is formulated, shared and applied across a range of institutional scales: from individual work-groups, The Organisation, through to the profession as-a-whole. Further, the knowledge on which each organisation is built is distributed across both space and time; with work often being shared between multiple individuals, across multiple locations; in the past, present and future. Acknowledging this, The Organisation continually seeks to protect its intellectual assets - maximising the return on its investments - by attempting to pass insights gained from the experiences of those solving problems on its behalf, both now and in the past, to those that follow. Embedded within this complex institutional matrix, individuals must continually work to develop their own understanding - through direct experience, the guidance of peers and mentors, access to corpuses of technical information, and supported by various tools and technologies - whilst at the same time seeking to formulate themselves as competent members of their wider social and professional communities.

Against the backdrop of the social and organisational re-shaping brought about by the ongoing transition to, and continual transformation of, the Knowledge Society, it was not until the early 1990s - and after the failure of the latest management fad, Business Process Re-engineering (BPR), which left organisations stripped of their most knowledgeable staff - that The Organisation began to view the management of knowledge as a distinct and necessary business operation (Drew 1999, Wilson 2002). However, the beginnings of Knowledge Management - like the modern organisation itself - can in fact be traced back to the rise of the industrial complex and the development of Scientific Management - often called '*Taylorism*' - at the turn of the 20th century. Indeed, in a somewhat prophetic statement, Taylor claimed that one of the primary roles of management was to gather '*together all of the traditional knowledge which in the past has been possessed by the workmen and then classify, tabulat[e], and reduc[e] this knowledge to the rules, laws, and formulae which are immensely helpful to workmen in doing their daily work*' (Taylor 1914, p. 36). Through the deconstruction and fragmentation of production processes into a series of atomised tasks which could be undertaken by workers with minimal training, Scientific Management promoted the substitution of the judgement and skills of individual workers for those of the detached scientist. Whilst many within Knowledge Management baulk at the notion of Taylorism, it might be argued that this is in fact what a sizeable proportion of the

discipline's researchers and practitioners are attempting to achieve: the separation of knowledge - something that The Organisation sees as its property; its 'intellectual assets' - from its constituent members.

Set against this background, *Knowledge Management* and its analysts are typically tasked by The Organisation with the separation of various intellectual assets from its constituent members, 'capturing' them on some substrate so that their value might be capitalised upon by The Organisation's other agents, both now and in the future. Further, it must achieve this end without inadvertently creating a set of additional problems that workers must overcome in order to get their jobs done, such as the inappropriate siloing of information, socio-ethical disruption of the workplace (Alter 2006, Baskerville & Dulipovici 2006), the high incidence of projects that fail to meet stakeholder expectations (Lucier & Torsilieri 1997, Storey & Barnett 2000), or those that simply fail altogether (Standish Group 2009). Early examples of Knowledge Management interventions - many of which are now common-place - included encouraging interdisciplinary working, rewarding employees for their intellectual investment in the future of The Organisation, facilitating informal get-togethers in order to foster communities-of-practice, and the application of modern technologies to support work practices (Stewart 1991). By the mid-1990s a number of publications were appearing in the popular business press which started to outline the role that a distinct discipline of Knowledge Management might play within modern organisations (Nonaka & Takeuchi 1995, Davenport & Prusak 1998), and in particular set out how the discipline's '*Knowledge Managers*' could assist The Organisation in avoiding some of the failures of the past. Despite ongoing claims that Knowledge Management was simply the latest in a long line of business fads (Scarborough, Swan & Preston 1999, Streatfield & Wilson 1999, Bryant 2006) academic interest in the management of knowledge within both commercial and non-commercial organisations has led to the formulation of a vast array of theories, frameworks, methodologies, tools and technologies through which to approach its problems, many of which are based upon understandings from other more established disciplines, such as Philosophy, Cognitive Psychology, and the Social Sciences.

1.2.1. Technological support for knowledge work

The reuse of existing information to solve current problems based upon on past solutions - that ourselves or others have formulated - is a common practice across a range of work settings, as well as in everyday life. Call centre staff reuse existing solutions to help them guide callers to a resolution of their current troubles (Collins, Shukla & Redmiles 2002,

Erden, von Krogh & Nonaka 2008), service technicians utilise the past experiences of others to inform current repairs (Lutters & Ackerman 2007, Orr 1996), corporate lawyers reuse existing technical documents as templates for new contracts (Blomberg, Suchman & Trigg 1996), and architects reuse past designs when formulating new buildings (Schmidt & Wagner 2004). In all these settings, existing information constructs are re-interpreted and re-contextualised in order to assist individuals in the mundane work of solving the eternal question: *'how do we go on?'*.

The utilisation of information management technologies for the management of such resources is nothing new (see Vannevar Bush's microfiche 'Memex' concept for an early example, Bush 1945), and the design, development and deployment of modern computer-based '*Knowledge Management Systems*' is a well established research area spanning from at least the early 1970s through to the present day. However, whilst the fine scale functionality of modern systems has become highly refined, the gross functionality of the majority of mainstream applications has not advanced significantly from those presented in the early part of the field's evolution (Akscyn, McCracken & Yoder 1988, Lucier *et al* 1988). These database driven, networked, multi-user environments, provided functionality for the storage and retrieval of electronic documentation via the desktop, the linking of individual information objects via hypertext, and communications channels between disparate individuals using electronic mail and bulletin boards. Such systems now form an important part of the technological infrastructures put in place by modern organisations of all sizes in order to support their staff in the creation of organisational value, and are increasingly seen as the primary substrate upon which 'captured' knowledge can be stored and made available to The Organisation and its other agents, both now and in the future (Marwick 2001). Although detailed functionality varies, Knowledge Management Systems are typically designed to perform one or more of the following activities: the *creation* of new knowledge; the *storage* of captured knowledge and its subsequent *retrieval*; the *transfer* of knowledge to new individuals; and the *application* of knowledge in the pursuit of solutions to the-problem-at-hand (Alavi & Leidner 2001). Such systems range in size and complexity from desktop applications for the management of personal knowledge (e.g. Microsoft OneNote, Evernote), networked system infrastructures for managing the knowledge of groups (e.g. Microsoft SharePoint, SocialText), through to system ecosystems that manage knowledge from a range of different sources (e.g. traditional Intranets/

Extranets, Google Apps suite)². Further, although such systems have traditionally been based upon installable applications that could be loaded onto The Organisation's personal computers by centrally co-ordinated Information Technology services, increasingly the Internet - and the World Wide Web in particular - is seen as the universal substrate upon which such applications will be developed and deployed, allowing staff to access them from any location and through a range of different form-factors.

1.2.2. System failure

Across the Information Technology industry as-a-whole, the failure of the design, development and deployment new systems continues to be an ongoing issue for those invested in their success, with 44% of projects failing to meet stakeholder expectations (e.g. late, over budget, or with reduced functionality), and 24% failing altogether (Standish Group 2009). Causes of such failure are varied, but well established issues include a lack of appropriate strategic intent for new systems (Storey & Barnett 2000), inadequate identification of real user requirements (Goguen 1996), a disregard for the socio-technical issues that new systems will be faced with once deployed (Grudin 1988), and a failure to adequately educate and train users to support their deployment and use (Peltu 1996). Lessons have been learned from the sometimes catastrophic failures of the past (such as the near fatal collapse of the London Ambulance Service Computer Aided Dispatch system, South West Thames Regional Health Authority 1993, Peltu 1996), and an array of formal methodologies now exists to support those designing, developing and deploying such systems within modern organisations in order to better assure their stability and security. However, whilst such catastrophic failures have become less common (although significant failures do still occur, e.g. the recent collapse of the London Stock Exchange's technological infrastructure, Mason 2008), the failure of new systems to meet the actual needs of the users who will eventually call upon them to support their work remains a persistent and pervasive problem in projects of all sizes. These subtler forms of failure are becoming particularly important as the role of new technological systems extends beyond the support of formalised business processes and they begin to play an indispensable part in supporting a diverse range of less structured work practices, such as those that are a common feature of knowledge work.

² Microsoft OneNote [<http://office.microsoft.com/en-us/onenote/default.aspx>], Evernote [<http://www.evernote.com/>], SharePoint [<http://sharepoint.microsoft.com/Pages/Default.aspx>], SocialText [<http://www.socialtext.com/>], Google Apps [<http://www.google.com/apps/>].

Despite the well established nature of Knowledge Management Systems, and the often significant sums and effort invested in their development and deployment, projects to implement them within organisations also continue to suffer from frequent failure, with identified causes including: a lack of understanding of the human and organisational factors that effect such systems (Clarke & Lehane 2000), lack of support from senior management (Lucier & Torsilieri 1997), misconceptions regarding the relationship between organisational inputs and outputs (Malhotra 2004), the application of generic solutions to specific circumstances (Markus 2001), and the creation of disparate silos of information (Newell 1999). Within this context a growing number of commentators have suggested that many of the troubles faced by the developers of such systems might in some part be due to the ways in which Knowledge Management and its agents conceive of its primary phenomenon: the knowledge of The Organisation's constituent members. Of particular concern is the increasing use of abstract accounts of reified phenomena which have become a common feature of the Knowledge Management literature, and which treat knowledge as a concrete object which can be extracted from the knower - and the context within which knowing occurs - and stored on some substrate as discrete instances of 'knowledge' (Huysman & de Wit 2003, Thompson & Walsham 2004, Cox 2007); with some arguing that taking such a stance ignores the fundamentally situated, active, and emergent nature of knowing (Blackler 1995, Suchman 2007). As a result of such concerns some researchers have turned to the '*situated paradigm*' to serve as a corrective for those responsible for formulating Knowledge Management's technological interventions (Clases & Wehner 2002, Suchman, Trigg & Blomberg 2002), an approach which seeks to acknowledge the multiple, partial and local nature of knowing. Within the context of this paradigm, Knowledge Management's technological interventions should not be conceived of as a state-holding device, designed to 'capture' knowledge, but rather as just one part of a dynamic socio-technical system, formulated to augment the workings of an organisation's communities of knowledge workers in such a way that those faced with each-next-problem can develop the understandings that they require to go on with their efforts, and do so in a timely fashion. Specifically, such systems should provide support for the '*contextual clues*' which might enable users to more effectively re-contextualise the information that such systems actually contain, wherever it is located, and in whatever form (Thomas, Kellogg & Erickson 2001, Lutters & Ackerman 2007).

1.3. Tacit knowledge

Given the complexity of its task, it is hardly surprising that the design, development and deployment of Knowledge Management's technological interventions have often faced difficulty in fulfilling their role to the satisfaction of all those involved. One reason for these ongoing difficulties is said to be that a large proportion of the knowledge that individuals utilise as a resource for the solving of each-next-problem is largely hidden from an undirected view, and therefore unavailable to The Organisation or its analysts. Typically classified under the rubric '*tacit knowledge*', such phenomena are viewed as particularly problematic by The Organisation as it seeks to reduce its reliance on ephemeral individuals by converting their tacit knowledge into an explicit resource, from which it can continue to extract value long after they have moved on. In particular, such knowledge presents The Organisation with a resource that is beyond its direct command & control, and therefore represents both a potential inefficiency - in terms of its having to continually reinvent the wheel - or a direct threat - in terms of its ability to control its position within a competitive globalised marketplace.

Brought to prominence within Knowledge Management through Nonaka's work on organisational knowledge creation (Nonaka 1994, Nonaka & Takeuchi 1995), tacit knowledge has continued to play a pivotal role in its programme ever since (Tsoukas 2003). Loosely based upon Michael Polanyi's philosophical construct (Polanyi 1966, 1973), conceptions of a tacit knowledge are typically used to characterise any knowledge which cannot be articulated in a form that is amenable to immediate 'capture' through the tools and technologies of Knowledge Management. However, Knowledge Management's use and conception of the notion has not been without its critics (Castillo 2002, Hildreth & Kimble 2002, Tsoukas 2003, Gourlay 2006), whilst others have gone further by questioning the validity of the tacit/explicit duality upon which so much of Knowledge Management's programme is built (Stenmark 2002, Wilson 2002). Other disciplines with an interest in the technological support of work practices have also acknowledged the role played by a tacit knowledge, such as Workplace Studies, Requirements Engineering and Computer Supported Collaborative Work (Bentley *et al* 1992, Heath *et al* 1994, Rouncefield *et al* 1994, Goguen 1996, Hughes *et al* 1997, Whalen, Whalen & Henderson 2002), but here too it has been noted that the meaning of the term has sometimes been glossed (Randall 2007).

Because of these ongoing difficulties, the formulation of effective interventions that support the development and maintenance of workplace knowing remain a high priority for

investigators within Knowledge Management and related disciplines (Marwick 2001, Castillo 2002, Styhre 2004, Gourlay 2006), and there have been regular calls for researchers to formulate improved conceptions of the role played by such hidden phenomena in the workplace, as well as mechanisms through which this understanding might be applied to the development of new technological interventions for their support, including:

- Approaches that improve our understanding of the social processes which underlie the production of the taken-for-granted aspects of practice which might ordinarily be hidden from view (Tuomi 1999, Schmidt 2000, Watson 2006);
- The formulation of generalisable concepts that can support the application of Knowledge Management strategies (Reichling, Veith & Wulf 2007), such as might be achieved through the establishment of a corpus of studies founded upon stable, domain focused conceptions of knowledge (Hughes *et al* 1994, Randall 2007);
- Improved approaches to formulating our understanding of how tacit knowledge might be more appropriately supported by technological systems (Marwick 2001), such as those that can take account of the material tools that are embedded in practice (Gaskin *et al* 2010), or approaches to understanding how the likes of knowledge workers build up repertoires of knowledge so that their invocation can be better supported by technology in the future (Schön 1988).

1.4. Aims & objectives

Within this broader context, the aim of the research presented in the remainder of this thesis is to advance a re-conceptualisation of Knowledge Management's primary phenomenon - the knowledge of a setting's members - in order that its researchers and practitioners might reduce the risk of their Knowledge Management Systems experiencing failure, whilst increasing the system's utility for those calling upon them to support their work. In particular, this work has four main objectives:

- Central to Knowledge Management's efforts are its conceptions of, and approaches to, the management of tacit knowledge. We will examine some of the perceived weaknesses in its approach, and it will be argued that - in order to escape some of the tensions and misconceptions that plague the use of term - we might be better served re-conceptualising many of the phenomena given this characterisation as '*hidden knowledges*'.
- Focusing on the formulation, maintenance and propagation of an architectural practice's design philosophy - offered as an example of a tacit knowledge in action - we will

examine the utility of *ethnomethodologically informed ethnography* as a way of noticing the work that an array of hidden knowledges are doing in everyday work settings.

- This research will then present the development and evaluation of a *pattern language* as a practical technique for guiding the developers of Knowledge Management's technological interventions, one which is particularly suited to articulating an understanding of our noticings of these normally hidden phenomena to all of the stakeholders invested in a new Knowledge Management System.
- Finally, the implications of this work for those wishing to develop new Knowledge Management Systems in the future will be outlined, in order that they can take full account of the array of hidden knowledges that support even the most mundane of work practices.

1.4.1. Document structure

- **Chapter two** of this document provides an overview of conceptions of a tacit knowledge from a range of disciplines, and puts forward a re-specification - in the form of 'hidden knowledges' - arguing that this might be a more appropriate notion through which to conceive of many phenomena given this label in the future.
- **Chapter three** provides an overview of some existing methodological approaches to noticing such hidden knowledges, and argues that - in the light of the earlier re-specification of such phenomena - ethnomethodologically informed ethnography is an approach that is particularly suited to understanding the work that they do in everyday work settings.
- **Chapter four** presents the findings from an ethnomethodologically informed ethnographic investigation of an architectural practice, and examines how a shared - but largely hidden - knowledge of the practice's design philosophy plays a vital role in both individual and Organisational success.
- **Chapter five** examines how we might more effectively communicate our noticings of the part played by such hidden knowledges to all of the stakeholders invested in the design, development and deployment of new Knowledge Management Systems, and puts forward a pattern language as a mechanism that may be particularly suited to achieving this end.
- **Chapter six** presents an evaluation of the approach outlined in the previous chapters during the redevelopment of a Knowledge Management System to support the sharing of

existing knowledge across a large team of temporally, spatially and professionally distributed staff within a mid-sized Government agency.

- Finally, **chapter seven** presents a synthesis of the implications of this work for those wishing to take account of - and provide support for - the array of hidden knowledges that support even the most mundane of work during the formulation of Knowledge Management's technological interventions, and outlines a range of further work to support this end.

2. Hidden Knowledges

2.1. Introduction

In chapter one the important role that the discipline of Knowledge Management plays in supporting the creation and maintenance of the intellectual assets which increasingly define the capabilities of modern organisations was outlined. In particular, the significance of its technological interventions were highlighted - namely *Knowledge Management Systems* - which are typically implemented to support the ongoing capture and conversion of the understandings of The Organisation's constituent Knowledge Workers into quantifiable organisational value. Finally, the central role that notions of a *tacit knowledge* have played within Knowledge Management's developing programme were noted, something which many of the discipline's interventions are at least partially targeted at 'capturing' on The Organisation's behalf.

In this chapter we will review the literature supporting conceptions of a tacit knowledge from across a range of disciplines, and examine the ongoing debate regarding its nature, the role that it plays in actual work settings, and whether or not it should - or indeed can - be captured and managed. In order to counter some of the confusion and criticisms associated with the application of the concept - particularly from within Knowledge Management itself - this work will then draw upon research undertaken by those operating within the *situated paradigm*: an approach which seeks to pay special attention to the local, partial and multiple character of situated '*knowledges*'. Based upon the insights made available to us by taking this turn, the use of the trope '*hidden knowledges*' will be advanced as a gloss for all those knowledges that are hidden from the undirected view of The Organisation and its analysts. It will be argued that conceiving of the array of phenomena normally labelled as a tacit knowledge in this way may provide Knowledge Management's researchers and practitioners with a useful device for avoiding some of the tensions and misconceptions that have become associated with the application of the term in the past, leaving it available as a description of the actual phenomenon for which it was originally intended: the deeply held personal passions and artful expression of skills that enable us to excel in certain tasks, but for which we will never be able to articulate a complete account.

2.1.1. Knowing

Since the beginnings of time man has agonised over what it means to know, and what

constitutes valid knowledge of the-world-out-there. Indeed - as we have heard - conceptions of knowledge are coming to play an increasingly important role in all modern societies as they make the transition from industrialised economies to those built upon the outputs of 'knowledge work'. In this new Knowledge Society the value of Knowledge Workers to The Organisation is not a result of their manual labours, but rather a product of their intellectual capacities, as they solve novel problems and create new innovations on its behalf. Across much of the research and practitioner literatures surrounding the management of such intellectual assets, a quantum of knowledge is typically reified into a discrete and explicit object - not unlike information - which can then be separated from the knower, written to some substrate, and then taken up in a comparable form by other actors, both now and in the future. This common category mistake often leads to conceptions - and subsequent workplace interventions - that discount the fundamental part played by the vast array of contextual clues that imbue each-next-moment of knowing with its very status as-such, and which many believe can only be drawn into a meaningful whole by a competent human actor as they work to address the problem in-hand: namely 'how do we go on?' Possibly as a result of such misunderstandings, Knowledge Management's workplace interventions are sometimes unable to fully address the array of hidden factors that are thought to support even the most mundane of work practices, and so their focus often shifts to the production of more familiar information constructs that can be managed using the traditional tools and technologies of Information Management, alongside The Organisation's existing corpuses of data and information.

In order not to get drawn too deeply into the epistemological affray surrounding notions of knowledge, it is accepted here that a common starting point to this conceptual puzzle is to accept that, in its most basic form, knowledge can be characterised using the philosophical construct '*justified true belief*': that in order for something to count as knowledge we must believe it; we must be able to justify that belief in some way, typically through perceptual evidence; and that it must be evidenced as being true: that is, we must be able to successfully act upon it. Within this context there are five primary sources of knowledge which can be called upon to develop and support claims of knowing: direct perception mediated by our sensory apparatus; the introspective examination of our own private thoughts; calling upon our memories of past experience to guide our future actions; the power of reason to unpack a problem; and the testimony of trusted others (Landesman 1997, Audi 2003). Further, across much of the Knowledge Management literature conceptions of knowledge rarely stand alone, but rather are typically seen as being part of a continuum that

spans data, through information, and on to knowledge itself - and sometimes beyond, to encompass more abstract notions such as wisdom (Tuomi 1999, Boisot & Canals 2004).

A useful analogy for articulating the commonly perceived differences between these facets is that of the recipe: At one end of the continuum we have the corpus of recipes *in toto* - whether they be stored digitally as a database, or physically as the pages of a book - and which, taken together, form the data-set of recipes in aggregate, with a shared collection of attributes, such as a title, lists of ingredients and their corresponding quantities, etc. As we draw a single recipe into focus, perhaps with the intent of using it to create a special meal, what was part of an aggregation of indistinct values suddenly becomes individually meaningful - as information - as we check to see whether we have all the ingredients listed for this particular recipe, and we read the instructions in order to understand how they might be correctly combined. Finally, as we work to produce our tasty treat, at this time, in this kitchen, and based upon our previous teachings and experiences of both reading and applying other recipes in the past, we both utilise our existing knowledge of these processes and procedures, but also develop new understandings that can be applied to future endeavours, or even to create new recipes that can be added to the existing corpus. It is this last part that is usually the stated focus of Knowledge Management's workplace interventions, and a vast array of tools and technologies have been developed that aim to capture the understanding of those working on The Organisation's behalf in order that it can be made available to its other agents, both now and in the future.

2.2. Tacit knowledge

Within the scenario outlined above, tacit knowledge might properly be conceived of as that part of our understanding which is centred on our developed skills - such as our ability to discern subtle differences in the taste or texture of the combined ingredients, and which may have been developed through extended periods of trial and error - or the role that our personal passions - such as our passion for certain cultural foods and a desire for authenticity - play in our ability to produce a meal which goes beyond the information that is contained within the recipe itself, and towards the artistry of the craft of cooking. Within the Knowledge Management and related literatures such understanding is commonly juxtaposed with explicit knowledge, which is typically conceived of as that part of knowing which can be communicated through language - such as the formulation of explicit instructions regarding the appropriate use of the various tools available within this particular kitchen - and which can therefore be easily transformed back into an information construct and

managed using traditional approaches to the management of such resources: namely *Information Management Systems*.

However, the notion of a tacit knowledge is increasingly employed by both researchers and practitioners to describe a growing range of phenomena that are obscured from the immediate view of those attempting to capture them on The Organisation's behalf, leading some to question the credibility of claims regarding its management, or indeed the validity of the use of the concept itself (Wilson 2002, Tsoukas 2003). Before addressing such criticisms further, we will first explore the role that the concept of a tacit knowledge has played in a range of other disciplines - not just those tasked with serving the interests of commercial organisations - by examining some illustrative examples taken from the four main threads which can be discerned within the now extensive literature on this topic: those that focus on its *philosophical foundations*; those which attend to its *basis in cognition*; those that conceive of it as a *sociological construct*; and those which emphasise its *use in praxis*.

2.2.1. As a philosophical construct

Those who address tacit knowledge as as a philosophical construct seek to uncover its theoretical basis through introspective investigations of its conceptual structure.

First introduced by the polymath Michael Polanyi in the 1950s & 60s, the notion of a tacit knowledge was originally formulated in order to account for the hidden role that the personal aspects of knowing play in the formulation of 'good science'. Polanyi had a very high regard for the role that science plays in society, but - like his contemporary Kuhn (1962) - he believed that the positivist ideal of scientific detachment was a fallacy (Jha 1997), and that we needed an account of the scientist's activities that provided space for their ability to create artful solutions to the problems with which they were faced on a daily basis. He believed that personal passions and commitments played a central part in an individual's ability to develop new understanding, and set about formulating a way of accounting for their role in a world where the production of science was seen as being devoid of the messiness of personal interests and interpersonal relations.

Polanyi argued that it was not possible to account for any form of knowledge using purely explicit operations: that there are deeper commitments on which our explicit understandings are founded, commitments that are themselves driven by our personal passions. These tacit aspects of knowledge are summarised by the often cited phrase '*we can know more than we*

can tell' (Polanyi 1966, p.4), which encapsulates his view that the explicit portion of our understanding - that which can be made available to others through language - is only a small part of our total understanding. Polanyi believed that all knowing is rooted in this tacit knowledge and that coming to an understanding is always an act of active mental engagement, through which an array of subsidiary clues located on the periphery of our consciousness are drawn together (intelligently reorganised) into a new meaningful whole; something which itself is never fully conscious. His philosophy was founded upon the idea that this process of integration is *ultimately un-specifiable*, and that the actual locus of the meaning that defines all acts of knowing is in the transient product of this integration, not its immutable component parts.

For Polanyi the quest for good science was not unlike the pursuit of other humanist activities - such as art - both of which involved theoretical knowledge (knowing-what) as well as the performance of skills (knowing-how), such as the 'art of diagnosing' performed by doctors (*ibid.* p.7). He argued that the formulation of new scientific knowledge involved a specially trained kind of perception: one founded upon the skills necessary for the recognition of the particular patterns of problems faced by scientists, and the artful identification of possible solutions. Polanyi was particularly interested in the role of apprenticeships in the acquisition of these skills, and emphasised the part played by both the teacher - or master - in creating a focus for the student's attention through acts of pointing and naming, but also that played by the student's personal commitment to learn from the master in order to develop those skills for himself. He believed that an important facet of our commitment to learn is our desire to uphold the standards of the existing members of a community - such as those of the community of established scientists - as well as show ourselves as accountable to them. For Polanyi, the ultimate expression of our personal commitments to the truth, and to learning from others is the achievement of connoisseurship (Polanyi 1973). He believed that such high degrees of expertise are as much an art of doing as they are of knowing, and are not therefore amenable to explicit articulation, but rather can only be developed and passed on to others through example, guided by a more competent other.

2.2.2. As a cognitive construct

Those who address tacit knowledge as a cognitive construct work towards uncovering its basis in internal mental processes, through the statistical analysis of data gathered from laboratory experiments or formally structured interviews.

Partially as a reaction to the inadequacies of philosophical introspection as an account for hidden mental processes, a series of paradigmatic shifts occurred, initially to Behaviourism - where the observable movements of our bodies were taken to directly stand in for underlying mental processes - and then on to Cognitive Psychology - where attempts were made to model actual mental processes, treating the workings of the mind as no more than a series of programmable mental operations, and where physical action was seen purely as an epiphenomenon of these cognitive machinations (Suchman 1988). Attempting to demonstrate the underlying mechanisms through which we learn from experience, researchers from the field of Cognitive Psychology have utilised laboratory based investigations to show that we can take on a tacit knowledge of the world around us through acts of '*implicit learning*', even though we may be unaware of both the learning process and its product. Here, researchers seek to statistically demonstrate the presence of a tacit knowledge by showing that participants are able to reach a successful conclusion more frequently than might be expected by chance, whilst at the same time being unable to fully articulate the mechanisms by which this success was achieved.

In his 1989 paper 'Implicit Learning and Tacit Knowledge', Reber utilised laboratory based procedures - such as providing participants with mild electric shocks when they made errors during the learning of artificial grammars - to demonstrate how such implicit learning might provide the foundations for the development of a tacit knowledge (Reber 1989). Reber's work attempted to shift the conception of such knowledge from the realms of philosophy into to that of experimental psychology, and characterised the mind as a pattern recognition system capable of piecing together fine scale, disparate events that occur on the periphery of our awareness, into a coarser, more meaningful whole. Reber saw the resultant tacit knowledge as an abstract representation of the structure of the real world that is built up over time, and which is used in the pursuit of solutions to novel problems. He differentiated this abstract model from instantiated (representative) memories - which are an un-interpreted recording of events - defining tacit knowledge as a '*reasonably veridical, partial isomorphism of the structural patterns of relational invariances that the environment displays*' (*ibid.* p.229): that it is a model that accurately, if only partially, reflects changes in the environment of the knower; a model that people make of the world around them without thinking about it; that a considerable portion of memorial content is unconscious; and that the majority of knowledge acquisition takes place in the absence of the intent to learn.

In an attempt to understand why the results of Intelligence Quotient (IQ) tests were a

statistically accurate predictor of academic success, but not of professional achievement, Wagner & Sternberg (1985) examined the role that a tacit knowledge plays in the achievement of '*practical intelligence*': the set of capabilities that are called upon when undertaking everyday tasks, such as those found in work settings. Using data generated through formally structured interviews and questionnaires they undertook a detailed statistical analysis, the results of which indicated that it is not necessarily access to experience itself that leads to professional success, but rather one's ability to learn from the experiences one does have access to. Based upon their findings they maintained that such knowledge is not typically formally taught, is largely unstructured, is practical in nature, and that it plays an important role in a range of activities related to professional success: such as one's ability to effectively manage oneself, manage others, or manage the course of one's career.

More recently, as technological advances in the field of neurology have enabled researchers to examine brain processes in real-time, researchers have attempted to establish deeper accounts of tacit knowledge, including its evolutionary basis. Here, a tacit knowledge is used to account for our ability to react intuitively to real world events, without having to consciously plan out a response. Such tacit knowledge can be the product of implicit learning events, such as those identified by the likes of Reber, but can also be established through repetitive application of routine actions, whereby a previously explicit instruction-set moves into the tacit background through familiarity (Eraut 2000). In particular, researchers in this area have attempted to offer an account of why certain aspects of our understanding are difficult to articulate, arguing that the ways in which our brains are physically wired means that certain knowledge can never be effectively communicated in a manner that would be meaningful to others (Nightingale 2003).

2.2.3. As a sociological construct

Those who have addressed tacit knowledge as a sociological construct have examined the role that it plays in the re-production of normative orders across a range of social scales.

Theories that address the pervasiveness of certain social phenomena often call upon conceptions of a universal background tacit knowledge in order to account for the consistency and continuing propagation of common practices and traditions across both space and time (Pleasant 1996, 1999), and the part that these play as a stabilising force within society by offering each of us a shared basis on which to proceed. This

'*transcendental knowledge*' is typically conceived of as forming an unarticulated background which is known-in-common by all competent members of a given social collective, and is characterised as a shared sociological object that is persistently and consistently transmitted throughout a given group, although the actual process of transmission is rarely explicitly accounted for (Turner 1994). The claim within this paradigm is not always that such tacit knowledge is fully unconscious in nature, but rather that it can only be partially and imperfectly expressed through language - given the mechanisms available to us as ordinary members of society (Giddens 1979). As a result, researchers operating within this paradigm often juxtaposing themselves against the conceptions outlined in the previous section, which are seen as being overly cognitive in nature, and which are thought to place too much emphasis on the the internal machinations of the individual mind as the primary source of social action (Goodwin 1997, Howells 2002, Gertler 2003). However, with appropriate instruction - specifically that received by competent members of the Social Sciences - such tacit knowledge can be made explicit on the collective's behalf by using the methods that this training makes available to the analyst.

A common aim of those operating within this paradigm is the development of theoretical models and frameworks, the purpose of which is to offer an explanation of the role that tacit knowledge is playing across a range of social scales. Arguing that there has been a lack of conceptual frameworks '*integrating micro-level learning activities with organisational forms and macro-level societal institutions*', Lam (2000) presents a comprehensive multi-dimensional framework the aim of which is to expose the relationships between knowledge types (societal, organisational and cognitive), organisations (the culture of The Organisation and the ways in which it utilises knowledge), and institutions (education systems and labour markets). Based on this framework the author identifies four institutional configurations which affect the management of knowledge, the aim of which is to better understand the role played by tacit knowledge in Organisational learning: the *professional model*, with formalised, elitist education and occupational specialisation; the *bureaucratic model*, with a strict career hierarchy; the *occupational community model*, with high mobility, networks of firms, high social capital, and meta-organisations/industries; and the *organisational community model*, with broad-based education, decentralised and collective problem solving. Significantly, the author concludes that the '*knowledge configurations of firms and patterns of learning cannot be separated from specific organizational forms and institutions*' (*ibid.* p. 508): that such institutions play a top-down role in shaping organisational learning and the development of tacit knowledge.

Notions of innovation are a common area of interest for researchers operating within this paradigm, and in particular the role that tacit knowledge plays as the genesis of novel ideas. In a discussion of the contribution made by tacit knowledge to just such activity, MacKenzie & Spinardi (1995) examined the part that its ineffable nature plays in limiting the proliferation of nuclear weapons. Examining the creation of the first nuclear bombs during the Second World War, the authors highlight how the sheer complexity of the task was significantly underestimated by all involved, something which led to rapid increases in the numbers of scientists involved (eventually encompassing many thousands of individuals), the breadth of disciplines asked to contribute to the design process, as well as associated increases in organisational complexity and bureaucracy. They argue that, despite certain aspects of the design process becoming black-boxed within mathematical models, tools and technologies, or embedded in organisational processes and procedures, tacit knowledge continues to play an essential role in informing the design and development of new weapons. They give the example of 'codes' - complex computer models used to predict the outcome of a nuclear explosion - that remain unable to account for all of the factors that affect the results of an actual fission or fusion event. Because of this ambiguity, the formulation of models - as well as their appropriate application to the design of physical artefacts - remains as much an empirical art as it is an objective science, with the formal models serving as a conceptual map regarding just which approximations and assumptions to make, and where personal judgement and intuition still need to be brought to bear on the problem in hand.

Other researchers have attempted to show the mechanisms through which a tacit knowledge flows through a discipline by tracking the spread of certain innovations as they propagate across social networks of scientists. In a search for Kuhnian '*social circles*', Collins (1974) examined the transfer of knowledge amongst a set of geographically disparate scientists as they individually and collectively formulated new approaches to increasing the output of gas lasers. His work showed that the interpersonal relationships between individual members of the different laboratories in the discipline under investigation played an essential role in the diffusion of tacit knowledge and its associated innovative activity. Further, he highlighted the distinction between formal and informal relationships, and showed that the informal exchange of technical information and accounts of practical experiences played a significant role in the progression of the laser's development. These findings were further developed in later work that highlighted the role of personal accounts of the trials and tribulations of those undertaking experimental procedures in transmitting the more tacit aspects of work, in this

case the measurement of the quality of sapphires (Collins 2001). This work illustrated the important role that our trust in the capabilities of others plays in encouraging us to go on with our own efforts: that you have achieved the desired result in the past - and that it was as difficult for you as it is for us - suggests that, if we go on, we too will be able to achieve success in the end.

2.2.4. As a praxeological construct

Those who have addressed tacit knowledge as a praxeological construct have examined the part that it plays in supporting the moment-by-moment conduct of situated practices.

Researchers with an interest in how we conduct our everyday lives - and in particular how we effectively achieve the coordination necessary for the conduct of work - have often acknowledged the important role played by the unarticulated, intersubjective background of common understanding upon which meaning is constructed in the moment-by-moment course of action. Whether it be our basic belief that, as we experience the world, so to do those around us experience it as we do, and that they expect the same of us; the part played by shared but unstated beliefs and rules in informing the normative nature of everyday actions; or the circumstances in which we can mean more than we are able to say *in-just-so-many-words*, notions of a tacitly held knowledge play a central role in accounting for even the most mundane of practices. Within the context of this account the status of idealised conceptions of an objective knowledge - such as those that are seen as being based upon *justified true belief* - begin to be replaced by a view of knowing as an emergent activity situated within a specific temporal, physical and social setting. Here to we begin to get a sense of the juxtaposition between the praxeological paradigm, and those operating within the cognitive and sociological paradigms discussed previously: that those operating within the cognitive paradigm are referring to the workings of 'a' subconscious mind, by its very nature something we will likely never have direct access to; whilst those working within the sociological paradigm are sometimes guilty of setting themselves up in direct competition with a setting's members' knowledges, by taking an analytically ironic stance to their understandings, one that can lead to their tacit knowledge going completely un-noticed (Watson 2006). Within the praxeological paradigm on-the-other-hand, a '*member*' is conceived of as someone who can competently engage in the production and display of commonly held knowledge in a way that is accountable to the setting's other members. Such accountability is a practical accomplishment, and our own understanding of it as-such is achieved by examining the situated practices through which it is made manifest: practices

which are themselves available to all competent members - including an observant investigator.

That we each share a set of basic, tacitly held, intersubjective understandings about the way the world works - and our part in its machinations - has been shown to play an essential role in our ability to go on with even the most mundane of activities in our day-to-day lives, as well as our capability to effectively coordinate our efforts with those around us (Pollner 1974). Within this context, some have attempted to show how notions such as the 'rules' of conduct are a gloss for an array of constituent practices that together form part of the local context, and which can be conceived of as a set of sense-making instruments which are deployed in-situ, known, and used in-common by a setting's members. One of the central notions of this known-in-common world is that of *trust*, which is viewed in this context as a tacit phenomenon that is built into the routine production of a local orders (Watson 2009). Those with such a view maintain that, without our being able to trust that we are all operating by the same set of presuppositions and procedures, there would be a chaos of meaningless actions and perceptual data, making even the simplest coordinated action impossible. Some have argued that because of its tacit nature, this conception of trust is elusive to the formal approaches of the mainstream Social Sciences, which conceive of it very differently to the way that a given setting's members do (Garfinkel 1963, Watson 2006). In particular they attempt to reify trust, ignoring its fundamentally constitutive nature, transforming it into a unitary phenomenon that can be transposed and reproduced across space and time (as we will see later, this is a common problem with the use of formal approaches to understand such situated phenomena).

Some have argued that, in order to uncover the situated manifestations of this trust, we should examine the local '*ethno-methods*' that are deployed by a setting's members as they go about their daily lives, and have highlighted two approaches that are particularly suited to this work: *Ethnomethodology*, with its interest in the methodic work in which we all engage in order to establish a sensible order; and *Conversation Analysis*, with its interest in the systematicity of the ordering procedures themselves (Watson 2009). The likes of Garfinkel and Watson have argued that such an ethnomethodological re-specification of trust might offer a remedy to many of the difficulties created by the use of more formal approaches: that rather than being treated as something that is a product of social action, trust should be seen as the basic starting point and a necessary precondition for concerted practical action. Only by taking such a stance can we begin to observe the part that trust is playing in the ordered

properties of everyday settings, such as the ways in which queues of traffic flow in an orderly manner (Garfinkel 2002): the tighter the flow of traffic, the more ordered it is, and the more trust there is between individual drivers (particularly evident during racing events, where participants rely on the skilful practice of each other to maintain a tightly packed formation at high speed). An initial approach to uncovering the tacit assumptions upon which the normative order is established were known as '*breaching experiments*' (Garfinkel 1963), which involved the ethnomethodologist attempting to effectively break stable social orders - to institute a breach - in order to expose what was assumed to be known-in-common. Within such 'experiments' the researcher would behave in an abnormal fashion, observing the distress of the setting's other members as they worked to repair what they saw as a breach in acceptable conduct. This repair work often involved attempts to surface previously unspoken beliefs regarding how one should conduct oneself in just-these-circumstances, and were typically accompanied by attempts to normalise the behaviour of the wayward ethnomethodologist (Garfinkel 2004). Taking such an approach highlighted that - in the right circumstances - a motivated observer could gain special insight into the procedures through which a given setting takes on some of its ordered properties, something which has become a common feature of ethnomethodologically informed investigations (although breaching experiments have themselves since been rescinded).

In an investigation of the ways in which settings themselves can provide instructions for appropriate conduct, Pollner (1979) examined the methodic character of the workings of court rooms, where he argued that defendants could be seen to be managing their actions based upon their understanding of what had gone before. He examined how, in the absence of any explicit instructions on how one should conduct oneself *in-just-these-circumstances*, defendants proceeded in an 'ad hoc' manner, making use of the resources embedded within the setting itself to provided them with the necessary guidance regarding how they themselves should go on. In particular, he highlighted the ways in which the adequacy of locally relevant constructs, such as '*the plea*', can only be established during the actual flow of courtroom events, and that our observations of the adequacy - or a lack thereof - of the pleas of those that have gone before, informs how we proceed with our own pleas in the future. For example, being asked whether one is going to be represented by a lawyer for the first time might be heard as '*are you being represented by a lawyer, because you're going to need one*', whereas if everyone can be seen to have been asked the same question - and survived unscathed no matter their answer - then it will be heard simply as a procedural question, a transformation which itself will go unannounced. However, Pollner

acknowledges that it can be difficult to say whether defendants are actually utilising these ad hoc instructions to inform their own actions - or indeed whether they are using them to manipulate the situation to their own advantage - and so offers a number of secondary sources of evidence to support his claims, including: the ways that members can be seen to have created abstractions of previous events as a basis upon which to proceed, such as pre-empting questions with competent answers; the ways in which they call upon previous events as exemplars, and demand that the current event adheres to them; or the ways in which they formulate an excuse, using what has gone before as supporting evidence.

That we are often in the position where we mean more than we are able to say *in-just-so-many-words* has lead some researchers to investigate the procedures through which such moments are achieved in practice (Garfinkel & Sacks 1970, Jalbert 1994, Watson 2006). In their formative work, 'On Formal Structures of Practical Actions', Garfinkel & Sacks (1970) examined the ways in which the use of indexical expressions serve as one of the procedures through which we can mean more than we can say, something they characterise - in a typically recursive fashion - as '*glossing practices*'. In this work they attempt to establish the central importance to ethnomethodology's programme of the reflex relationship between natural language as both the circumstance, topic, and resource of everyday life (including that of the sociologist), and as a technology for the undertaking of sociological investigations (both lay and professional). Central to this interest is the fact that, in the course of our everyday lives, we rarely spend time naming the constitutive parts of our conversations, their supporting texts, or their actual topic, despite the fact that each of these can almost always be disputed in any given case. In particular, they show how the use of indexical expressions by a conversation's participants provides them with a sensible procedure for meaning more than they can say *in-just-these-circumstances*, and *in-just-so-many-words*. Here, indexical expressions are treated as those utterances whose full meaning is left undecided both during and subsequent to their use - prototypical examples being 'I', 'you', 'here', 'there', 'now', 'then' - and whose meaning may never be fully elaborated upon, for what the speaker meant to say at the time was just what they said. Further, the fact that something is being glossed is not normally a matter for remark or remedy, because the materials necessary for a competent member to understand just what the gloss stands-in-for are provided for within the circumstances of its use. Garfinkel & Sacks claim that such glossing practices exist in '*empirical magnitude*', but because they are a members' procedure for producing observable understanding, they are all available and understandable using members' methods (and therefore available to a competent investigator).

To support the claim that the use of a gloss rarely needs to be remedied, they point to the fact that on-the-whole the world remains an orderly place without the use of constant explicit formulations of just-what-is-meant, and that we can generally proceed without needing a definitive sense of what was intended: that the requirement for definitive meaning is rarely a member's requirement, but rather one that belongs to the analysts of the Social Sciences. They argue that much of the work of the Social Sciences is aimed at removing the ambiguity from such expressions - through the use of formulations designed to explicate their hidden meaning - in order that they can be transformed into an objective reality. Because of this requirement for explicitness, they claim that the formal structures of practical action are typically unavailable to such analysis, and that its ongoing attempt to repair them can never be definitive, *not least because the very procedure of repair recursively creates its own set of ambiguities*. They propose that, because of its interest in the mastery of natural language, and because it treats all productions of natural language equally no matter who is producing them - including Sociologists, described as '*ethnomethodological indifference*' - ethnomethodology can show such glossing practices to possess ordered properties. Further, they argue that this order is a member's situated accomplishment and that rather than attempting to create analytic abstractions to account for its nature, we should focus our attention on the actual situated practices through which it is made manifest.

2.2.5. More than we can know

The preceding sections have provided a necessarily brief overview of the part played by notions of a tacit knowledge across a range of disciplines that maintain an ongoing interest in some of the normally hidden factors that inform the orderly conduct of our everyday lives. We first heard that the concept's roots can be located in Polanyi's attempts to formulate a philosophical account of the production of 'good science'; something he saw as being founded on the personal passions of invested individuals seeking to uphold their membership of their disciplinary communities, and which went counter to the ideal of the purely objective knowledge of the detached scientist so prevalent at the time. Polanyi's initial conception of tacit knowledge garnered sustained interest throughout the later half of the 20th Century, and continues to motivate a raft of investigations that seek to uncover the role that it plays in an array of everyday settings.

Despite the continuing appeal of Polanyi's writings, the emergence of the 'cognitive revolution' (the paradigm shift that led to the establishment of the cognitive sciences) was in

many respects a reaction to the inability of philosophical approaches - including Polanyi's - to offer a meaningful and consistent account for actual mental processes, and which led to the establishment of an ongoing programme of attempts to formulate a cognitive basis for our understanding of a range of mental phenomena, including a tacit knowledge. We then examined the efforts of some of those working within this programme to identify the cognitive basis for a tacit knowledge, through the statistical analysis of data generated through experimental procedures and formally structured interviews, something which it is argued allows us to make inferences about the unconscious mental operations that are occurring within individual minds. Polanyi called the type of learning identified by the likes of Reber '*subception*' - contrasting it with perceptual (conscious) learning - and used it to highlight what he saw as the two terms of tacit knowledge: the point of attention (that on which our attention is focused) and the tacit dimension (which is located on the periphery of our conscious awareness). However, he argued that it is the application of meaning - by a knowledgeable human - to join these two elements into a new whole that is key: *on its own an implicitly learnt reaction is nothing more than the jerking of a knee*. Although work continues in this area, there are those who argue that attempts to formulate a cognitive account of tacit knowledge - such as those centred on the types of constructs used in the development of Artificial Intelligences that treat cognition as a series of programmable processes which can be replicated in silicon - have been no more successful than the philosophers who went before. In particular, the fact that we cannot even account for the following of explicit rule-sets by calling upon specific mental states begs the question how we can hope to appeal to those that are tacitly held as evidence for the patterned action that we see before us (Coulter 1991). Further, critics of those operating within the cognitive paradigm have often highlighted the inherent disregard that such approaches have for the contribution made by the social milieu within which all moments of knowing are embedded, arguing instead that it is an irremediably situated phenomenon which is the product of an array of factors from the biological through to the sociological.

In response, we heard that a number of theoretical constructs have been formulated by those attempting to offer an account for the part played by a tacit knowledge across a range of social scales, from individual disciplinary communities, through to the globally distributed institutions so revered by the Knowledge Society. Polanyi's interest in the unarticulated background of knowledgeable action has offered those within disciplines such as the Social Sciences a basis for the development of an account of the perceived consistency of social structures across a range of spatial and temporal scales: from the intimate relationship

between a master and his apprentice, through to the persistence of traditional forms of practice across an entire civilisation. Here too however, the use of Polanyi's thinking to fill the void between individual agency and the top down causative power of institutions has not been without its critics, with some arguing that the real meaning of the actions that we see before us are not somehow hidden from view - and therefore only available to a trained scientist through the application of abstract theoretical constructs - but rather are there for all competent members to see in the actual moments of their production. Such criticisms often focus on the desire of those operating within the Social Sciences, who on the one hand wish to formulate generalisations that possess predictive power, in the form of theoretical constructs that are not burdened by the messiness of everyday circumstances, and on the other be seen as conducting an empirical enterprise on a methodological par with the Natural Sciences (Hutchinson, Read & Sharrock 2008). Specifically, it is argued that appeals to a tacit knowledge by those operating within such a context are merely an artefact of the observer's theory and practice, and are therefore no more than a re-description of the actual phenomenon under observation in a theoretical language, one which tells us nothing that we didn't already know pre-theoretically (Pleasants 1996, 1999). One focus for such concerns is that, whilst we may share a common basis for a set of practices that are superficially the same - the fundamental biology of our bodies, similar social upbringings, attendance on specific training programmes, etc - claims that those exhibiting such similarities must therefore share the same set of tacit presuppositions are extremely problematic, not least because they imply the possession of shared conceptual objects (Turner 1994). For the likes of Turner it is this notion of sameness - in terms of the perceived consistency of the practices we see before us - that is the cause of much confusion: that just because we see patterned action does not necessarily mean that the causes of those practices are identical, or even similar. Instead it is argued that their consistency and persistence is no more than a product of our access to similar patterns of resources - such as other competent members who we can observe performing a given skill - which combine to create the cultural frame from within which we develop our own understandings.

Such criticisms not only go to the very heart of what a tacit knowledge is typically conceived to be, but also question some of the fundamental premises upon which many sociological investigations are constructed: namely the tendency to see behaviour governed by a shared set of rules, where in-fact there is merely a consistent pattern of concerted action. To support this claim some authors have called upon Wittgenstein's distinction between activities that follow a rule, and those which merely have the appearance of being

in accordance with one (Pleasants 1996, 1999): that most of the time we are simply performing the action as we have learnt to do so (in order to achieve the desired outcome), rather than our conduct specifically conforming to some *a priori*, tacitly held rule-set:

‘Imagine that Giddens and Wittgenstein are both observing the same practice, say a linguistic utterance, or a person riding a bicycle. Giddens maintains that the ‘condition of possibility’ for these practices is the individual’s possession of tacit knowledge of how to apply the transcendental rules necessary for their production. Wittgenstein, on the other hand, insists that our understanding is not enhanced by appeals to transcendental phenomena, and that all we need to do is to describe the practices themselves.’ (Pleasants 1999 p. 65).

Such a view holds that an observer’s account of that action as the product of a tacit knowledge is not some special insight into what caused it to happen - e.g. a set of underlying rules available only to a specially trained observer, or even hidden cognitive processes - but rather it is simply a re-description of the observed phenomenon in a theoretical language; with notions such as rules being a *post hoc* justification of an event that merely conformed to some recognisable pattern. In such circumstances, says Pleasants, invoking the notion of a tacit knowledge adds nothing in terms of an explanation. As we will see later, many approaches to managing tacit knowledge implicitly rely on a conception of such phenomena as being rule-governed, for if this were not the case then there would be nothing of a consistent nature to explicate and capture.

Pleasants’ robust critique notwithstanding, the sense that our actions are informed by a common-understanding that is shared with other competent members of a given social collective has been thoroughly investigated by those operating within the praxeological paradigm. Here the notion of a tacit knowledge is offered by those with an interest in the conduct of concerted practical action as a mechanism for accounting for the maintenance of normative orders - the shared norms, rules, methods and procedures upon which stable social order is founded in the here and now - through an account of knowing as situated within particular spatial, temporal and social contexts. However, unlike those operating within the cognitive or sociological paradigms, those taking such an approach do not use philosophical constructs to make space for socio-cultural explanations (Lynch 1999), attempt to appeal to cognitive constructs buried deep within our subconscious, or formulate sociological constructs that transcend the situation in-hand, taking up a marginal (some might say ironic) point-of-view regarding members’ practices. Rather they endeavour to

examine the actual procedures which give a particular practice its tacit nature, treating all cognitive properties of persons as embedded within - and therefore available from - the circumstances of their situated manifestation; viewing notions such as intelligence or knowing as practical and accountable social achievements (Coulter 1991). Despite this focus on praxis, critics such as Pleasants have continued to argue that those operating within this paradigm have also succumb to the desire to engage in the formulation of theoretical representations, with the likes of Garfinkel's portrayal of the knowledgeable reflexive actor, and his omnipresent - but tacitly held - normative order, being just another general theory of social action (Pleasants 1999). He suggests that such constructs are ontologically the same as those employed by the likes of Giddens, and that like Winch and his famous critique of interpretation in the Social Sciences (Winch 2008 [1958]), many ethnomethodologists remain locked into the same socio-theoretical problematic they seek to reject: that most ethnomethodologists 'tacitly' hold the theory that actors are reflexive, interpretative and knowledgeable members of society at all times, whereas there are times when we are the very '*cultural dopes*' that Garfinkel sought to expel.

Whilst, following the criticisms of the likes of Pleasants, we would be on shaky ground if we were to attempt to invoke a tacitly held set of formal constructs (be they bottom up mental processes, or top down transcendental rules) to account for the ordered character of social action, there are nevertheless consistent patterns that are there for all to see, but for which we are often unable to offer a full account. Therefore, rather than treating the notion of a tacit knowledge as *prima facie* 'explanatorily empty' (Pleasants 1996 p. 249), we should take their critique as a caution in order that we as investigators do not attempt to imbue what we see before us with more substance than the evidence provides for: that we should not attempt to '*say more than we can know*' (*ibid.* p. 252).

2.3. Workplace knowledge

Within the mainstream Knowledge Management literature, tacit knowledge has been conceived of in a number of different - and sometimes competing - ways, including: as a *private knowledge* that we hold in reserve because it is not in our interest to make it publicly available; as a *socio-cultural understanding* which is known-in-common by the various members of a group, and so there is no need to explicitly state it; as understanding developed through *implicit learning* events, following direct experience; as *personal knowledge*, informed by our individual interests in particular topic areas; as *know-how* - in the form of learnt skills and practices - that are so deeply ingrained that not even the knower

is able to articulate their true nature; and as *cognitive models*, which serve as a conceptual framework linking our experiences of the past to those with which we are currently faced (Smith 2006). However, probably the most widely deployed conception of tacit knowledge within the Knowledge Management literature is that put forward by Nonaka, developed during the formulation of his SECI model (Nonaka 1994, Nonaka & Takeuchi 1995), and which purports to represent the ways in which knowledge is created and transferred through - and by - The Organisation's constituent members.

Nonaka's investigations of innovative activity - and in particular his study of the development of an automated bread making machine by a large Japanese electronics manufacturer (Nonaka & Takeuchi 1995) - were largely responsible for the establishment the tacit/explicit dyad within the then fledgling discipline of Knowledge Management. Nonaka believed that innovative activity could not be accounted for using *The-Organisation-as-information-processor* paradigm dominant at the time, and argued that it might more appropriate to conceive of The Organisation as the setting for a process of problem definition and solution formulation, arguing that if we are to fully understand this activity then we should approach it as a knowledge creating entity (Nonaka 1994). For Nonaka '*knowledge is a dynamic human process of justifying personal beliefs as an aspiration for the truth*' (*ibid.* p. 15), and organisational knowledge creation happens when all four quadrants of the SECI model - each relating to a specific pattern of social interaction - are organisationally managed to produce a continuous cycle based upon an ongoing dialogue between tacit and explicit knowledge, through *Socialisation*, *Combination*, *Internalisation*, and *Externalisation*. In Nonaka's view the use of metaphor to expose and articulate contradictions, followed by the use of analogy to resolve them, is the basis for the conversion between tacit and explicit knowledge. He therefore examined the use of metaphor in attempt to revive The Organisation's flagging creativity, with the trope '*easy & rich*' representing management's desire for a bread-making machine that was easy to use, whilst enriching the lives of its owners with nutritious food. One area that had proven particularly problematic had been finding a way to get the new machine to knead dough in the same way as a human's hands, the art of which can take years of experience to fully develop. As a result of these difficulties, one of the organisation's software engineers served a period of apprenticeship with a local master baker in order to discover how to bake bread for herself, during which she learned these kneading skills through observation, imitation and practice.

Endeavouring to share what she had learnt she developed a further metaphor - '*twist & stretch*' - in an effort to articulate her understanding of the kneading process, and attempted to guide the development of the kneading mechanism using general statements such as 'make the propeller move stronger', or 'move it faster'. However, despite having learnt these skills for herself, the engineer found that she was no more able to articulate the full detail of the kneading process in a systematic way than the professional baker who had gone before, and expressed doubt that anyone could learn this skill without experiencing it first-hand. As a result, the engineers responsible for developing the machine's kneading functionality had to come to the bakery and experience the process for themselves before they were able to formulate the machine's final mechanics, a trial-and-error process which still lasted several months. The outcome of this work was the creation of a product which, it is claimed, embodies the skills of the master baker in a machine, but which can be operated by people with no knowledge of the bread making process: that skills which previously relied on the baker's tacit knowledge were reproduced through the machine's functionality.

Throughout his writings on the topic, Nonaka views tacit knowledge as something which is openly and un-problematically transferred through the four patterns of interaction identified by the SECI model, facilitated by the creation of metaphors like 'easy & rich' or '*twist & stretch*'. However, despite the utility of such metaphors in providing a basis for a common language between those who had directly developed competence of the kneading process, Nonaka & Takeuchi present no evidence that an explicit 'capture' or 'transfer' of tacit knowledge had occurred; indeed, they reported that those who had experienced the kneading process for themselves were still unable to articulate their new understanding to those that hadn't, even with the use of metaphor. In spite of his framework's success, Nonaka's use and development of the tacit/explicit dyad - and in particular his conception of tacit knowledge - has since been called into question by a number of authors, who claim that Nonaka was mistaken in his interpretation and application of the concept (Wilson 2002, Tsoukas 2003), and that he ignores one of the key attributes of tacit knowing: its fundamental ineffability. Others have criticised Nonaka's later attempts to develop the model - and in particular his incorporation of the Sociologist Anthony Giddens' theory of Structuration - as being too simplistic and based upon superficial readings of both Giddens and Polanyi (Zhu 2006).

Arguing that the likes of Nonaka rarely invest much effort in clarifying the actual distinction between tacit and explicit knowledge, Styhre (2004) claims that too much attention has been paid to reconceptualising the firm as a knowledge creating entity, and not enough in

developing a sound ontological and epistemological foundation for our understanding of knowing in the workplace. As a result, the notion of a tacit knowledge has become little more than an umbrella category for unrepresentable knowledge - rather than being a stable theoretical construct - something which has been driven by the perceived ideals of scientific knowledge, which require that knowledge be represented in a static form. Basing his critique on the philosophy of Henry Bergson, Styhre argues that the boundaries between tacit and explicit knowledge are mobile, dependent upon an individual's ability to articulate what they know, and that it would be better to locate knowledge in an epistemological and ontological framework where the balance is between intellect and intuition, rather than the tacit/explicit dyad so commonly used.

Claiming that the notion of tacit knowledge has become increasingly embellished with ever more layers of meaning, diluting and extending the boundaries of the concept's meaning, Castillo (2002) puts forward his own typology, itself consisting of four aspects: *Non-epistle*, which is highly personal, ineffable and indescribable, and which equates to gut feelings; *Socio-cultural*, which is an emergent product of the socio-cultural system as-a-whole; *Semantic*, which is known in common throughout a group, and is therefore unnecessary to articulate; and *Sagacious*, which is the ability to quickly integrate disparate clues into a new solution. He argues that unless Knowledge Management establishes some conceptual clarity around the notion, supported by empirical evidence, then it is in danger of becoming a 'conceptual weed patch', and proposes a simple 'litmus test' to identify instances of tacit knowing: to whom is tacit knowledge tacit to; is it articulable upon reflection; is the knowledge based in routine behaviours/actions; and does it have an experiential basis. Applying these simple questions to notions of a tacit knowledge, suggests Castillo, should help provide the stability that is so desperately needed within the discipline.

Arguing that the lack of a clear definition is hindering the ability of researchers and practitioners to support tacit knowledge, Gourlay (2000, 2002, 2006) identifies six ambiguities common in the Knowledge Management literature: personal versus supra-individual; experiential versus pre-dispositional; personal learning versus learning from others; practical skills versus abstract conceptual thinking; a source of innovation versus a source of stability; and non-verbal inarticulate-able versus ability to make explicit. Questioning the validity of Nonaka's conception of tacit knowledge, he argues that tacit knowing is '*constrained in time and space to particular perceptual-manipulative events undergone by individuals*' (Gourlay 2000 p. 12). Gourlay proposes that humans are unique

in that they have two repertoires of signs available to them - the verbal and the non-verbal - and that because technology does not participate in everyday life, tacit knowledge remains beyond its reach. To support this view he turns to the writings of the pragmatist John Dewey, and in particular his notion of degrees of linguistic sophistication - which spans base grunts through to scientific discourse. Based on these insights he argues that, at its core, tacit knowing is a phenomenon that cannot be expressed in words, and that the non-verbal signs through which it is made manifest have been largely overlooked by Knowledge Management. Based on this re-conceptualisation, Gourlay suggests that, rather than working to make the tacit explicit we should seek to understand its fundamental basis, something which would allow us to recreate the conditions under which it was originally developed, such as formulating the workplace in such a way that facilitate its articulation and fostered its development in other individuals.



Whilst rightly critical of Nonaka's conception of the notion we can see that, in pursuit of a useful definition of tacit knowledge for Knowledge Management, these authors have done little more than offer up their own theoretical constructs in response - constructs that are often even more detached from the realities of actual work practices than Nonaka's. Further, while these authors have all provided well structured arguments for their particular conception, none have provided first-hand examples of a-tacit-knowledge-in-action to support their chosen stance, leaving themselves open to criticism from the likes of Pleasants that they have achieved no more than a competent display of *desktop philosophical puzzle solving*: why turn to an elaborate theoretical framework to answer the question as to whether metaphor, a typology, or even non-verbal communication provides a basis for our understanding of a tacit knowledge, when we can just look and discover it for ourselves? Others have expressed doubt that the types of theoretical or philosophical constructs that we have seen called upon here can assist us in understanding what meaning was actually intended or understood in just-these-circumstances, and suggested that the creation of such abstractions leads to the specificity of practices becoming hidden from view: that the generation of the patterns of work described by these authors is a local achievement, and we should therefore begin our investigations in the routine sequential orders within which they are actually made manifest, not some abstract rendering of them (Lynch 1999).

Whilst modern conceptions of a tacit knowledge continue to fulfil a central role within Knowledge Management, they have also come to play a peripheral role in disciplines with a

specific interest in the conduct of work, with researchers operating in fields such as Workplace Studies, Requirements Engineering, and Computer Supported Cooperative Work acknowledging the important part that such phenomena play as a facet of everyday work practices. In an attempt to establish tacit knowledge as a topic of study within such disciplines, Goguen (Goguen 1996, 1997) argued that our awareness of its role plays an important part in understanding what it is that a setting's members work actually consists of, and consequently our ability to build successful technological systems that adequately support that work. Claiming that a system's future users rarely know what is technologically feasible, and that managers are often unable to articulate what their workers - or even themselves - do in fine detail, he argued that in order to achieve a sufficient understanding of work practices we must go to where work is actually done and observe it directly, something which can provide direct access to members' tacit knowledge. Although rarely developed beyond a passing reference, examples from within these disciplines include its characterisation as a local knowledge of how to use a system as an ordinary, taken-for-granted, commonplace aspect of work activities (Rouncefield *et al* 1994); as a practical knowledge that is accumulated over time and which enables members to anticipate events as they unfold, based upon their past experiences (Whalen, Whalen & Henderson 2002); knowledge that is not normally expressed unless the order of work begins to break down (Bentley *et al* 1992); or an awareness of the work of others as a skill that is made up of delicate competencies, and which requires careful unpacking (Hughes *et al* 1997). However, here too it has been noted that the meaning of the term has sometimes been glossed (Randall 2007).

2.3.1. Situated Knowledges

Conceiving of knowledge as something which is capable of being objectively true provides those responsible for formulating Knowledge Management's social and technological interventions with a seemingly stable basis upon which to claim that it can be elicited, acquired from the knower, and managed like any other explicit resource over which The Organisation has control: namely its corpuses of data and information. Those who conceptualise knowledge in this way often claim that this valuable resource can then be made available to The Organisation's other members, across both space and time, through technologies such as Expert Systems, which are said to stand in for knowing individuals during problem solving activities (Chervinskaya & Wasserman 2000, Suchman 2007). However, there have been ongoing criticisms of Knowledge Management's tendency to

create abstract accounts of knowledge work and to objectify its primary phenomenon - the knowledge of a setting's members - treating it as a reify-able thing which can be extricated from the mind of the knower, and stored on some substrate as a discrete instance of 'knowledge', transforming it to such an extent that it becomes difficult to distinguish from information (Brown & Duguid 1991, Wilson 2002, Huysman & de Wit 2003, Thompson & Walsham 2004, Cox 2007). Concerns raised about such an approach include an uneasiness with the ways in which it discounts the essential role played by both the individual and their immediate context in acts of knowing, as well the elevation of the role of the analyst in such a way that encourages the development of analytically ironic views of members' practices:

'... anonymous and unlocatable designers, with a license afforded by their professional training, problematise the world in such a way as to make themselves indispensable to it and then discuss their obligation to intervene, in order to deliver technological solutions to equally decontextualized and consequently inlocatable "users" ' (Suchman 1993, p. 27).

Those with such concerns argue that workplace knowledge should not be conceived of as a timeless body of truth that individuals possess, but rather approached as something people do (Cook & Brown 1999): that knowing is an active process that is mediated, situated, provisional, pragmatic, and contested; and that representations of an individual's knowledge - such as a textbook - are no more than resources to be used in the specific circumstances of knowing (Blackler 1995). Others have taken such a stance a step further by arguing that there is no such thing as knowledge itself, just a continual emergent process of knowing that is inseparable from the context within which it occurs, and that if the design of interventions targeted at workplace knowing are to be successful, we must take full account of this context in their design (Thompson & Walsham 2004).

Some have attempted to expose the discursive transformations that can occur between detailed field studies of knowing-in-action - which often view knowledge as elusive, oral, improvised and social - and more formal accounts of that same work, which can be shaped by vested Organisational interests, leading to an abstracted picture of knowledge as encodable, countable, audit-able and individual, and which stresses reasoned behaviour over intuitions and 'gut feelings' (Cox 2007). Undertaking an examination of Orr's investigations of the work of Xerox's photocopy technicians (Orr 1996) - and the subsequent transformations of his detailed ethnographic account - Cox argues that such case studies can undergo a transformation into pre-packaged narratives that are heavily influenced by - and

used to promote - The Organisation's conception of itself. In Orr's original work, storytelling was revealed as an essential mechanism for sharing understanding within the community of field technicians, with stories serving a number of purposes, including the establishment of a sense of belonging, and the route through which new technicians earn their membership of the community. However, because the stories told by the technicians are told to other competent professionals, they are often elliptical, and miss out taken-for-granted understanding; something that makes them difficult for outsiders - including those from other parts of the same organisation - to understand, and which can lead to a number of problems with The Organisation's understanding of, and relationship with, such unofficial communities-of-practice. In particular, Cox argues that accounts of counter-cultures - such as those of the technicians - can come to be rendered safe and comfortable by leaving out forbidden knowledge, and where the complexities of situated knowing get replaced with something far simpler, fixed, and therefore manageable.

In order to counter some of the concerns associated with the creation of such abstracted accounts of knowing in the workplace, or those that objectify knowledge itself, some have argued that we must pay special attention to those aspects of work that might ordinarily be hidden from an undirected view: whether it be the tedious tasks undertaken by workers - and which they might wish to background in order to elevate their standing - or the knowledgeable work of those normally responsible for routine tasks - something which others might wish to background for similar reasons (Suchman 1993, Suchman 1995, Blomberg, Suchman & Trigg 1996). Those with an interest in such hidden work argue that we should avoid calling upon representations that are generated following superficial investigations of multiple work settings, and instead try to reach for a deeper understanding of *just-these-work-practices* in *just-these-circumstances*. Developing a framework established along a continuum that goes from invisible to visible work, Star & Strauss (1999) provide some illustrative anchor points to assist us in our conception of such hidden activities:

- The non-person, where the work or its product is visible but the person doing it is not, such as work that is unrecorded, unregulated or unprotected, or which occurs within the 'total organisation' dissolving the individual's identity to just a number;
- Circumstances where the person doing the work is visible, but any sense of a product of that work - or the work itself - is hidden, such as where the work is part of the background, taken-for-granted, assumed, routinised, or where the detail of work is erased because it is too hard to articulate;

- The use of abstract measures of work, articulated in the supposedly neutral language of metrics manipulated by those who never experience the work for themselves, and which are used to decide on factors such as resource allocation or design training programmes.

Whilst identifying where on this continuum our conception of work should be located is an important part of understanding such practices, some have cautioned that investigators must also be careful not to damage the very thing they are trying to understand, such as violating an individual's ability to remain autonomous, avoid intrusive surveillance, sidestep unnecessary paper work, or to hide shameful aspects of their work from others (Suchman 1995, Star & Strauss 1999). Failure to take account of these risks may lead to the investigator being ostracised by a setting's members, and therefore not able to gather any useful information about the work that is actually done.

In an ethnomethodological analysis of an accidental tape recording of a group of scientists discovering the first optical pulsar, Garfinkel, Lynch & Livingston (1981) showed how the actual practices of discovery were elided from the formal report of the breakthrough as it was presented through professional channels: in this case peer reviewed journal articles. The authors show how the pulsar was discovered during the 'first-time-through' - as opposed to later upon re-analysis or reflection - and that the actual act of discovery was only observable through the historical series of events within which the measurable properties of 'the' pulsar emerged into the formal construct that it later became. They argue that, whilst theoretical science told the scientists that a pulsar should exist - and even where they might look for one - they were not engaged in documenting the theory of 'some' pulsar, but rather discovering just-this-pulsar: a pulsar that was not there at the beginning of their night's work. The authors highlight how each of the night's series of observations consisted of a set of vulgarly competent practices - competences which have been established again and again and were therefore no longer in doubt or question - that were orientated towards the possibility of a discovery, practices that they characterise as occasioned, exclusive, done unwittingly, detailed rather than abstract, unavailable to the future for looking back on in detail, naturally accountable, only discoverable, and hidden. In particular, they illustrated how the knowledges of the pulsar's discoverers were knowledge of just-this-thing, and that this knowledge was available in the 'Quiddity' of their work: that is it was available to all competent members of the setting (including competent observers) through its real-time production; its actual appearance; its just-this-ness; and its locally produced competent practices. The authors point out that the locally ordered properties of these practices became

ephemeral when the discoverers looked back on their work as being the product of a plan, with the situated work of the discovery of the actual pulsar becoming encapsulated within the abstract construct that the pulsar was to become: that this construct later appeared to have caused its own discovery, was independent of this act of discovery, and those who discovered it. Further, the authors claim that the objectified and abstracted formal account of their work needed to be set aside in order for the authors to see the recording of the scientist's work as an actual moment of discovery.

Arguing that we must look beyond theoretical approaches to conceiving of cognitive structures if we are to fully understand human cognition, Goodwin (1997) contrasted the situated activity within which knowing actually occurs with formal conceptions of human colour perception: a view that sees it as being built upon a universal infrastructure which has traditionally been separated from the messiness of its actual deployment. Basing his analysis on a group of scientists as they worked '*to find a specification for black that can distinguish tones within "the endless variety of grays"*' (ibid. p. 120), he examined the patterns of representations, material tools, social interactions, and historically shaped and socially distributed forms of knowledge that the setting's members called upon when deciding whether to stop heating a chemical soup, something which was partially guided by its reaching a 'jet black' state. In particular, he examined how conceptions of '*jet black*' were actually accomplished as a group of students worked to discover what counted as adequate blackness for themselves - guided by the senior scientist who developed the procedure - and argued that the term offers little assistance to those attempting to categorise something as actually existing within such a category: that the problem we must overcome isn't one of 'seeing' the colour, but rather how we learn to link this specific colour with this particular label. In his analysis, Goodwin showed how the methodic procedures the participants used to draw the phenomenon of interest into focus - separating it from its complex background - included their ability to touch and talk about the material, and in particular their use of metaphor to juxtapose the current status of the fibrous material with its desired future state (Orang-utan and Gorilla fur respectively). He argued that these locally produced tools were used in preference to those of science-as-a-whole, and showed how they were under constant modification as the students worked to develop their own understanding of what constituted a 'jet black' state. Goodwin noted that, despite the central role that formal descriptions of such work play in supporting the reproducibility that is the basis of 'good science', the situated work needed in order to actually establish an adequate colour categorisation was absent from the instructions for undertaking this particular procedure,

even though they were authored by the very scientist guiding these particular students. He argued that, if approaches which claim that such knowledge can be made explicit were correct, then anyone should be able to read these formal accounts as a recipe and use it for themselves; but as could be seen in this example, such recipes often rely on an ensemble of embodied competence and tacit knowledge not possessed by the uninitiated, and which therefore require much additional work to make a seemingly innocuous term such as ‘jet black’ meaningful *in-just-these-circumstances*.

Some have attempted to show how the ‘*lived work of knowledge production*’ is not only deleted from traditional scientific discourses - in an attempt to present an account that is based upon the ideals of objective knowledge - but also from narratives that inform the design of new technological systems (Suchman 1993). To counter this tendency Suchman argues that systems should be designed for the specific circumstances of their use, and that special effort should be made to overcome the institutional arrangements that separate a system’s designers from its users in order that they can become fully involved in the design process. To achieve this end Suchman suggests that we should free ourselves from the constraints of normative explanations - and their flawed claims of objectivity - and instead work towards new techniques that can *merge disparate knowledges together into new multiplicities of representations*: an alternative that offers so much more in terms of an account of members actual work practices. Presenting a case where the routine work of data inputers was compared with the organisationally sanctioned ‘knowledge work’ of professional lawyers, Suchman (2000a) argues that professional groups can maintain their privileged status by foregrounding work areas that require reason and judgement, whilst obscuring the practical, mundane aspects of their work, and vice versa for those undertaking practical work. Inverting the conception of professional knowledge as a set of propositions that exist prior to practice, she examined the production and re-production of professional knowledges in everyday work, and showed that whilst both groups were coding documents using the authorised schema, they were both also using subjective judgments regarding the nature of a document and its potential value to ‘*the case*’. In particular, her work highlighted the ways in which this particular setting’s members’ personal understanding of - and interest in - the case played an essential role in their ability to perform competently, no matter which group they were located within. She suggests that, rather than being based upon the subjective/objective duality, her findings show the distinction between the two groups would be more appropriately described using their identities, relations to the materials of work, symbolic rewards, or their positions within social networks.

By utilising approaches that pay special attention to the normally hidden facets of everyday activities, these researchers have amply illustrated that the generality of knowledge - so sought after by the likes of Knowledge Management - comes not from its contextual disembodiment, but rather the extent and stability of the socio-material configurations through and within which it is actually made manifest (Suchman 2000b). Further, these examples also demonstrate that the pursuit of a singular, objective conception of 'knowledge' is ultimately a limiting stance as there is no totalising perspective to be found by either The Organisation or its analysts, only an array of partial perspectives; there is no abstract-able, use-anywhere understanding, just a series of views from somewhere; there is no singular Knowledge, only an endless array of '*knowledges*'. Within this context, Suchman has argued that the only route to the stable conceptions of work needed by those responsible for creating new technological interventions is to form a collective vision that is shared by all those with a stake in their production (Suchman 1993), something which can only be achieved by engaging with the fundamentally situated nature of knowing, and acknowledging the local, partial and multiple character of members' knowledges (Haraway 1988): *local*, in that they are necessarily located in specific spatial, temporal and social contexts; *partial*, in that we only ever have knowledge from here, and never from over there; and *multiple*, in that there is not just one single knowledge to which we all aspire, but rather an array of knowledges which are both discrete and interlinked, shared and individual, whole and incomplete. Within this context, the design, development and deployment of a new technological intervention becomes the meeting of many knowledges, just two of which are the system designer's knowledge of the technology and its capabilities, and the system's users' knowledge of the work that they and the system will eventually do, and the role of the investigator becomes one of translating the knowledges of all of its stakeholders - no matter where they are located, and what power they might have (Suchman 1993, 2002). Utilising the situated approach in this way offers a radical alternative to the mainstream conceptions of knowledge that dominate Knowledge Management; one which facilitates a re-specification of notions of knowledge by moving away from a specific and specifiable object, and towards a deeper understanding of the array of beliefs, passions and experiences which each individual brings to just-these-circumstances.

2.4. Hidden knowledges

In the preceding pages we have heard that Knowledge Management places a high premium upon notions of a tacit knowledge, often claiming that its tools and technologies are

particularly effective at making this hidden resource available to The Organisation and its constituent members in an explicit form. However, we have also heard that one cause of the difficulties often faced by those invested in the formulation of successful Knowledge Management Systems is their treatment of workplace knowing, an approach which often abstracts away from the messy details of actual work, and reifies their primary phenomenon of interest: the situated knowledges of the very individuals who will eventually use such systems to support their efforts. As well as playing a central role within Knowledge Management, the notion of a tacit knowledge has also been shown to play an important part in a number of other disciplines, although conceptions of its nature differ: from a philosophical account of the integration of our experiences of the real world in and through our intellectual passions; an explanation of the cognitive mechanisms through which we implicitly learn new skills; through to an explanation of shared sociological objects that are said to account for the propagation of common practices across a given social collective.

However, we have also heard that the likes of Turner and Pleasants have questioned the validity of such constructs, claiming that they are unnecessary analytic developments that achieve no more than a re-description of the observable phenomenon in a philosophical, theoretical or technical language. As these critics have noted, those who possess an understanding of explicit sets of rules (such as the formal rules of grammar) sometimes foist their use onto those performing actions that appear in accordance with them - but who in fact may have no direct knowledge of them themselves. Such critics argue that most competent members can perform a given practice without any conception of 'the rules', and that such rules are normally an epiphenomenon of the patterned nature of everyday practice, not a cause of it. On this basis, these authors have argued convincingly against conceptions of similarity and transmission - which those taking an objectivist stance towards knowledge and its management require - claiming that this leads to its treatment as a reify-able thing that gets transmitted in-the-whole between the membership of a given social collective, something for which there is no evidence, or in fact any mechanism through which it might be obtained. Within this view, what has the outward appearance of similarity, and is therefore seen as somehow based upon the same phenomenon - such as a set of shared rules - is in fact a private construct that is unique to each of us, and we need say no more about it than the evidence provides for: to say that someone did something unconsciously is to say that they did it without thinking about it, or attending to it; to say there was a tacit consensus simply means that we were unable, unwilling, or there was simply no need to articulate the full array of aspects to such an agreement (Pleasants 1996). Such critics call elaborate

accounts of a tacit knowledge into question, asking what we have actual evidence for: for the likes of Pleasants at least, the answer is often very little.

Despite the robustness of these criticisms, the position being advanced in this thesis is not that there is no such thing as a tacit knowledge, but rather that we cannot justify speaking of such a thing within the context of some form of underlying similarity - such as a set of shared rules serving as a causative force - and which would therefore be amenable to explication and management. Instead we should treat it as manifest in the actual, observable practices which are the basis of both its 'transmission' and our understanding of it, and which should therefore be the focus of Knowledge Management and its technological interventions.

In response to similar concerns in other areas we have seen how those operating within the situated paradigm have offered an alternate approach to understanding workplace knowledges, where they are actually located, and what role they are actually playing in the conduct of each-next-moment of practical action. Here such phenomena do not remain tacit for purely cognitive reasons, but rather there are an array of factors that influence a particular meaning's availability within the immediate social milieu, and those taking such a stance show us that refocusing our analysis firmly on a setting's members' performance of their work in-the-here-and-now offers the potential for special insight into those facets which might ordinarily be hidden from an undirected view (Suchman 1995, Watson 2006): the very work that the creators of Knowledge Management Systems often set out to support. Within this context, the use of the term 'knowledges' continues to be a useful trope for illustrating the array of understandings that support even the most mundane of work practices, and here we have heard about the results of a number of studies undertaken within the situated paradigm that have effectively illustrated that certain knowledges can remain hidden from the undirected view of both The Organisation and its analysts. Further, the findings of those operating within this paradigm further support the case that it might be more appropriate to focus not on making the tacit explicit, but rather *on understanding how we might facilitate the continuing development of a setting's members' knowledges by putting in place technological interventions that assist their achieving and articulating their own array of understandings, supported by the work of their peers, including those that have gone before.*

Given the inconsistencies inherent in the competing conceptions of a tacit knowledge, it might therefore be more productive for those responsible for formulating Knowledge

Management's interventions to draw away from the use of the term, and instead utilise the trope '*hidden¹ knowledges*' as a gloss for all those knowledges which are obscured from the undirected gaze of both The Organisation and its analysts. This move represents a shift away from attempts to maintain a link with what was a purely philosophical construct, to one that is centred on its praxeological nature; a shift from desktop exercises in philosophical puzzle solving, to the identification of practical problems, and the formulation of appropriate solutions, based upon actual observations of members' knowledges in action. In particular, making such a move allows us to focus our attention on those patterns of concerted social action for which a setting's members may be unable to offer a full account - such as those moments when they can be seen to be meaning more than they are able to say *in-just-so-many-words* - freeing us to formulate meaningful descriptions of these patterns, the members' procedures through which they are made manifest, and the work that is achieved through their enactment; rather than attempting to manufacture abstract theoretical representations of their contents. Further, this is a re-specification that leaves the notion of a tacit knowledge available as an account of that unquantifiable facet of our understandings that is at the very heart of our artful practices, and for which it was originally intended: our personal passion for engaging with the world around us in pursuit of a sense of truth and beauty, in whatever form that may be.

¹ Here the term 'hidden' is intended as a heuristic device which serves as a reminder to seek out concrete examples of what *just-this-knowledge-in-action* actually looks like (Pollner 1974, Watson 2006), rather than as a claim of having discovered a particular class of knowledge, such as is implicitly asserted by categorising something as a 'tacit knowledge'. Many phenomenon ascribed as a tacit knowledge come to be characterised as such because of their hidden nature, not because they can be shown to possess any of the characteristics - such as a specific cognitive status - that we have heard about in the preceding pages.

3. Noticing Hidden Knowledges

3.1. Introduction

In the last chapter we reviewed conceptions of a *tacit knowledge* from a range of disciplines - including Knowledge Management - and heard that the ongoing inability of researchers and practitioners to effectively differentiate between a range of disparate phenomena associated with knowing in the workplace has often resulted in their being inappropriately lumped together under this single category; something which has ultimately diluted the notion's meaning and reduced its utility as a descriptor of the specific phenomenon for which it was originally intended. In order to take a step away from some of the tensions associated with differing applications of the term, it was proposed that it might therefore be more appropriate to apply the trope '*hidden knowledges*' to categorise those knowledges which are ordinarily hidden from the undirected view of both The Organisation and its analysts, a move that could enable a reconceptualisation of the part that such phenomena are playing in actual work settings. In order to facilitate such a move we examined how the interest of certain researchers in approaches that pay special attention to the situated understandings of a setting's members could offer a mechanism for noticing such hidden knowledges in action. In particular, we heard that investigators operating within the situated paradigm commonly make use of ethnographically informed techniques in order that all of their knowledges are given the opportunity to influence the outcome of an investigation. Further we also heard that, by taking approaches which acknowledge the situated and plural nature of such knowledges, researchers argued that we can still achieve an effective understanding of the work that they do without needing to go beyond that which there is observable evidence for.

The aim of this chapter is to examine just how such an understanding might be practically achieved by those investigating the settings within which Knowledge Management's technological interventions will eventually be deployed. We will begin by reviewing some of the more formal approaches currently utilised by those with an interest in transforming a setting's members' knowledges into an explicit topic, and examine whether the discussion outlined in the previous chapter - regarding just what it is that we actually have evidence for when we speak of such things - might shed new light on their applicability for addressing such phenomena in everyday work settings. We will then juxtapose these approaches with those utilised by researchers and practitioners operating within the situated paradigm -

namely ethnomethodologically informed ethnography - and explore whether it might be particularly suited to noticing the role played by such hidden knowledges in actual work settings, rendering them more meaningful, practical, and ultimately addressable by Knowledge Management and its technological interventions in the future.

3.2. Some formal¹ approaches used to uncover hidden knowledges

The Knowledge Management and associated literatures present a number of tools, techniques, and methodologies which claim to identify the hidden knowledges of a setting's members and convert them into an explicit resource. These approaches range from those which map the structure of an individual's tacit knowledge to inform the creation of a dimensioned or graph model of their understanding, such as might be used to support the design of a Knowledge Based System; those which aim to directly convert an individual's tacit knowledge into its more manageable explicit counterpart; through to those which analyse the networks and distributions of a tacit knowledge at organisational or even global scales. Such approaches typically claim to be able to produce explicit representations of the hidden knowledges of individuals or groups, something which is said to offer those with the appropriate professional training special insight into the nature of their understanding, and how it might best be managed on The Organisation's behalf.

In order to achieve this end researchers and practitioners have called upon a wide range of theoretical and methodological approaches from a number of academic disciplines, including Actor Network Theory (Hull 1999), Speech Act Theory (Nightingale 2003), Action Research (Reichling, Veith & Wulf 2007), Ethnography (Gabbay & le May 2004), Grounded Theory (Schultze & Boland 2000), Activity Theory (Clases & Wehner 2002), and Protocol Analysis (Fruchter & Demian 2002) to name but a few. In the following pages we will examine examples from just three of these approaches in order to provide a sense of some of the themes that inform the wider literature on this topic: Protocol Analysis, Activity Theory, and Grounded Theory. However, the aim here is not to provide an overview of each approach in its ideal form, but rather to examine accounts of how they were actually applied

¹ The notion or 'formality' used here and throughout this document relates to the tendency of formal methodologies to elevate the investigator's standpoint above that of the settings under investigation, through abstraction and reification (See Goguen [1996] and Star & Strauss [1999] for further discussion on the limitations of the application of formal approaches to fully understanding situated phenomena).

by investigators as they worked to uncover the role such hidden knowledges - typically characterised as a tacit knowledge - were playing in the settings under investigation.

3.2.1. Protocol analysis

Following the rejection of descriptions of introspective examinations as a mechanism for understanding consciousness - brought about by the cognitive revolution - Protocol Analysis was developed by those with an interest in formulating theories of how individuals acquire new knowledge and apply it to novel problems (Ericsson 2002). Protocol Analysis utilises a number of techniques for generating its data, including interviews and observations, but perhaps its most distinguishing feature is its use of 'talk-aloud' problem solving, where the subject under investigation provides a running commentary of their thoughts as they work. The data generated by such an approach takes the form of a record of the sequence of the subject's performance over time (the protocol), with the knowledge used by the individual under examination being transcribed, a set of encoding categories identified, and a set of rules to map the behaviours to those categories defined. The provision of these rules and categories serves to reduce the scope for subjective interpretations, with the aim of making the relationship between the two so explicit that it could even be undertaken by a machine (indeed there have been several attempts by those within the Artificial Intelligence community to do just this).

Undertaking an analysis of a range of approaches for facilitating the domain expert/analyst interactions that inform the creation of Knowledge Based Systems - such as Expert Systems designed to stand in for a knowledgeable human during problem solving activities - Chervinskaya & Wasserman (2000) examined a number of facets of the interchange to understand how it could be facilitated to maximise the explication of the expert's tacit knowledge. In particular, they examined the role of visual stimuli in eliciting expert reasoning, the differences between two strategies of visual information analysis (analytical versus synthetic), the effect of domain expert experience on the choice of visual information analysis strategy, and the influence of the wording of questions on the process of eliciting expert reasoning. Arguing that it is impossible to trace the course of expert reasoning by merely observing their work, and that domain experts themselves acknowledge that there are discrepancies between the sequences of their reasoning and their commentary when presenting their understanding in a tutorial mode (such as when giving a lecture to students), the authors present Protocol Analysis as an approach that offers insight into the reasoning strategies being called upon by the experts during task completion. Suggesting that eliciting

tacit knowledge is merely a matter of providing the expert with the right stimulation, they asked experts to talk-aloud as they undertook analysis of an image. The authors recorded these logically and grammatically unstructured commentaries on tape and - after performing a statistical analysis on their results - plotted the relationship between expert's experience and the effect of strategy chosen, arguing that their analysis allowed them to formulate hypotheses about the general regularities in the reasoning strategies of these particular experts over time.

Identifying four tensions that need to be resolved in the establishment of a theory of design - that much design knowledge is tacit knowledge; that we need to find generalities in practice; that there are limitations in the accumulation of design knowledge from one project to the next; and how is it that a singular design comes to be formulated from many disparate voices - Schön (1988) puts forward the notion of 'types' as an analytic construct that might usefully inform the design of computer support for educating and assisting architects during work of design formulation. Arguing that these 'types' provide the basis for the application of design 'rules' - which can only be applied effectively if the underlying 'type' is properly understood - Schön turned to Protocol Analysis, claiming that this approach lends itself to the identification of the underlying patterns of reasoning involved in the design process. Through a lab-based experiment with seven designers who were asked to formulate a design for a library based upon a standardised set of instructions, Schön undertook an examination of how designers operated during the practice of design. For the experiment the designers were provided with a floor plan, some tracing paper, a task description, and were asked to 'think out loud' as they worked to produce their designs during sessions that lasted between one and three hours, and which were tape recorded and transcribed for analysis. Schön argues that his analysis showed the designers to be reasoning from premises to conclusions, and that these premisses took the form of design rules through which the design was formulated, and which were 'sometimes explicitly stated', but more often 'implicitly understood' (*ibid.* p. 185). Further, he claims these patterns of inference were familiar and conventional, and were indistinguishable from those found in everyday discourse.

3.2.2. Activity theory

Another popular approach called upon by researchers interested in the role of hidden knowledges within the workplace is Activity Theory, something which is said to offer investigators a theoretical lens through which to study cognition in the contexts within which it actually occurs (Blackler 1995). At its core the Activity Theoretical approach is one

of building a model of the 'activity system' within which such knowledges are made manifest, with the use of an overarching theory to structure analysis leading to a number of factors that might otherwise be hidden from view being exposed to the investigator. The focus of such an analysis is the 'activity' - the dialectic relationship between subject (person) and object (purpose), and its mediating tools - considered to be external manifestations of internal cognitive activity - and which offers the investigator access to normally hidden mental processes.

Arguing that Knowledge Management theory is fragmented and that the developers of Knowledge Management Systems should take better account of the cultural and historical context within which they will operate, Hasan & Crawford (2003) propose the use of Activity Theory to provide a 'bigger picture' of situated activity. Claiming that all activities are mediated by the available tools, and that Knowledge Management Systems are just such an activity mediating tool - one that undertakes extra-cranial knowledge work - they argue that we must study the activities and the tools together in the actual contexts within which they occur if we are to fully understand the work that they do. To undertake such an analysis they turn to Cultural Historical Activity Theory, an approach that focuses on the activities people undertake based upon their interpretations of their role, the opportunities available to them, and their perception of the purpose of The Organisation. Using this approach they conducted two case-study investigations of existing Knowledge Management Systems, comprising of a series of structured interviews with a number of the systems' stakeholders. Performing a statistical analysis on the collected data they examined factors such as the respondent's conceptions of knowledge, their capabilities with technologies, and their degree of agency. Based on this analysis they argued that there is more to know about the work that people do than can be uncovered using practice-orientated approaches, and that calling upon Activity Theory can tell us something about the wider context - and in particular provide a historical perspective - to help us understand why activities are structured the way that they are.

Calling upon Activity Theory to study the tensions in and between activity systems - in order to identify the requirements for a knowledge reuse system to capture and maintain customer support engineers' knowledge - Collins, Shukla & Redmiles (2002) focused on a single activity system: the documentation of solutions to customer problems within an existing Knowledge Management System, an activity known as 'knowledge authoring'. Gathering their data via a series of interviews averaging an hour in length - that they describe as

ethnographic (*ibid.* p. 58) - their aim was to design artefacts that would change the activity system in a way that would achieve better alignment between the services provided and those required by both customers and The Organisation's knowledge strategy. In order to achieve this end they applied two analytic approaches: a Mediating Artefacts Hierarchy (an approach designed to identify the properties of those artefacts essential to the system's functioning) and Activity System Modelling. For the latter approach the transcribed interviews were analysed in order to classify discussions of each activity system element and the relationships between them, focusing on any tensions identified by the interviewees, and which might offer insights into the possibilities for system evolution. Further, they used their analysis to identify a number of tensions within the activity system, between its elements, and between activity systems, such as the implicit and explicit rules that led to siloed working, the implicit rules that guide the rating of useful documents, and the differing priorities of those wanting reusable knowledge and those wanting to prioritise direct customer support.

3.2.3. Grounded theory

Stemming from criticisms of those operating within the Social Sciences - and in particular the grand social theorists such as Marx and Durkhiem, who were seen to have lost the connection between social theory and our everyday reality - Grounded Theory was developed to re-establish the relationship between observations made in the field and the formulation of a new class of sociological theory (Bryant 2002). By providing standardised procedures for gathering, coding and analysing data, the approach aims to offer investigators a framework within which to formulate theories that have a methodological rigour comparable to that of the Natural Sciences, enabling the analyst to both explain and predict the behaviour of a setting's members. However, unlike more formal qualitative approaches, Grounded Theory is not an attempt to find a specific truth, but rather focuses on the iterative search for patterns in the data, patterns that are assigned to categories, which in turn leads on to the formulation of theories that are said to account for the manifestation of those patterns in the settings under investigation. In Grounded Theory, data collection, analysis and theory development occur in parallel, rather than being guided by *a priori* assumptions (indeed the analyst is expected to treat each-next research setting as a blank slate), with the grounded theory that emerges from the process being said to have been induced from the data (Cutcliffe 2000). This process of emergence is said engage the researcher's tacit knowledge and creativity as they work to identify the phenomena in the data and transform their

findings into a theory that, whilst abstract, remains intelligible to the setting's members.

Arguing that tacit knowledge is difficult to observe directly, measure quantitatively, cannot be reduced to theoretical constructs, and that few studies provide concrete examples of its role in organisational learning, Boiral (2002) undertook an investigation into the practical role that it plays within environmental management. He argues that - because it is difficult to verbalise, subjective, and context specific - tacit knowledge can only be revealed through a process of inductive research, observations and inquiry, and calls upon the Case Study method for gathering data, and Grounded Theory for its analysis and interpretation. Datasources for the eight case studies examined included 126 individual interviews, group meetings, participation in training events, and internal & external company documents; with individual and team interviews being transcribed for further analysis. Any information concerning tacit knowledge was categorised using both pre-defined categories and those which emerged through the analysis process, such as combining or splitting existing categories. Primary categories identified during his analysis included the relevance of tacit knowledge, such as the identification of pollution sources, the management of emergency situations, or proposals for preventative solutions; and the promotion and sharing of tacit knowledge, such as consultation of personnel, empowerment, training, or documentation and retention.

Arguing that a primary source of learning for trainee nurses was the discovery of hidden knowledge embedded within clinical practice, Davis (1993) undertook an investigation into what it means to be a good role model. To assist him in this task he called upon Grounded Theory to uncover a number of facets of practice not normally found in the academic/formal nursing literature, such as creativity, artistry, role responsibility, the facilitation of patient autonomy, the maintenance of professional competence, the socialisation of novices, and collaboration within multi-disciplinary teams. Gathering his data from unstructured interviews with six students - selected on the basis of their ability to articulate their personal experiences - Davis undertook a thematic analysis which used coding, memo-writing and diagramming to identify major and minor themes based on discoveries made by the students themselves. These themes were founded on attributes possessed by the role models and focused on commonalities across individual student interpretations, which were then converted into a visual tree structure in order that interrelationships could be identified. Based on this analysis Davis argued that the hidden knowledges identified were contained within four patterns of practice that were noticed by the students involved in the study: good

clinicians; bad clinicians; clinician as facilitator; and creative carers & trusted friends.

3.2.4. The limits of formal approaches

The aim of including these examples from the literatures of those with a particular interest in studying the hidden knowledges of a setting's members has been to illustrate just a handful of the diverse approaches taken by researchers to uncovering the role that they play in everyday practice. However, as we heard in the last chapter, there are concerns that many of the tools and techniques that are called upon to access such phenomena are vulnerable to the same criticisms that have been levelled against the more formal approaches of the Social Sciences: namely that they focus on abstracted or reified conceptions of such phenomena, something which discounts their fundamentally situated nature, and which may therefore desensitise the investigator to the very thing that they seek to understand.

Despite claims of Protocol Analysis' utility for explicating the tacit understanding of knowledgeable individuals, its underlying philosophy and application has not been without its critics, and here we have seen two aspects in particular that warrant concern regarding the validity of its outputs as an account of such phenomena. The first is the artificial nature of the circumstances within which a 'subject's' knowledge is made manifest, typically through a contrived situation during which the subject is asked to narrate their actions, sometimes taking place within a laboratory setting. Such approaches are particularly vulnerable to our tendency to design our language for its recipients - such as our perception of the desires of the analyst - and what we say in such circumstances may not be some unencumbered view of what we are actually thinking during each-next-moment, but rather a narrative that is tailored to the display of competence. Investigators with an interest in similar devices for measuring the cognitive capacities of individuals - such as Intelligence Quotient tests - have argued that the ad-hoc methods that members use to create a competent display inevitably come between their thoughts and any supposed accounts of them, begging the question just what is it that is actually being measured in such circumstances (Coulter 1991). Some have suggested that the individuals under investigation can be seen to be doing visible work to present themselves as competent at the tasks they have been set: both the work of the experiment itself, but also the work of being a good 'talk-a-louder'. This accountability is evidenced in the tendency for the subject's language to flip between talking to themselves and talking to the others present, their use of first person plural expressions, which are more indicative of someone giving a lecture ('first we must do x'), their use of impersonal constructs, such as 'it appears to be', and that mistakes are apologised for and excuses given

for an inadequate performance (Goguen & Linde 1993). Further, even the proponents of Protocol Analysis have highlighted a range of concerns associated with the use of verbal reports as data, including whether they accurately reflect thought; whether asking people to report on their thoughts changes the nature of those thoughts; and whether such data can be treated as objectively as other data: primarily that of the Natural Sciences (Crutcher 1994).

The second concern centres on Protocol Analysis' focus on notional rules, both those that the subject is said to be using to inform their performance, but also the rules that the analyst must use to categorise their observations. We can see that, in the examples presented above, the cognitive activity of individuals was treated as being either explicitly or implicitly rule-based, and that the role of the analyst was to uncover these rules so that they can be represented in a structured form that can easily be communicated to others, such as the designer of a new technological system. However, as we heard in the last chapter, the notion that our understandings, and therefore our actions, are the product of rule following is extremely problematic, and is a stance that has been shown not to hold up outside of formally structured thought experiments. Indeed, Schön noted that his data provided him with a number of intractable problems, including the fact that different design 'rules' sometimes led to the same outcome, whilst the same 'rules' sometimes led to different outcomes; that different designers applied different knowledges in pursuit of solutions to the same problem; and that the application of specific 'rules' were context dependent, and therefore difficult to predict (Schön 1988).

Above we have also seen how other researchers have called upon Activity Theory to address what they perceive as limitations in the capability of practice-based approaches to take account of the wider context within which activity actually takes place. In the examples presented we heard that, whilst care is taken to engage directly with the setting's members, this engagement comes in the form of structured interviews, themselves often conducted away from the context within which the activities under investigation actually occurred. The data generated is then elevated further from the circumstances of the original work through the creation of abstracted analytic constructs that are said to represent the hidden mental processes of a setting's members, something which they are considered to be unable to conceive of for themselves. Further, these analytic constructs are supported by conceptions of activity as being driven by mental structures which are themselves defined by top-down institutional constraints, such as the cultural and historical context of the current circumstances, something which leads to a tendency to ascribe propositional reasoning and

knowledge on to situated action (Schmidt & Wagner 2004).

In earlier work examining the role played by representational artefacts in the architectural design process, and the ways in which their meaning is made manifest through the conventionalised practices of architects, Schmidt & Wagner (2002) present a robust critique of Activity Theory arguing that, as both an intellectual tradition and a conceptual framework, it makes it difficult to systematically address the actual role of material artefacts in work. Specifically they claim that its conceptions of them are ‘utterly vacuous’ because anything that can be given a name is classified as an artefact (something which is exemplified by the claim that Activity Theory is itself a kind of artefact) (*ibid.* p. 388). Further, they argue that the ambition of the Russian psychologist on whose work the approach is based (Lev Semyonovich Vygotsky, 1896-1934), was undermined by his conception of psychological tools, which are conceived of as artificial devices for mastering mental processes, and which are based on the mentalist preconceptions that underly his understanding of sign systems. As a result, mental and material phenomena are subsumed under the same category of tools, something which inappropriately reifies the skills involved in the likes of speech, writing, counting, etc.

Perhaps showing the greatest potential utility for uncovering those knowledges which might ordinarily be hidden from view, Grounded Theory’s creation of abstract categories within which its observations must be located leaves it exposed to some of the same criticisms levelled at other more formal approaches that were outlined in the last chapter. Whilst it sets out to replace detached theorising with the production of theories that are grounded within the actual circumstances to which they relate, the knowledges of the researcher still take primacy over those of the setting’s members, with its categories being those that the analyst applies to their observations and which, through the approach’s iterations, gradually move away from those that a member of the setting would recognise during the actual circumstances of their work. Indeed, the approach’s originators - Barney Glaser and Anselm Strauss - saw the creation of sociological theory as the sole job of appropriately trained sociologists, and not the members of a setting (Bryant 2002).

Some have cautioned that the application of *a priori* knowledge by the approach’s practitioners can lead to the researcher testing hypothesis, rather than allowing theory to emerge from direct observations (Suddaby 2006), something which is the antithesis of how Grounded Theory should be conducted. Further at odds with the approach’s claims to be formulating theories that are meaningful to the setting’s members themselves are its

advocate's claims that analysts should be '*abstracting into theoretical statements about causal relations between actors*' (*ibid.* p. 635), and that any analysis should take the researcher to a slightly higher level of abstraction than the data itself. As a result of these inherent tensions, a number of authors have noted confusion in the Grounded Theory literature regarding to what degree the researcher should engage with the data and setting, the role that existing literatures should play, and how much their own *a priori* knowledges should influence the outcome of any analysis (Cutcliffe 2000, Bryant 2002). This perceived need to separate the knowledges of the researcher from those of their informants reflects the desire of those responsible for the approach's development to be viewed as credible in the eyes of the Natural Sciences, with the tension between the strict application of technique and interpretative insight that is inherent in the approach eventually proving too much for its founders, who went their separate methodological ways.

Here we have seen that, whilst these approaches offer obvious utility to researchers for uncovering the patterns found within their respective data-sets, they are not necessarily well suited to uncovering the part played by phenomena that might ordinarily go unnoticed - such as the hidden knowledges of a setting's members - and in particular those which are only made manifest during the actual moment-by-moment conduct of work. In particular we have seen that the primary sources of data for such approaches are often based upon secondary accounts, such as contrived laboratory based experiments, where subjects are asked to enact an idealised version of their role, or structured interviews with a setting's members, during which they are asked about the work that they do in some other place and at some other time. Some critics have suggested that those taking such approaches prefer that which is easily made manifest to that which is hidden, often characterising the individual actor as a 'cultural dope' who produces stable social structures by blindly enacting the pre-established alternatives that society provides him with (Coulon 1995). By taking such a stance, the researcher inevitably establishes an epistemological distance between the observer and the observed, elevating the former to the privileged viewpoint of being on the outside looking in, a position from which it is easy to perceive social phenomena as stable objects that are only available to an appropriately trained investigator.

As we will hear in the following chapters, the product of much of the existing research into hidden knowledges is a series of analytic constructs that claim to bridge the gap between the identification of patterns of practical action - something which these approaches have shown themselves to be amply capable of - and the ascription of rule following onto the conduct of

a setting's members - a stance that we have already heard is vulnerable to charges of abstraction and reification - and which tells us little about the ways in which people actually work. However, first we will examine an approach that attempts to offer an alternate to these more formal methods, one that refocuses the investigator's attention on the work that a setting's members are actually doing in just-these-circumstances.

3.3. Ethnomethodology

As we heard in the last chapter, some investigators have attempted to counter concerns regarding the ways in which workplace knowing is conceived by arguing that Knowledge Management and the developers of its Knowledge Management Systems should take a more 'situated' approach to the formulation of its technological interventions: one that acknowledges the fundamentally local, multiple, and contested nature of all knowing. This is an approach which accepts that the formulation and application of all of our knowledges comes from the artful integration of the range of socio-material configurations from within which they are made manifest, and that in order to achieve the necessary understanding of such work investigators must examine its actual conduct in the here-and-now, rather than analyse it through second-hand or abstracted accounts of it (Suchman 1993). To counter similar concerns raised in the related disciplines of Requirements Engineering, Workplace Studies and Computer Supported Cooperative Work, we heard that some have turned to ethnomethodologically informed approaches, and the non-ironic stance that they take towards the situated knowledges of a setting's members. Proponents of such approaches argue that the temporary suspension of the-taken-for-granted offered by the ethnomethodological turn facilitates the focusing of our attention on those aspects of members' practices which might otherwise be hidden from an undirected view, and transform them into an explicit topic of study (Watson 2006). As we also heard in the last chapter, such work can be hidden for a number of reasons (section 2.3.1), but in those circumstances where someone observably struggles to articulate the full meaning of their actions or understandings, ethnomethodology actively eschews attempts to reduce this down to the bodily movements of Behaviourism, or the hidden mental processes of the Cognitive Sciences (Suchman 2007). Instead it focuses on understanding the practical work through which such knowledges are accountably accomplished in the-here-and-now, and so can offer potentially valuable insight to those attempting to understand how such work might be appropriately supported by technological interventions in the future.

Initially formulated by Harold Garfinkel in 1950's America, Ethnomethodology sets out to

examine the practical members' methods - their ethno-methods - through which the social order that we experience as being an inherent and mundane property of everyday life is actually achieved in and through each-next-moment of its production. In particular Garfinkel's interest centred on the juxtaposition between the dominant conception that social order was governed by top-down institutional 'rules' which could only be understood in the abstract - through the application of the formal approaches of the Social Sciences, and by an appropriately trained sociologist - and the notion that the order that we perceive is constantly being maintained in and through the local, everyday, understandable, accountable, concerted, and largely knowledgable practices of those around us (Rawls 2002). For Garfinkel, notions of both the self-contained individual and that of overarching social structures were reifications, something which inevitably produced a sense of conflict that could only be resolved through the use of theoretical abstractions, such as those commonly called upon by '*Formal Analysis*'. He believed that the use of such abstractions inappropriately elevated the status of the analyst, for he becomes the only person who can possess complete knowledge of the construct that he has created, something which leads to the setting's members' reason being seen as incomplete or inadequate: that they were nothing more than '*cultural dopes*'. Further, unlike the actual phenomena of practical action, these theoretical abstractions can never be lost from view, and therefore lull the analyst into believing that they have discovered a more concrete picture of the circumstances under investigation than the members themselves are capable of conceiving.

As a result of these concerns Ethnomethodology goes to great effort to avoid the creation of such abstractions, focusing instead on the ways in which just-these-members are working in just-these-circumstances. To achieve this end it approaches its phenomena of interest through a relatively small number of simple concepts (although they can be quite difficult to conceive in practice), the aim of which is to assist the investigator in formulating and articulating their own understanding of just what it is that they see before them, and which are presented through the discipline's ever growing corpus of studies (Garfinkel 1996). The core concepts of ethnomethodology are founded on the assumption that meaning, order, and rationality are built-up during the course of our everyday interactions, through the use of an endless array of practical members' methods, and that the more these procedures are held in common across the membership of a particular setting - and therefore no longer require explicit articulation - the more carefully we as observers must look if we are to notice the work that they do through their enactment.

3.3.1. Indexicality

The first of these concepts is the notion of indexicality, which centres on the belief that our social lives are primarily constituted through the everyday use of a shared language, and that one basis for our membership of a given social collective is our competent use of its *lingua franca*. Specifically, indexicality relates to the fact that the full meaning of any given utterance is necessarily incomplete and open to interpretation, and that the indexical nature of an expression implicitly draws much of its meaning from the circumstances within which it is used. Further, the presence of the indexical ground *in toto* remains necessarily implicit, with particular indexicals being called upon to bring specific facets into the foreground during each-next-moment of an interaction. To achieve this members can manipulate the resources at their disposal to motivate just-the-required-understandings, such as with the use of temporal indexicals e.g. those referring the past, present or future; spatial indexicals, e.g. ‘here’ or ‘there’; personal indexicals, e.g. ‘I’ and ‘you’; and gestural indexicals, e.g. physically pointing at something. Through the active use of such indexicals the meaning of an utterance or action is temporarily stabilised in the here-and-now. In the last chapter (section 2.2.4) we heard that Garfinkel & Sacks (1970) showed the use of such indexical expressions can serve as a gloss that provides members with a sensible procedure for meaning more than they can say in-just-so-many-words and in-just-these-circumstances, and that because they are a members’ procedure for producing observable-reportable understanding, they are available to a competent investigator as well.

3.3.2. Reflexivity

At its core reflexivity is the conception that each-next-thing that is done can be informed by that which has gone before, and that it has the potential to change what we do next. Further, what is said or done next reflects back on what went before, potentially re-specifying its meaning in the here-and-now. Whether it be the relationship between a conversation’s interlocutors as they take turns at talk, the subtle ebb and flow defining its constituent meanings (Rawls 2008a), or the ways in which the intelligibility of a gestural reference rests upon the activity within which it is embedded (Hindmarsh & Heath 2000), such practices both constitute and are constituted by the context within which they occur. Garfinkel argued that reflexivity was a primary condition for stable social orders, but the reflexive nature of our own interactions typically goes unnoticed - because it is mundane - and it is only when something out-of-the-ordinary occurs that it comes into view. He believed that there was no need for grandiose theories to account for this order, because the members’ methods used in

its everyday production do just fine. As a result Ethnomethodology does not treat this reflexivity as something that occurs in people's minds, but rather as something which is available in the witness-able flow of action, through the practices that we use to make the available resources meaningful in just-the-required-ways and in just-these-circumstances. Perhaps the strongest development of reflexivity is the notion that the ethnomethodologist should explore the very practices through which they ground their own understandings of a given setting. Known as the '*radically reflexive*' position, those undertaking such an analysis must recursively ask themselves what it is they understand about a setting, and how it was that they came to just-this-understanding. Those who promote such a stance argue that the ethnomethodologist does not observe from a secure and stable vantage point, but that an ethnomethodological analysis is an endogenous accomplishment which occurs from within just-these-circumstances (Pollner 1991). Those who turn away from this radical position, argues Pollner, risk moving into a positivist mode of investigation.

3.3.3. Accountability

The most common manifestation of the notion of accountability is the fact that if our actions are not viewed as sensible or intelligible by a setting's other members, we will likely be called upon to make them so, or offer an account of why we cannot do so. As such, accountability is administered directly through our social relationships, sometimes supported by wider institutional controls, such as the citing of the rules or procedures. The methodic production of accountability can take many forms, whether it be a simple turning to those same institutional rules in order to justify one's behaviour, or the complex work that one must do to show oneself to be professionally competent in the eyes of one's peers, such as that performed by those learning to properly identify the blackness of a chemical soup that we heard about in section 2.2.4 (Goodwin 1997). During his investigations of the '*convict code*' (discussed in more detail in section 4.7) Wieder showed how the parolees called upon the code's 'rules' to provide their actions with a sense of accountability, and showed how these informal forms of accountability can work against more formal institutional ones (Wieder 1974). He showed that when such a conflict occurs, one merely needs to name the code for other members to know why one is acting in just-this-way in just-these-circumstances. Wieder's investigations highlighted that the accountable nature of such activity is a constitutive part of that activity, and because of its methodic nature it is therefore intelligible, describable, reportable and analysable (Coulon 1995). Finally, just as a setting's members are accountable to one-another, so to are the investigator's claims of

knowledge about that setting accountable to its other members, something which is an important aspect of the reflexive nature of an ethnomethodologically informed analysis (Suchman 1993).

3.3.4. Members' methods

Garfinkel was especially interested in the patterned and instruct-able ways in which the ordered properties of each-next-situation are made publicly available and mutually recognisable through the endless array of practical members' methods, which themselves are available in and through the very circumstances of their use:

'the essential thing is that the person goes on - that they can go on - that they know how to go on - and that there are methods and practices for doing this that are known in common to members of any given practice. Furthermore, since they can go on - and do so publicly - it must be possible to figure out how they are doing this' (Rawls 2008b p. 25).

Unlike those who call upon formal approaches, which attempt to treat the orderly nature of everyday life as the product of the following of both explicit and tacit rules - rules which are viewed as being more theoretically significant than the practices they are said to cause - Ethnomethodology's interest is purposefully constrained to the viewing of such regularities merely as patterns of concerted social action (Rawls 2008a, Watson 2009). For those taking a more formal stance, the vulgar details of individual practices can come to be viewed as both too complex to be encapsulated within such rules, but also a constant source of irregularity and error, and as a result much effort can be put into normalising data, treating 'the population' in abstract (Rawls 2002), with the risk that anything that threatens a construct's viability can come to be pushed into the analytic background.

Ethnomethodology on-the-other-hand embraces these irregularities; Garfinkel arguing that both the investigator and a setting's members are involved in the recognition of common occurrences of a pattern, with each-next-occurrence of a phenomenon being treated as pointing to and creating the underlying pattern, but also being informed by it (Garfinkel 1972a). Within this context, occurrences that cannot find their place within an existing pattern are treated as problematic by both the investigator and the setting's members, a problem that is addressed by its own visible methodic work (such as questioning what it is that somebody is up to). It is by observing the reactions of those attempting to return such situations to the the realms of normality that we might learn something about how everyday

order is itself maintained (indeed, the aim of Garfinkel's breaching experiments were to manufacture just such circumstances in order that his students might experience first hand both the sense of abnormality as well as the lengths people will go to repair the breach that they had created). As we began to see in the last chapter (section 2.2.4), Ethnomethodology's specific interest in hidden knowledges, and the part that they play in the formulation of the underlying inter-subjective substrate (the normative order) upon which action is constructed in the here-and-now, is presented as a series of analyses of the members' methodic procedures through which they are made manifest in just-these-circumstances, such as their use of ad-hocing procedures (Garfinkel 1972b), the Documentary Method of Interpretation (Garfinkel 1972a), and glossing practices (Garfinkel & Sacks 1970).

Ad hocing procedures

'Ad hocing' refers to the often open ended nature of the procedures utilised by a setting's members as they work to establish a particular meaning in just-these-circumstances. Work by Garfinkel (1972b, 2004) showed that members' categorising practices - such as those used by clinical staff to segment patients, and those used by students researching those same segmentation practices through an analysis of the clinic's records - were not an automatic activity that followed specific, or even general guidelines. By examining the actual procedures through which the students were making the clinical records meaningful, Garfinkel was able to expose the ad hoc nature of the methods they were calling upon to achieve their work's ordered and accountable properties, and show these to be an essential part of interpreting the institutional instructions that they had initially been provided with for undertaking such work. In particular, Garfinkel's analysis showed how the elasticity of the relationship between formalised, abstracted, idealised or generalised instruction-sets (which are necessarily and inevitably always incomplete), and the application of those instructions by a setting's members in just-these-circumstances, is achieved by calling upon an array of ad-hocing procedures which have the following characteristics:

- *Etcetera*: that if you can see the rule in what I am saying then there is no need for me to give more examples here - and of course as a competent member you will know what this rule is and therefore it need not be explicitly stated;
- *Unless*: that if you can see the rule in what I am saying there is no need for me to state the cases where it does not apply - and of course as a competent member you will know when these cases are and therefore they need not be explicitly stated;

- *Let it pass*: provides bounds for *etcetera* and *unless* by stating that enough-is-enough - and of course as a competent member you will know where these bounds are and therefore they need not be explicitly stated;
- *Factum valet*: that under certain circumstances this rule may be breached - and of course as a competent member you will know when these cases are and therefore they need not be explicitly stated.

Documentary method of interpretation

The Documentary Method of Interpretation (DMI) is one of Garfinkel's prototypical members' methods, and serves as an account of the work that any observer of a phenomenon must do to recognise and re-produce something as an example of *just-this-thing* (Garfinkel 1972b), such as establishing just what it is that someone is talking about when they are meaning more than they actually say. Because there is always insufficient information to say with absolute certainty just what is meant in *just-these-circumstances* - such as the inevitable incompleteness of a set of instructions - the DMI serves as a members' procedure for filling in the gaps, enabling us to view the actions of others that we see before us in the here-and-now as manifestations of *just-these-patterns*, in order that we can assign appropriate meanings to them (Coulon 1995). In a typically recursive fashion, Garfinkel believed that each underlying pattern of social action is both made up of, and informs, each-next-manifestation of it, and that without our ability to use the patterned nature of social action as a guide for making sense of what we see before us, the social milieu would be a meaningless chaos. For a pattern to be available to the DMI, an understanding of that pattern - as an understanding of just-this-pattern - must be held in common with other members of a given setting, and as a result the presence of the pattern must be observable, reportable and describable: it must be *accountable*. When calling upon the DMI, members can be seen to be doing such work as: observably-reportedly acting in accordance with a shared code of practice, without it being explicitly stated in just-these-circumstances (Wieder 1974); the visible work that medical professionals must do to 'read into' the official records the work that was previously done to create those records, as a record of just-this-outcome (Hartswood *et al* 2003); or the work that students must do to observably-reportedly see the subtitles in the changing colour of a chemical soup, as a document of the current status of its underlying chemical process (Goodwin 1997).

Glossing practices

As mentioned in the last chapter (section 2.2.4), glossing practices are a members' method

for producing observable-reportable understandings that mean more than was actually said in just-so-many-words (Garfinkel & Sacks 1970), and which are used to gloss over knowledges which are taken to be held in common and so need not be explicitly stated in just-these-circumstances. As such the use of a gloss serves as a yet-undecided-mock-up, abstraction, model, etc, whose meaning will only be settled upon during and after the actual moments of its use. Further, glossing practices are not limited to language, but can also be created through the performative impact of gesture, such as through the use of pointing to draw our attention to particular objects within the scene before us, an action that itself typically passes unremarked (Hindmarsh & Heath 2000). Members' use of glossing practices acknowledges that, whilst action is both concrete and situated, its full meaning can reach beyond the current circumstances, and that our experience of the here-and-now is constantly outrunning our knowledge of the world around us (Garfinkel 1972b). The key to understanding glossing practices is to appreciate that what is being glossed may never be available in just-so-many-words, but that this doesn't mean that speakers don't know what it is they are talking about, or that listeners don't understand what is meant. When something is glossed it can pass unremarked; be openly called upon as being unusual; not interpreted within the current context; or be so odd that it simply goes unnoticed (Garfinkel & Sacks 1970, Garfinkel 1972b). Glossing practices typically have the following characteristics:

- That they are a gloss for something;
- They are a necessary abstraction for some of the features of the current situation;
- They are just a gloss and not a replacement for the real thing;
- They are a limited account, and their limitations are understood and unproblematic;
- That it is for the user of the gloss to decide on the its adequacy;
- That the user of the gloss must be willing to discount the gloss when the actual situation provides more.

3.4. Ethnomethodologically informed ethnography

In the last section we began to get a sense of the potential that undertaking an ethnomethodologically informed analysis of the actual work of a setting's members might offer as an approach through which to understand the part played by the array of knowledges that support even the most mundane of activities, and in particular those which might ordinarily be hidden from view. However, whilst Ethnomethodology offers a powerful analytic framework from within which to approach such phenomena, if it is to be useful for understanding workplace knowledges it needs to be supported by a mechanism of both

generating primary data, but also for taking account of the wider context within which such activity takes place. Further, whilst an ethnomethodological analysis might provide us with deep insight into specific moments of hidden-knowledges-in-action, any approach taken must be viable within the context of the institutional settings within which Knowledge Management's technological interventions are typically implemented: namely in terms of cost, time, and sufficient access to undertake an effective investigation.

A common technique called upon by those with an interest in understanding the conduct of work is the undertaking of an ethnographically informed investigation, an approach to the collection of data and its analysis that sets out to discover the point-of-view of a setting's members. However, unlike Ethnomethodology - which is specifically interested in the methodic nature of members' practices - Ethnography focuses on their wider experiences of the cultural and social worlds within which they live (Dourish & Button 1998). As a mode of investigation Ethnography has a long history within the social sciences - and in particular Anthropology - where it is used as a technique for providing the investigator with access to the social and cultural context within which human events occur (Geertz 1973, Agar 1996). There are a number of paradigms from within which an ethnographic analysis can be undertaken, such as positivistic (objective definitions and descriptions formulated by the investigator), critical (active involvement between the investigator and members of a setting), ecological (which places a strong emphasis on context), and of particular relevance to the current work, interpretivist, which acknowledges that our understandings are built upon the intersubjective nature of meaning and experience (LeCompte & Schensul 1999). Ethnographic data can be generated from a number of sources, including passive observations, participant observation (where the investigator attempts to earn his place in the group by sharing their work), semi-structured interviews, questionnaires, as well as the analysis documents, images and other artefacts; but its primary distinguishing feature is its direct and ongoing engagement with the lives of those who inhabit the settings under investigation. The findings from ethnographic investigations are presented in the form of an ethnography, an account that sets out to describe the understandings generated from a detailed analysis of the gathered data (typically in written form, but visual and audio formats are also common), placing it into the context of the wider academic narrative surrounding the topics under investigation.

Despite its sociological and anthropological origins, there is now a well established literature on the application of ethnographically informed techniques in everyday work

settings, such as the gathering of requirements for new technological systems (Luff & Heath 1993, Heath *et al* 1994, Luff & Heath 1998, Jirotko *et al* 2005), studies of specific workplaces (Orr 1996, Luff, Hindmarsh & Heath 2000, Suchman 2000a, Zemel *et al* 2007), as well as wider organisational development (Schwartzman 1993); all of which amply illustrate the potential utility of these techniques for formulating the detailed accounts of work that those responsible for creating Knowledge Management's technological interventions need if they are to be successful. Further, some authors have highlight the specific utility of ethnographically informed approaches for noticing the multiplicity of knowledges at play in a given work setting by facilitating the investigator's direct engagement with the everyday work of its members (Schultze & Boland 2000, Suchman 2000b, Hartswood *et al* 2003). In such circumstances, ethnographically informed investigations serve to provide the designers of new technological interventions with a deeper understanding of the irredeemably social nature of the work that their systems are destined to support, something which can help avoid some of the issues highlighted in chapter two (Hughes *et al* 1994), and which they may lack appropriate intuitions about if they have not experienced that work first-hand: '*one of the rationales of ethnographic studies of work in CSCW [Computer Supported Cooperative Work] is an attempt to bring out the often subtle, often hidden, often unforeseen, features of the sociality of work which have mixed bearings on the effectiveness of system innovations*' (Rouncefield *et al* 1994, p. 281).

3.4.1. Knowledge management's use of ethnography

Whilst the use of ethnographically informed approaches are now well established in the related fields of Workplace Studies, Requirements Engineering and Computer Supported Cooperative Work (CSCW), and despite some early commentators indicating the valuable contribution this approach might make towards increasing our understanding of workplace knowledge (Blackler 1995, Thompson & Walsham 2004), it has only gone on to have a limited impact on Knowledge Management and the formulation of its technological interventions. This is likely due to a number of factors, including: the differing philosophical basis of the disciplines, with Knowledge Management and its agents often taking a more objective stance towards 'knowledge' than most ethnographers would be comfortable with; the time it takes to produce tangible results through such an approach, with ethnographic studies undertaken within the social sciences often taking months or years to complete; the resource commitments of such an investigation, such as the time the investigator must spend

in the field, but also the commitment that those under investigation must make to provide access to their domain; as well as the often commercially or politically sensitive nature of the work undertaken in such settings (see Plowman *et al* 1995, for a discussion of the same problem in other areas). Despite these barriers, there are a number examples of investigations where an ethnographic approach has been taken to understanding the problems faced by Knowledge Management, including:

- An investigation into ‘gate-keeping practices’ and their effect on constraining information flows within organisations, which used ethnography as a way of uncovering the local habits, assumptions, taken-for-granted context, and tacit knowledge that together forms the mundane detail of everyday life. Here researchers examined not just what a setting’s members do, but also what their doing does, in an attempt to go beyond the mimicry of existing work practices, and towards a generative force in the development process (Schultze & Boland 2000);
- A study of the application of evidence based guidelines in clinical practice, and the juxtaposition between socially constructed ‘knowledge in practice’ and official sources of information - such as documentation and Expert Systems - and which took an ethnographically informed approach to gathering data, including observations, semi-structured interviews, and document reviews (Gabbay & le May 2004);
- And an examination of the mechanisms of design and knowledge reuse in the construction industries, and the role of ‘social knowledge networks’ in providing the contextual understanding necessary for applying existing designs in the current circumstances, and which involved a two week field study, including the attendance at design meetings, site visits with engineers, and a number of interviews to examine the ways in which novices and experts interact in order to share what they know by calling upon past experiences (Demian & Fruchter 2006).

Although limited in number, studies such as these indicate the potential that taking an ethnographically informed approach has for increasing our understanding of the part played by knowing in actual work settings. Further, such studies also allude to the possibilities that this type of investigation has for noticing the part played by those knowledges which might otherwise be hidden from view - such as a tacit knowledge - in supporting the work of a setting’s members by bypassing some of the limitations inherent in more formal approaches - such as those discussed in section 3.2.4 - and which often implicitly rely on a setting’s members being able to articulate an explicit account of what they do and what they know.

3.4.2. Practical ethnography

In order to overcome some of the practical limitations of undertaking full ethnographic investigations in work settings some researchers have turned to forms of the approach specifically tailored to working within the constraints found within modern organisational settings (Hughes *et al* 1994), including:

- The undertaking of *literature reviews* of the existing corpus of ethnographic studies as a low-cost mechanism for sensitising the investigator to the broader issues that may be presented during the implementation of the new system, although such studies are unlikely to have been undertaken on exactly the same basis as the investigator's current interests;
- The undertaking of '*Quick & Dirty*' ethnographic studies tailored to inform specific design decisions, undertaken over a period of a few days to a few weeks, and which can be used to highlight areas that might benefit from a deeper investigation, as well as provide specific information about the sociality of work that is relevant to the current stage in the design process;
- The undertaking of *concurrent ethnographic studies*, where the design process and the study take place alongside - and inform - one another in an iterative process of fieldwork > debrief > prototype. In these circumstances the developing prototype serves as the requirements document, and the ongoing analysis of its use provides detailed insight into the subtleties of the sociality of work as it develops alongside the evolving system;
- Finally, the undertaking of *evaluative ethnographies* to systematically assess earlier design decisions, and which serve as a 'sanity check' for the designed system through the monitoring of its use within its final setting, but which can also facilitate evolutionary redesign as understanding of the setting and the system develops over extended periods of time.

Some researchers have attempted to further enhance both the efficiency and depth of understanding achieved through the use of such approaches by utilising a number of field methods specifically designed to maximise the information generated out of each unit of time spent in the field (Millen 2000). These include calling upon key informants, such as '*liminal informants*' who exist on the periphery of social groups, and who are more likely to notice exceptional events or behaviours; sending multiple observers into the field at the same time, allowing events to be viewed from a number of standpoints as they occur;

collaborative forms of analysis such as Cognitive Mapping (Causal Modelling, Influence Diagramming, and Concept Mapping), pictorial story telling (representing the data as a pictorial story using metaphor and analogy), Scenario Analysis (where related scenes are represented in images and accompanied by a narrative); the use of passive video recording, minimising the influence of the investigator's presence and allowing him to be in two places at once; and the use of computer assisted analysis, allowing large volumes of data to be analysed through searching, coding and annotating. By applying such techniques, investigators have the opportunity to achieve a deeper understanding of the nature of the work undertaken within the settings under investigation than might be achieved through the use of interviews or questionnaires alone, but do so without requiring the significant investments of time and resources - on behalf of the investigator or the setting's members - that a full ethnographic investigation would demand.

3.4.3. Ethnomethodologically informed analysis of ethnographic data

As we have heard, a range of disciplines - including those with an interest in formulating new technological interventions - have turned to ethnographically informed approaches to provide a mechanism for generating accounts of the settings under investigation. Indeed, some authors have noted that such approaches are particularly useful because of their focus on the tacit skills and knowledge incorporated into everyday work (Rouncefield *et al* 1994), whilst others have highlighted the important role that ethnographically informed investigations can play in translating between the knowledges of a system's designers and those of its eventual users, by asserting those knowledges that might otherwise be hidden from view (Suchman 2002). However, whilst ethnographically informed approaches are usefully applied to examining the culture, beliefs and symbolic meanings found within a setting, Ethnomethodology's interest in its ordered properties re-focuses the analytic spotlight onto the actual practices through which such conceptual typifications are made manifest (Rawls 2008a), a stance which treats the investigator's observations empirically rather than conceptually (Rawls 2002). Such an approach requires a different 'analytic mentality' in the selection of phenomena, the topic of analysis, and the issues attended to (Dourish & Button 1998), and the combining of these two approaches - in the form of *ethnomethodologically informed ethnography* - offers the investigator a powerful technique for focusing in on the fine detail of work's production, facilitating the noticing of the array of hidden knowledges which support even the most mundane of practices.

Within this context, abstract constructs - such as those often used to account for a tacit

knowledge - lose much of their utility, for we can begin to ask specific questions about the phenomenon of interest, such as: how is a knowledge of just-this-thing being practically achieved in just-these-circumstances; what work is it actually doing; and how is it being managed by the members of this setting themselves? Researchers taking just such an approach have studied a wide range of phenomena in the workplace, including:

- An analysis of the building of a new bridge as a 'persuasive performance' that involves the meeting of the professional knowledges of the bridge's designers, and the local knowledges of those whose community the bridge will eventually be located within (Suchman 2000b);
- An investigation of the 'ingenious methods' through which shop-floor workers in the print industry manage the orderliness of their work and their knowledge of the process-as-a-whole, contrasting these with the formal processes and procedures defined by The Organisation (Bowers, Button & Sharrock 1995);
- Or an analysis of the work of a group of ambulance control staff who have an array of tools and technologies at their disposal to support their decision regarding just which ambulance to send to the current emergency, and the methods that they use to pool their knowledge and experience during times of high workload (Martin, Bowers & Wastell 1997).

As we heard in the last chapter, a deeper investigation of those moments when we are meaning more than we can say in just-so-many-words might provide special insight into some of the hidden knowledges that are playing a role in such settings. In order to gain access to such events - many of which occur for just a few moments, and which are often deeply embedded within a complex social milieu - investigators have turned to the use of audio and video recordings of actual work so that those facets which might have previously gone unnoticed - because of our inability to keep up with the full detail of events as they occur - can be transformed into an explicit topic of study. Two approaches commonly called upon to analyse the data generated by such techniques - and which have shown particular utility for uncovering the hidden knowledges of a setting's members - are the detailed analysis of conversations, which examines the methodic nature of the establishment of a common understanding through talk, and the analysis of interaction, which examines the subtleties of the wider interactional field within which such methodic work occurs.

The analysis of conversation

Whilst a broader ethnomethodological analysis is interested in the methodic work of establishing a sensible social order, Conversation Analysis specifically examines how just-this-conversation is being systematically organised in just-these-circumstances (Dourish & Button 1998, Watson 2009). It treats language as the fundamental form of social action, rather than as an external representation of internal mental states, and so tries not to say more about what it hears than the available data provides for. The analysis of audio or video recordings of members' talk typically involves the creation of detailed annotated transcripts, the aim of which is to expose the microstructure of what has been said to the investigator - such as the location and duration of pauses, overlapping structures of talk, or its prosody (the patterns of rhythm, stress, and intonation) - in order that a deeper sense of the members' procedures that it contains can be achieved (Atkinson & Heritage 1984). Early examples of the application of Conversation Analysis attempted to develop a fundamental understanding of the methodic nature of everyday talk, including:

- An analysis of the taking of turns within a conversation, which was shown to be a methodic procedure for organising the eb-and-flow of talk, and which could be seen to be locally managed, party administered, interactionally controlled, and sensitive to recipient design (Sacks, Schegloff & Jefferson 1974). Further, it was shown that it is in and through the very nature of the turn taking organisation of talk that participants display to one-another that they have understood what has been said - and that such understanding is therefore available to the investigator - and that where misunderstandings did occur the methodic procedures for their repair were also available to a competent observer;
- An examination of what makes a joke a joke, which showed that the discursive nature of telling a joke is a product of its methodic construction in the form of a story, made up of a preface (such as an offer/request to tell), the telling, and an appropriate response (Sacks 1974). Sacks' analysis showed there to be a series of members' procedures for managing both the telling and the hearing of a joke, and that the latter can be viewed as an understanding test: that finding a joke observably-reportedly funny entitles you to membership of the select group who understood the joke to be just-that;
- Investigations into the methodic nature of the production of lists in ordinary conversation, which showed them to have a three-part structure that served as an interactional resource, that was a natural feature of talk, and which was attended to by the conversation's interlocutors (Jefferson 1990). Further, such analysis showed that where members were

unable to provide a third item for their list, a range of methodic procedures exist to account for its absence, such as the use of a generalised list completer (e.g. ‘you know’, ‘etcetera’, etc) to illustrate that, whilst I could only provide two items in just-these-circumstance, as competent members we all know that there are more to be found.

Since its development Conversation Analysis has been applied to a wide range of circumstances and uncovered a vast array of methodic procedures embedded within everyday talk, and which support the establishment of meaning in the here-and-now. In particular, some investigators have applied Conversation Analysis to uncover those members’ knowledges that might otherwise be hidden from the view of those utilising more formal approaches, including:

- An examination of the ways in which telephone operators in the banking sector engage with customers in an effort to get them to make what each of the parties see before them manifest through talk, including the ways in which the operators stepped outside of the institutionally sanctioned scripts in order to establish a common understanding with the customer based upon their personal experiences of common banking artefacts (Rouncefield *et al* 2003).
- An investigation into the use of an ‘Expert System’ to stand in for knowledgeable individuals in a call centre offering telephone support to customers with photocopier problems - supposedly relegating the operator to merely serving as a search interface between the talk of the caller and the text input required by the system - but which showed that operators were bringing a significant amount of their own knowledge to bare on both assisting the caller with articulating the nature of the problem, translating this into a language that the system would understand, as well as solving the actual problem faced by the customer, and guiding the system to the necessary conclusion (Whalen & Vinkhuyzen 2000).
- A detailed examination of the ways in which academics worked with digital images of ancient tablets, animating the document’s features through talk, gesture and gaze in order to bring about particular readings of the text, to instantiate the original scribe, to display their understandings of the act of writing on such artefacts with the tools of the time, as well as to make an array of distinct knowledges manifest, such as their knowledge of latin, Roman history, Papyrology, and Palaeography (de la Flor *et al* 2010).

Whilst such investigations rarely focuses on conversation alone, they amply illustrate the

part that the detailed analysis of talk can play in exposing those knowledges which might ordinarily be excluded from an analysis of such work, as well as its role in showing that information and knowledge do not exist in the abstract, but rather should always be viewed in their sequential contexts of use (Rawls 2008a).

The analysis of interaction

Whilst the detailed analysis of conversations offers the potential to achieve a deeper appreciation of the local procedures through which understanding is being achieved in the here-and-now, some have cautioned against limiting investigations to talk alone, arguing that simply focusing on a series of disconnected conversational fragments can result in a wide variety of contextual information being missed from an analysis, and which can have a bearing on our interpretation of what has been said (Hindmarsh & Heath 2000, Day 2008). A number of researchers have therefore turned to the analysis of the wider interactional field within which talk is embedded in order to understand some of the methodic procedures through which we are able to mean more than we can say with words alone. Proponents of such an approach argue that the knowledges of a particular community are located in the interactions between its constituent members (Jordan & Henderson 1995), and so we should focus on the often unremarked work done by a simple gesture or the subtle changing of the orientation of an artefact as an essential part of achieving a shared understanding within the current circumstances:

‘the body orientates itself in space, social space and physical space, and then it works to orientate objects and perceptions in that space so that the space is socially coherent in recognisable ways’ (Rawls 2002, p. 32).

As with the detailed analysis of conversation, such investigations rely heavily on the use of video recording, which is regarded as the best available - although inevitably impoverished - record of the events as they occurred (Jordan & Henderson 1995), and which allows the investigator to both repeatedly re-view the events as they were recorded, but also engage with other investigators in an effort to understand their full meaning. In order to undertake such an analysis recordings are broken down into vignettes containing the patterns of interaction that are of interest to the study, and analysed alongside transcripts of talk, with the vignettes serving to bring those aspects that cannot be articulated in language into the analysis process. In particular, proponents of Interaction Analysis have also highlighted the important role that it can play in making knowing manifest:

‘knowledge and action are fundamentally social in origin, organisation, and use, and are situated in particular social and material ecologies. Thus expert knowledge and practice are seen not so much as located in the heads of individuals but as situated in the interactions among members of a particular community engaged with the material world’ (*ibid.* p. 41).

Foundational studies that have examined the subtle part played by interaction include:

- Examining the methodic nature of the procedures through which we make the future usability of an artefact relevant in the current circumstances, Zemel *et al* (2007) showed how indexical talk and gesture were combined in order to manage the participant’s access to a range of background knowledges, such as their knowledge of the artefact as it was, as it is, and as it should be. In particular they showed the visible work that a pair of surgeons - in this case a junior surgeon being tutored by a senior colleague on how best to produce a fistula (an enlarged vein) for a kidney dialysis procedure - did to develop a shared understanding of the work that they must do, and how this was both locally determined and interactionally established: such as their transposition of the patient’s arm from the site of their current troubles, to the future time and location of the dialysis nurses who will eventually use it to perform their work.
- In an account of the of the difficulties faced by an apprentice archeologist as she worked to see certain professionally accountable phenomena in the patch of ‘dirt’ before her - in this case the slight discolouration left by a long decomposed wooden post - Goodwin (1994, 2003) examined the methodic work of reifying an object from an amorphous background, through which a senior archeologist guided her vision towards just-this-colour, and just-this-shape. Goodwin showed how the student’s perception must be structured through both the bureaucratic infrastructure of the profession - using standardised colour charts held up against the dirt - and through the micro-interaction of the archeologists as the outline of the vague post is drawn in the dirt using a metal trowel, transforming it into a definite thing. In particular, he highlighted the ways in which the Documentary Method of Interpretation (see section 3.3.4.) is used by the senior archeologist to separate these patches of colour from the background - as examples of ‘post mold’ - and that they in turn became part of that category.
- In an examination of the role played by experiential knowledge in professional conduct, Myers (2008) examined the ways in which a group of molecular protein modellers drew upon their own bodies as a resource for learning about, working with, and articulating the

molecular configurations that are at the centre of their work. She showed the important role that the mobility of the researcher's own body plays in developing their knowledges of a protein's structure, such as the contortions they make in their own form to display the tensions inherent in the molecules they are attempting to understand. Because of its embodied nature, an account of these knowledges is not only absent from the formal record of the molecule as published within the scientific literature, but are in fact missing from the very history of the discipline itself - including its pedagogical material - and must therefore be learnt directly by experience from senior researchers in the laboratory.

The findings from such investigations highlight the essential part that the wider interactional field plays in the establishment and articulation of a shared understanding, and how the moment-by-moment manifestation of such phenomena can easily pass unnoticed. However, by paying special attention to the detailed interactions that support hidden knowledges in action - through the fine-scaled analysis of recordings of work - we can arrive at a deeper understanding of workplace knowing than could be achieved by examining conversation alone.

3.4.4. Responsible investigations

Despite the utility of ethnographically informed ethnomethodology for identifying a range of situated phenomena within the workplace, investigators must be cautious in their application of such approaches as the information that they generate can have a negative impact on both the effective conduct of work, but also a setting's members themselves. As we heard in the last chapter (section 2.3.1), a number of authors have noted that organisational ethnographies can be misused to serve as a surveillance device, exposing previously hidden work in order that it can come under the control of 'Management'. They can also be used as a rebranding or marketing tool to show The Organisation to be a knowledge-based entity, and which can lead to attempts to discard what might be seen as the more unpalatable aspects of the work of its constituent members (Alter 2006, Cox 2007). Others have noted that there is an inherent conflict between the non-interventionist ideals of ethnography, which seeks to understand - but not change - the settings under investigation, and the realities of working in an institutional setting where the primary purpose of generating such understanding is to formulate interventions that will produce certain transformations in working practices (Rouncefield *et al* 1994, Hindmarsh & Heath 2000). As a result of such concerns investigators have certain responsibilities to a setting's members, responsibilities which may come into conflict with the interests of those who have

commissioned the work that they are undertaking on The Organisation's behalf, including:

- To consider the social expectations that inform the interactions between a setting's members, and which can be transformed by the introduction of systems that mediate new kinds of social relationships (Chapman 2006);
- To ensure that any intervention does not serve to negatively distort, suppress, or misappropriate the knowledges of a setting's members, whilst still allowing the clarification, disclosure or appropriation of knowledge to occur when they are used as a force for good (Alter 2006);
- To support the establishment of a voluntary 'economy of sharing', whilst protecting the intellectual property rights of a setting's members, and ensuring their right to privacy (Baskerville & Dulipovici 2006), rather than transforming their knowledges into a commodity to be traded on The Organisation's behalf (Bryant 2006);
- To avoid taking an ironic stance towards members' knowledges, one which sets-up the investigator's own understandings of the technology, its users, or the setting within which it will be located, in competition with those under investigation (Suchman, Trigg & Blomberg 2002);

In the last section we heard that much of the detailed work of ethnomethodologically informed investigations is often supported by permanent audio and video recordings of work, which have - as the costs of recording technologies have fallen - become an ever more practical mechanism for gathering large quantities of primary data. Indeed, it was access to recording devices that enabled such approaches to be established in the first place, for it was only through the penetrating analysis which they make possible that the full detail of the lived work of members' methods could be articulated in a meaningful way. However, some have cautioned that the analysis of practice (even when mediated by video) are '*contingent upon their reading in the context of particular moments of interpretation, informed by particular interests*' (Suchman 1995 p. 58): that all views are a view from somewhere, and the further we are from the work that is done in a given moment the more simplified our conceptions of that work will become. We must therefore be cautious that - as much as is practicable - we are experiencing the setting under investigation first-hand, and not mediated through the interpretations of others. Further, we must ensure that our own interpretations are open to the scrutiny of all of those who will be affected by them, not least of whom are the members of the settings under investigation.

3.5. Summary

In this chapter we have examined a range of approaches to uncovering the part played by the hidden knowledges of a setting's members in pursuit of a deeper understanding of the knowledgable work that they do: the very work that is the target of Knowledge Management's technological interventions. We began by examining some approaches that have taken a more formal stance towards such work, ones where knowing and knowledge are often treated as something which can be addressed separately from the knower and the context within which it is known, and converted into a more portable and palatable form. However, despite their utility for creating appealing representations of knowing within the settings under investigation, we heard how many of these approaches are vulnerable to the same criticisms that have been levelled at other formal approaches: namely that they can lead to the creation of abstract accounts of reified phenomena which can end up telling us little about the ways in which work is actually conducted on a moment-by-moment basis. We then examined Ethnomethodology's interest in uncovering the taken-for-granted intersubjective substrate upon which meaning is constructed in the here-and-now, which it achieves through examining the members' methods through which the ordered properties of social action are established, managed and understood. Here we began to get a sense of the distinctive - and somewhat disruptive - nature of both the ethnomethodological turn, and the nature of the knowledge claims that it makes about the settings under investigation: that whilst the likes of Polanyi and his followers take themselves to have made an empirical discovery about the cognitive mechanisms of knowing itself (specifically tacit knowing), Garfinkel merely claims to have discovered '*an aid to a sluggish imagination*' (Garfinkel 2004, p. 38), something which serves to draw our attention to those aspects of social action that might otherwise pass unnoticed. Finally we examined the practical applications of ethnomethodology to understanding the work undertaken within everyday settings - in the form of ethnomethodologically informed ethnography - and how this offers the investigator a viable mechanism through which to gain special insight into the work done by those knowledges which might ordinarily be hidden from view. In the next chapter we will review an investigation that applied just such an approach to uncovering an array of knowledges that might otherwise have gone unnoticed during an assessment of the feasibility of a new Knowledge Management System.

4. Hidden Knowledges in Action: ‘Doing design’

4.1. Introduction

In the last chapter we examined a number of approaches that have been used by researchers to transform the hidden knowledges of a setting’s members into an explicit topic of study. In particular *ethnomethodologically informed ethnography* was identified as an approach which might be particularly suited to uncovering the part played by such hidden phenomena in everyday work settings; something it achieves by addressing the members’ methods through which they are made manifest during the conduct of the very work that Knowledge Management seeks to support with its technological interventions. As we heard, a number of investigators have used this approach for surfacing the requirements for new technologies to good effect - such as those used to inform the development of Computer Supported Cooperative Work systems - requirements which may not have been explicated through the application of more formal approaches to understanding the conduct of the work of a setting’s members.

In this chapter we will examine a case-study investigation of an international architectural practice that utilised just such an approach, and which centred on the architects’ knowledge of this particular practice’s design philosophy - presented as an example of a tacit knowledge in action - that itself is supported by an array of knowledges which might ordinarily go unnoticed during the requirements gathering process. Here just four of those hidden knowledges are examined within the context of the work of ‘doing design’ across a range of conceptual scales: their knowledge of the artefact currently being specified; their knowledge of ‘the plan’ as it currently stands; their knowledge of the practice’s ever growing corpus of works; and their knowledge of the outputs of the wider profession within which they operate. Specifically, this analysis seeks to examine the influence of such knowledges on the feasibility of implementing a new technological intervention to support the reuse of existing design knowledge in order that we might gain a deeper understanding of the work that might be required to make the explicit resources contained by such a system meaningful, individually actionable, and ultimately organisationally valuable.

4.1.1. Design knowledge

One area where notions of a tacit knowledge have continued to play a significant role is

within the design industries - including, but not limited to architecture - as they have debated the professionalisation of their fields, attempting to fill the epistemological void that is a seemingly common feature of a discipline's evolution (Abel 1981, Cross, Naughton & Walker 1981, Friedman 2000) (much as many within Knowledge Management have attempted to do, see Cook & Brown (1999), Boisot & MacMillan (2004) for example). Here a tacit knowledge is typically associated with the creative intuitions of individuals and their ability to formulate novel solutions to the wicked problems faced by designers of all creeds. However, as in many other disciplines - not least of which is Knowledge Management itself - there is enduring discomfort with reliance on such intangible phenomena, and so there are those who have sought to transform the tacit knowledge of the disciplines' constituent members into an explicit product. Those wishing to develop such formal accounts of design work do so by attempting to establish an ontological distinction between practices and the tacitly held rules that are thought to cause those practices: that each-next-instance of a given practice is the result of the application of a rule - rules that can be exposed and encoded into instruction-sets. These explicated instruction-sets can then be called upon to inform the education of the next generation of designers, or analysed using the tools and techniques of the Natural and Social Sciences in order that work practices can be standardised, and processes & procedures optimised.

As we heard in the previous chapters, some have argued that it is the patterned appearance of such work that can lead observers to believe that there is a shared set of underlying rules which can be made explicit, and it has been noted that the same mistake has sometimes occurred with respect to the treatment of the knowledges of the design disciplines: that there is always more to a design than can be found by examining the articulable reasoning that went into its production (Abel 1981, Buchanan 1985). In particular, claims about the possession of a tacit knowledge have been used to fend off attempts by those wishing to develop more formal accounts of the creative work of designers, such as following the likes of protocol studies (Cross 1982, Schön 1988, Purcell & Gero 1998, Friedman 2003, Van Aken 2005), or the formulation of detailed design rationales (Regli *et al* 2000). Further, some authors have responded to such attempts by pointing out that in order to formulate a 'science of design' there must be a stable conception of its disciplines' knowledges - something which does not yet exist - and that following the work of the likes of Kuhn and Polanyi, notions of the practice of the Natural Sciences as strictly adhering to such ideals has in fact long since been abandoned (Cross, Naughton & Walker 1981).

4.1.2. Design knowledge reuse

It is already well established that the likes of architects rarely work from a completely blank canvas, but rather have an array of existing resources upon which they draw when creating a new design - not least of which are those that they themselves have created in the past - and which contribute to the form of their current efforts (Büscher *et al* 2001, Schmidt & Wagner 2004). This active reuse of existing designs can inform the design process in a number of ways, including 'evolutionary design', where a design is largely copied from a previous work, and 'variant design', where existing designs are used as exemplars for new ones (Van Aken 2005). Indeed, some authors have estimated that 20% of a designers time is spent searching for and absorbing existing information, most of which comes from personal repositories (Baxter *et al* 2007). Researchers with an interest in supporting such activity have taken a number of approaches to addressing the reuse of existing design knowledge, including:

- Those that attempt to capture the rationale for why just-this-artefact was designed in just-this-way, including the deliberations, reasoning, tradeoffs and decisions that went in to its production (Moran & Carroll 1996, Regli *et al* 2000);
- Those which examine the essential role that 'meta-negotiations' play in formulating and reusing a design, investigators arguing that any captured information should at the very least have pointers to these wider discussions (Lutters & Ackerman 2007);
- Or those who have argued that design reuse largely takes place through social knowledge networks, and that even where there are existing repositories of information, access to them is often facilitated by 'knowledge intermediaries': individuals who possess an intimate knowledge of the repository's contents and who help to re-contextualise them for the work at hand (Markus 2001 , Demian & Fruchter 2006).

In all of these investigations the focus has been on the capture, management and retrieval of static information objects within technological infrastructures - typically in the form of individual Computer Aided Design components - something which is achieved by stripping away what is considered to be non-essential information about the work involved in the artefact's original creation. However, there is increasing concern within the knowledge reuse literature regarding the interplay between the original contextualisation-work that occurs during the moments when a new solution is created, the decontextualisation-work that typically occurs as an informational representation of those experiences or their product is

generated so that they can be recorded on some substrate, and the re-contextualisation-work that must inevitably be done by those attempting to reuse that information to inform their own efforts in the future (Bannon & Bodker 1997, Markus 2001, Reddy, Dourish & Pratt 2001, Ackerman & Halverson 2004, Lutters & Ackerman 2007).

4.2. ‘Hamptons’

The focus for this case-study is a mid-sized international architectural practice with offices in the UK and Middle East, and which will be known throughout as ‘Hamptons’. The practice employs approximately 150 staff within its ‘design team’, approximately half of whom are Architectural Assistants: those still part way through their seven year training to become fully qualified architects¹. Since being formed in the mid-1970s the practice has accumulated a comprehensive corpus of award winning designs and is well known for its innovative, design-led buildings - predominantly in the ‘Hi-tech’ or Structural Expressionist style² - which place it very firmly on the architectural map. A number of books have been published about the practice’s works, - including two volumes presenting its corpus of designs since its inception, as well as a biography of its founding partner - and it appears regularly in the architectural press as new contracts are awarded, buildings are completed, and awards and accolades are won.

The practice has two main offices, in London and Middle East (the Middle East office also has two project specific satellite offices), with the London office - where the majority of the fieldwork presented here was undertaken - being situated in the city’s Marylebone district, close to both Marylebone tube station and Paddington railway station. The surrounding area is quite leafy, with a number of small parks close by - including Regents Park a few minutes walk away - and is largely residential with a mix of London brick terraced housing and tenement blocks, with a diverse social and ethnic mix. The road on which the practice is located is typical of the area with a mix of residential and small office use, as well as the occasional specialist shop, whilst immediately opposite the practice is the back of a theatre school, itself with an impressive list of famous graduates. The practice’s office is overlooked

¹ In the UK training to become an architect takes a minimum of seven years. Three spent in university, followed by a year in practice (Part I), in turn followed by another two years in formal education (Part II). Finally a further year of practical experience followed by a final series of examinations (Part III).

² Structural Expressionists choose to ‘express’ the underlying structures of a building, rather than hiding them behind a facade. This practice is particularly well known for achieving highly refined details from the underlying materials from which the building is constructed.

on all sides by the surrounding buildings and is located on the site of a former clothes factory. The site was bought by the practice in the mid-1980's and initial redevelopment involved the demolition of some of the existing structures and the erection of an office using a modular prefabrication approach developed by the practice (now known as 'building one'), and which uses manufacturing techniques imported from the aerospace industry. At that time the practice was made up of some 20 staff and as it grew more structures on the site were demolished and a second building erected behind the first (known as 'building two'). This building also uses the same modular system, although it was recycled from another development that was no longer required. As the practice grew further two mezzanine areas were added to building one (both buildings have very high ceilings). 'Building three' at the rear of the site is a brick structure that contains the practice's 'model shop' (the team responsible for creating three dimensional physical renderings of the architect's designs), kitchens, print room and IT services. The layout and airy style of the buildings engenders a 'campus' like feel, with the division of the practice between the three buildings giving the sense of an archipelago linked by a bridge: a white tensile-fabric covered open-air aisle way that runs along one side of the buildings, which themselves are separated by small gardens within which meetings are held during the summer months.

Because of the modular system used for their construction there is a slightly industrial feel to the buildings, with the majority of their structural elements exposed (the defining feature of the structural expressionist style). The interior of buildings one and two have a high-tech, spacious feel, with the North-west and South-east walls of the 6-8m high cuboid structures being entirely made of glass, as well as having large glass panels in the flat roofs. Both buildings are open-plan making it possible to see right across the space from any location, although the mezzanines in building one mean that those on the higher levels have an obscured view of the ground floor and vis versa. Noise levels in the office areas are generally quite low, often with a general murmur of conversation punctuated by the ringing of phones, calls across the office, and occasional bursts of laughter. The international nature of the practice is evident both visually and in the broad range of accents (and occasionally talk in a foreign tongue when two people who share the same native language come together). Overlaying the sounds of the office are those coming in from the street outside, through the often open windows in the walls and ceiling, including traffic passing on the street and the sound of children playing and singing in the adjacent theatre school.

The practice's architects are distributed throughout buildings one and two, with a desk

arrangement of facing rows with 3-4 on a side and no physical partitions between individual desks or rows of desks. The desks themselves are relatively small in area, with each containing a high resolution 19" LCD monitor, optical mouse, keyboard, basic office telephone and an angle-poise lamp (often fitted with distinctive blue daylight bulbs). Many desks have small desktop fans as it can get quite warm in the summer months (there is no air conditioning in the buildings). The desks are generally quite cluttered with various bits of stationary equipment (hole punches, stamps, pots of pens, etc) as well as various piles of paper (some of which are quite impressive in size), books and folders of various shapes and sizes. Many desks are littered with post-it notes, whether on their surface or stuck to the edges of monitors. The majority of the staff have high powered Windows PCs, while some have Apple's OSX based systems, and a few have both. The architects have a range of software available to them including the Microsoft Office suite, Microstation (their chosen Computer Aided Design package), as well as more specialised applications such as Rhino (a 3D modelling program). There are also a number of networked resources available to staff including a basic Intranet (including a simple but attractively designed corporate directory), networked file storage, an online photo library, as well as unrestricted access to the World Wide Web (during the period of the research there was heated debate about whether to continue allowing access to social networking sites). The IT services are outsourced to a small provider who specialises in supporting architectural practices, and whose owner was once a member of this practice. The printing services are outsourced to a large commercial printing provider who has on-site services in building three.

Of the approximately 180 staff employed by the practice, just under 100 of them are located in the London office (the remainder are located in the practice's offices in the Middle East). The majority of the staff are architects or architectural assistants, with those who don't fit into these categories undertaking support roles such as model makers, project administrators, human resources functions and cleaning staff. The practice has a well defined hierarchical structure, with the its founders (a husband and wife team) serving as chairmen, whilst a managing director leads the day-to-day running of the business. There are 11 Directors that both lead teams of architects, but who also have responsibility for various aspects of the business, such as disaster recovery, health and safety, public relations and IT. Each director is responsible for managing a team of architects made up of Project Directors (the most senior position), Project Architects, Architects (those who have most recently qualified as architects), Part III Architectural Assistants (those who have completed their institutional-based training and are now working towards their practice-based qualifications)

and Part I Architectural Assistants (those who are on their year-out between periods of institutional education). Directors sit amongst their teams and take a very hands-on approach to leadership, both in terms of people management, but also thought leadership, and in particular the direction that designs take down to their finest details.

Every new design undertaken by the practice is treated as a distinct project, each being owned by one of the practice's Directors. Architectural projects have a well defined life-cycle, with 11 distinct stages that are specified by UK architecture's governing body, the Royal Institute of British Architects: Preparation (stages A & B), Design (stages C, D & E), Pre-construction (stages F, G & H), Construction (stages J & K), and Use (stage L). A practice can be called in at any point in this life-cycle and may only be responsible for a limited number of the subsequent stages, with other stages often being completed by other practices. Not all projects succeed however, and at any one time the practice will be working on a number of designs that will not make it to fruition; common causes of failure including funding problems before the construction phase of a project, or the practice simply not winning the open design competitions which are a common mechanism for architect selection (but which means that they must do significant work to produce a competitive proposal). Each Director is typically responsible for 2-3 large projects (although they may also be running a number of smaller 'boutique' projects as well) and as these projects move through their stages the size of the Director's team expands and shrinks accordingly.

Unlike the striking London office, the main Middle East office is in a nondescript building within an industrial estate on the outskirts of the city centre. However, on the inside - and away from the astonishing heat - the architects, some of whom have transferred from the London office, have gone to great lengths to create an environment that has a very similar feel to that of the UK office. Like the London office there is a very international mix to the office's membership, although here it is centred more on South and East Asia, but with a relatively small number of Arabic speakers. The whole United Arab Emirates region is in the midst of a high-rise boom, and so architects have flocked to the city from all over the world for work, making it easy for the practice to grow to meet the demands of its rapidly expanding portfolio in the area. However, unlike those educated in Western architectural schools, few of those joining the Middle East office through local recruitment agencies have any sense of the practice's heritage, either in terms of it being a well established business in the UK, or its contributions as a design leader and part of the Western architectural education curriculum.

4.2.1. Research approach

Initial access to the setting was gained through the sponsor of this case-study - the Chief Executive Officer of a Knowledge Management consultancy - and his friendship with the Managing Director of the practice. At the start of the project a meeting was set up with the practice's IT management group and a short presentation of possible interventions was made by the sponsor. This led to an invitation to the bi-monthly IT Strategy meeting later that afternoon, at which two architects were present, and with whom return visits were arranged. During these first visits to the practice a number of semi-structured interviews were conducted with staff fulfilling a range of different roles (both from the administrative and design sides of the business), with guiding themes centring on the ways in which the interviewees maintained awareness of the workings of the practice, as well as any problems that they faced in their day-to-day work. The aim of focusing on these particular themes was to begin to get a sense of any troubles that the staff themselves faced in going about their work, and which might be amenable to improved technological support. Once a base-line understanding of the work of the practice had been established further visits to begin ethnographic observations with the practice's design teams were arranged in order to get a deeper sense of the mundane realities of 'doing design' in this particular practice.

In total some 40 visits were made to the practice's offices in the UK and Middle East over a 12 month period in order to attend meetings, undertake interviews, gather observational data and present findings. Data was gathered in a number of formats including handwritten ethnographic field notes, audio recordings of semi-structured interviews, video recordings of work practices, and a number of internal documents provided by the practice. Field notes were recorded during each visit, broadly based on the following criteria: physical setting, sound, positioning and mobility, what are people doing, their roles and responsibilities, tools, artefacts and equipment, appearance, key events, patterns of interaction, and resources (Heath *et al* 2003). Where observations or video recording were being undertaken permission from individual teams was sought in advance by email through the team's administrator or manager, and site visits were made intentionally low-key in order to minimise observer effects. For physical observations a spare desk was sought in the team's work area from which the author quietly observed the day's activity, engaging the architects in discussion where the meaning of events were unclear. Where video recording was being undertaken the camera was set up in a corner overlooking a particular team prior to their arrival first-thing in the morning, checked at lunch time, and then collected at the end of the

day. Prior to analysis, the daily video streams were edited into vignettes of between 30 seconds and one and a half hours, based upon the perceived bounds of the interaction. In all some 700 vignettes totalling approximately 46 hours of video data were identified from 17 days of recording. Any information sharing activity found within each vignette was assessed for its potential contribution to the research and assigned to general themes (e.g. manifestations of their knowledge of artefacts, etc). Vignettes selected for further analysis - those containing strong examples of particular themes and of suitable audio quality - were then transcribed based upon the standard Conversation Analysis notation (Atkinson & Heritage 1984). Both the act of transcription, and the transcripts themselves, were then used to facilitate detailed re-analysis of the vignettes as understanding of the work of the architects grew.

4.2.2. 'The plan'

Early into the year long period of fieldwork at the practice, members of the senior management team expressed an interest in establishing a catalogue of 'design details' that would enable them to reuse existing Computer Aided Design (CAD) components within new projects. The informal reuse of existing designs is already a well established activity within the practice and includes the reuse of both the design concept (e.g. the general look and feel of an artefact or its technical properties), as well as the transfer of actual CAD objects from one plan to another (although these are often heavily modified after the initial transfer)³. Given that the specification of highly refined design details is one of the core competences of this particular practice, the formalisation of this activity within a design reuse system was seen as one of the ways in which The Organisation could maximise its return on its investment in these valuable intellectual assets. This was particularly important as they expanded their operations abroad, where access to appropriately qualified staff can be more problematic⁴. Specifically it was anticipated that any system would:

- Reduce the time spent producing/re-producing design details, ensuring that staff were not 'reinventing the wheel' each time they began the formulation a new component;
- Mitigate the effects of staff turnover, particularly in the lower echelons, and the sense that

³ Each element in a CAD drawing can be separated from the design as a whole, meaning that it can literally be copied from on drawing and then pasted into another.

⁴ Appropriately qualified here refers to staff that have the creative abilities associated with architectural design at this level, rather than simply the technical competence associated with being an architect.

those departing the organisation took with them their hard-won experience and understanding of formulating the design details on which they had worked;

- Support ‘new starters’ in the work of formulating design details that were in-line with the practice’s distinctive approach by providing them with faster access to its existing corpus of designs, whilst at the same time providing sufficient contextual information that users might get some sense of the background to a given component.

For the purposes of investigating the feasibility of implementing such a system within the context of this particular practice the focus was on the production of ‘*the plan*’: the collection of drawings, renderings and technical information that, at any point in time, stands in for the yet-to-be-constructed-building. From an analytic perspective ‘the plan’ is a particularly interesting artefact, and may be characterised in a variety of ways, including: as an ordering system (Schmidt & Wagner 2004), in that it coordinates work both within the practice and further afield; as a boundary object (Star & Griesemer 1989), in that it translates between the differing perspectives of its various stake-holders, and in particular its role in transmitting the architect’s imagining of the-building-as-it-will-become to those who will eventually make it manifest; and as a quantum of organisational memory, in that it serves as the formal record - and often the first port-of-call - for those wishing to look back on the work that was undertaken during the formulation of a completed design. During its production the plan has many manifestations - rough sketches in ubiquitous blue notebooks and on cheap tracing paper, digital CAD files, plastic and wooden scale models, 3D digital renderings, animated fly-throughs, large format paper plans, etc - but in its final iteration it takes the form of a bound set of paper drawings and technical documentation that meets the contractual and legislative responsibilities of the practice for the design that they have created. However, even this representation is just a snapshot in time, as the building will continue to be altered during both its construction phase and throughout its lifetime, based on the requirements of its various and inevitably temporary stakeholders - and much to the consternation of the architects!

Within the context of this particular practice a number of traditional file servers currently fulfil the role of storing the work of the architects, with the ‘design server’ hosting active projects and a read-only ‘archive server’ hosting completed projects. The practice’s older projects are only available as paper documents and space considerations force these to be stored off-site, making it unattractive to call upon them on a regular basis. There are various disparate routes through which existing designs might be discovered, but the most common

is to ask those with whom you sit if they know of any suitable components and their location, or know anyone else who might. This search invariably leads to a senior member of staff who was involved with the relevant project (most senior architects have worked their way up through the practice's hierarchy), and who then helps with the location and re-contextualisation of the component of interest. However, asking people for help in this way does not scale in today's globalised companies, and so Organisation's - through its Knowledge Management interventions - seek to separate the key elements of any reuse system from the individuals who were responsible for their initial formulation. This is also the case in this particular practice which has - as it has continued to grow and establish itself internationally - struggled to maintain the consistency and quality of design for which they are known and rightly proud.

4.2.3. Doing design

Whilst the work of a modern architect is varied, the point at which they are most 'being an architect' is whilst 'doing design': formulating individual 'design details' and adding these to 'the plan'. Doing design occurs across a range of spatial and conceptual scales, from the look-and-feel of the site as-a-whole (such as the way a set of buildings might influence a public space), the formulation of a particular space within a building (such as an atrium), right down to the fine detail of individual components (such as the formulation of a window frame). Each of these must be 'detailed up': transformed from conceptual constructs - represented by conversation or ad hoc sketches - into formal Computer Aided Design representations which can then be added to the plan. Whilst doing design is only part of a modern architect's role - a significant proportion of their time is spent as project and information managers - it is the point at which they are most able to express the artistry that they see as the defining feature of being a 'good architect'.

A common locus of design activity is the conduct of design reviews, during which two or more architects come together (either physically, over the phone, or during a video conference) in order to discuss the current status of a design, and identify any changes that might be made to it. Design reviews are a common occurrence in the practice and take place across a range of organisational scales, from discussions between Architectural Assistants struggling to make an original contribution as they learn the 'Hamptons way', groups of

senior architects reviewing each other's work in formal - and sometimes combative - 'crits'⁵, through to Directors seeking counsel with the practice's founder about the underlying intent of a design. A wide range of issues can be raised during design reviews (e.g. technical, political, material), but here we focus on design issues, and in particular whether the design-as-it-currently-stands can be considered as a suitable candidate for the practice's burgeoning corpus i.e. is it recognisable as a 'Hamptons building'.

In the following sections an analysis of a series of fragments of audio and video data is presented, the aim of which is to examine the locally accountable procedures through which this particular group of architects work to contextualise the particular aspect of the plan on which they are currently focused. Specifically we will examine the situated and contingent work of formulating designs within the context of design reviews, as the primary circumstance of a design's specification, the role played by four knowledges which might ordinarily go unnoticed during the gathering of requirements for a new technological intervention (their knowledge of artefacts, the plan, the practice's corpus of works, and those of the profession as-a-whole), and which themselves support an individual's tacit knowledge of this particular practice's underlying design philosophy.

4.3. Knowledge of the artefact

At its finest scales the work of doing design involves the specification of a vast array of individual artefacts that will be made manifest by as many manufactures, and eventually pieced together on-site to form the building-as-it-will-become. Each of these artefacts must be skilfully imagined, carefully drawn, their technical properties specified in three dimensions, materials for their construction selected, and then they must be placed into their proper location within the plan as-a-whole. In modern design environments such activity is the work of doing design in its most elemental sense, and typically finds form as a series of extended periods of solitary activity as the architects work silently at their computers or scribble on sheets of tracing paper placed over previously printed versions of the artefact, punctuated by short periods of often intense and detailed discussion with colleagues as they negotiate the true nature of just-this-artefact.

⁵ Crits are an important part of architectural education and take the form of the presentation of a building's design to one's peers, who then critique the design in a public forum (Webster 2005). Here it is suggested that such crits continue to be an everyday part of an architect's working life throughout their careers.

4.3.1. 'Let me go and detail that up'

'Detailing up' is the work of formalising the digital representation of a design at its finest spatial and conceptual scales. Proposed or existing designs are discussed at length and in great detail at the desks of individual architects, in small groups huddled over one of the meeting tables scattered throughout the practice's offices, or around a poster-on-the-wall; and then one of the architects, typically the most junior, is sent to make the necessary changes to the CAD (Computer Aided Design) drawings so that the plan can be updated. In the following fragment we observe just such activity as a senior architect discusses the formulation of a design with a junior member of staff in order that the plan might be amended. The project on which they are working - an extension to a large UK university campus - is already well advanced, and they are now in the process of providing fine scale, detailed drawings to contractors in order that the building's individual component parts can be manufactured.

We join the conversation as the architects - one a Project Director (P1), the other a part III Architectural Assistant (A1) - discuss an artefact about which they are currently embroiled in an ongoing debate with a contractor, via a series of meetings, telephone conversations, and emails. The 'down-stand' is part of a sliding triple-glazed window frame, and its relationship to the frame's other components - primarily the track along which the window will travel when being opened, and the column to which the frame will be affixed - needs to be represented accurately in the architect's CAD drawings if the artefact is to be manufactured to their exacting specifications. This artefact is typical of those that the practice would like to store in the proposed reuse system as it is - at first sight - a generic component that can be found in many designs, but also one that absorbs valuable staff time during each-next-formulation.

P1 has a particular formulation of the artefact that he would like to see represented in the plan (the down-stand underneath the track), but in order for this to be made clear to the contractor he must first ensure that A1 shares his understanding: for it is he who will ultimately make the necessary changes to the plan's CAD drawings. As the conversation progresses it becomes clear that A1's understanding of the artefact is not in-line with that of the senior architect, and so P1 attempts to outline what he sees as the current state-of-play, based upon the various representations that are already in existence. He attempts to achieve this telling of his understanding, both verbally, through description, but also gesturally, using the fingers of both hands to illustrate where the various components will meet, as if they

01 P1 on the sketches (0.4) on the sketches we've been looking at
 02 (0.4) the angle the other way up (1.2) the end of the toe (0.2)
 03 would give you an on line with the end of the track
 04 (0.6)
 05 A1 yeah (0.8) but we're not=
 06 P1 =so if you flip it=
 07 A1 =but we're not flipping it (0.6) we're flipping it (0.2) and then
 08 (0.2) flipping [it again
 09 P1 [yeah
 10 (1.4)
 11 P1 but the end of that toe was (0.2) in thin air:: (1.0) over the edge
 12 of the slot (0.4) definitely (0.2) you could put it - turn it
 13 up-side-down an- you can bring (0.2) the: (0.4) down-stand under
 14 the edge of the track (1.6) on: the sketches we were looking at
 15 (1.4) on your sketches (1.2) check the sketches (0.4) can you just
 16 check that that's actually true

Fragment 1.



Figure 1. A1 illustrates how they are not flipping the down-stand in both the vertical and horizontal planes using rotating motions of his hands.

were in the air in front of them (fragment 1, lines 1-3). However, A1 resists P1's conception of the artefact's configuration (lines 5 & 7) and, using rotating motions of his own hands to instantiate an alternate version of the artefact, attempts to give an account of his own understanding. In particular he attempts to show how they are not flipping the down-stand first in the horizontal, and then in both the horizontal and vertical planes (lines 7-8, figure 1). Despite A1's offering being an attempt to articulate a different understanding, P1 actually agrees with his point, and then uses it to reinforce his own: that in the current configuration the end of the 'toe' was in thin air over the edge of the 'slot', and that you could therefore

turn it upside-down and bring the down-stand under the edge of the track (lines 11-16).

In this fragment we can see some of the subtle mechanisms through which the-design-as-it-currently-stands, as well as the-artefact-as-it-will-become, is made manifest in the current circumstances. Specifically we see how, through talk and gesture, their actions animate the artefact they 'see' before them, it being difficult to tell whether A1's rotating hands are holding the artefact, or they become the actual artefact itself. These three dimensional ephemeral renderings of the artefact stand in stark contrast to the others that they have available to them, in that they are either limited to two dimensions - such as the hand-drawn sketch that A1 will later work on once their understanding has been aligned, and which will be passed back and forth across the desk as work on the artefact continues - or in the form of literal descriptions - such as in the emails that have gone back and forth between the artefact's various stakeholders. Further we see how these representations do not stand in for the artefact in abstract, but rather the architects attempt to instantiate some of its specific technical properties, such as the actual placement of yet-to-be-manufactured components in a yet-to-be-created three dimensional space.

4.3.2. 'It's the sort of detail that you may not see anyway'

In following fragment we join one of the practice's Directors (D1), together with one of his Project Directors (P2), as they discuss a design that is currently well in to its construction phase. P2 has returned to the office after visiting the site of the building's assembly during the previous day, and the two architects have an informal early morning meeting to discuss the current status of a number of facets of the-building-as-it-currently-stands, juxtaposing them against the plan as it was drawn-up by them. Specifically their conversation focuses on an aspect of the design that uses a mixture of wooden frames and zinc coated panelling, something which they were concerned might not produce the desired affect when actually constructed. During his visit to the site P2 took a number of photographs on one of the practice's digital cameras and, as they discuss the previous day's findings, they huddle over D1's laptop, browsing through the images that P2 placed in the project's shared folders on the practice's design server.

Both architects have had direct contact with the contractor responsible for making this particular aspect of their design manifest, and they are especially concerned as to whether he has gone on to build what they agreed with him in prior discussions, and specifically whether the artefact that they now see on the screen before them has been 'built as drawn'; both by them in their formal drawings contained within the plan, but also in the contractor's

sketches which were produced during subsequent discussions about how their imaginings of this aspect of the plan might finally be made real. As we join the conversation they are navigating their way around the artefact - by way of one of the images on D1's screen - and collaboratively working towards a common understanding of the-artefact-as-it-currently-stands, as well as the changes that might be applied to it in order to bring it back in-line with their original aspirations for it.

At this point in the conversation their discussion is focused on a joint that runs along one edge of the structure's zinc panelling, and the part that its placement plays in achieving the overall aesthetic affect of the artefact. In response to the discussion so far D1 uses his current conversational turn to set out his vision for how the artefact before them might be reconfigured in order to achieve the desired result. However, neither the nature of this final aesthetic, nor the adjustments necessary for its achievement, are ever spoken out loud, but rather find form in a series of intricate sketches that he makes over the top of the digital image of the artefact projected on the screen before them, using the index finger of his left hand. This performance, which creates a 14 second break in the conversation's talk (fragment 2, lines 3-4), and which is set up with the conversational tag 'you know' (line 3), is followed with a brief 140 degree twist of his head and body towards P2, who has remained silent and still throughout. D1 closes his turn with a question regarding whether some of the constraints of the approach used to manufacture the join might have informed what they now see before them, again fleetingly pointing towards the image to highlight what the product of those constraints might actually be (line 4). However, P2 only offers a cursory response to this request, and instead - reaching across the desk in front of D1 - he begins to outline his own thoughts on how the artefact before them might be reconfigured. In particular he focuses on how the sheet of metal could be cut differently in order that a better seam might be produced. The nature of this new seam demonstrated with the use of his right hand held in front of the image on the screen, coinciding with the use of the words 'seam over' on line 13, and taking the form of a curling action of his fingers as he physically folds the metal over to form the desired result (figure 2).

In this fragment we begin to get a sense of the ongoing malleability of the building that the architects have worked hard to design, even as it is constructed, and the work that they must do to ensure that their imaginings of the-building-as-it-will-become - as represented by the plan - will be taken account of by the myriad of contractors who work to make it manifest. In particular we see how the aesthetic qualities that they wish this specific artefact to

001 D1 I mean its the sort of detail you may not see anyway but (0.4) I
 002 think your right to get (0.8) either (1.2) either to get that joint
 003 moved up (1.0) ther:e so that it (0.6) you know (11.4) [unheard]
 004 (2.2) but is these (0.2) appear (0.2) these limits on things
 005 (0.8)
 006 P2 well (0.4) ye::s (0.2) I mean I think that (3.6) what I was
 007 thinking (1.8) was that (1.6) okay: (0.2) thats (0.4) thats not the
 008 greatest joint (.) but I think they can do better than that (0.8)
 009 and actually that dimension there: (0.6) you can get out of a sheet
 010 (1.8) so you could cut
 011 (2.0)
 012 D1 yup=
 013 P2 =a one piece verge (0.2) that you then seam over (0.4) so that this
 014 starts just behind it (2.6) so that (0.6) ok=
 015 D1 =[I know
 016 P2 =but you get joints anyway

Fragment 2.



Figure 2. P1 demonstrates the curling that the mental will have to undergo in order to create an acceptable seam.

engender, as well as the reconfigurations that must take place in order to achieve them, need hardly be said out loud when in the company of other competent members of the practice; needing nothing more than a series of finger sketches over a digital image on a computer screen or the curling action of a hand in order to create a shared understanding of how they might go on. Here we also see a common feature of the work of these particular architects:

their ongoing concern for the finest details of their design, even those aspects which may never be seen by the eventual users of the-building-as-it-will-become: '*I mean its the sort of detail you may not see anyway*' (line 1). Such concern for the design's hidden aspects is a common characteristic of the discussions held throughout the practice, and something that the architects themselves often acknowledge during the course of their work, but which they see as an essential part of being a competent member of this particular practice.

4.3.3. Talking with your hands

In the absence of the-artefact-as-it-will-become the architects must call upon the resources at-hand in order to make its current and future status manifest within the mundane flow of their current work; be it through talk, their bodies, rough sketches on the cheap tracing paper that litters the office, the formal CAD representations which are the final output of their work, or even digital photographs of the artefact-as-it-currently-stands. In particular, here we see two examples of the essential role that the architect's own bodies play in animating aspects of their knowledge of the artefact that might ordinarily be hidden from an investigator's undirected gaze: their detailed knowledge of the configuration of the-design-as-it-currently-stands and their imaginings of the-artefact-as-it-should-be.

A number of authors have noted the important role that the body plays as a resource for the production of knowledge (Star 1992), including the limitations of natural language in getting across one's understanding of complex, three-dimensional structures (Myers 2008), such as those being discussed by the architects. In such circumstances the body becomes the representative medium through which the nature of an artefact is enacted for all competent members to see, and here we saw the ways in which the architects reconfigured their own bodies in order to motivate a specific understanding of the artefact's properties: its positioning in three dimensional space, or the ways in which it must be folded in order to create a seam of the desired aesthetic quality. In particular we can see that this subtle 'body-work' (*ibid.*) provides the architects with an effective mechanism for meaning more than they can say in-just-so-many-words, something which passes as an unremarked aspect of their establishing and displaying their knowledge of just-this-artefact.

Some have noted that ethnomethodologically informed approaches enable the observer of such bodily movements to place them into the context of the wider intersubjective 'lifeworld' within which they occurred, and through which a deeper understanding of their meaning might be established (Wieder 1980). Here, our observations of this unspoken work, and the contexts within which it occurs, highlight that in order for the architects to have a

meaningful interaction about the detailed nature of the artefacts that they are working together to design they must hold an array of knowledges in common, including an understanding of the processes of design and manufacture, as well as the ways in which the artefact is expected to behave or appear in its final manifestation. However, it must also be remembered that the artefacts that they are working here to specify in great detail may never be experienced directly by them in any of their iterations - if indeed they are ever made manifest - for they will be manufactured some distance from their current work, both physically and temporally, and the architects themselves will likely have moved on to other projects or practices by the time they are actually placed into their final positions.

4.4. Knowledge of the plan

As has already noted, ‘the plan’ is the set of artefacts and representations that stand in for the-building-as-it-will-become, and which serves as a device to co-ordinate the work of the architects, to communicate that work to various other stakeholders (e.g. the large number of contractors who will ultimately manufacture the building’s individual components and bring them together on-site), as well as function as the primary record of that work for those looking back on the project in the future. As a result, being able to formulate and demonstrate an understanding of the plan is an important part of presenting oneself as a competent member of ‘the team’ and much time is dedicated to remaining well informed about the plan’s current state-of-play.

4.4.1. Calling on ‘the plan’

The following fragment is from a formal design review conducted at the practice’s offices in the Middle East, which occurred during a visit to the region by Hamptons’ Managing Director. The design under discussion is a very large and high profile project located in the same city as the office, and which is made up of a number of individual buildings distributed across several acres, including conference centres, residential and retail units, as well as a number of hotels. The plan is already well advanced and construction work on the first phases of the project are underway. Present at the review are the practice’s Managing Director (MD), the Director in charge of operations in the Middle East (M1), and two mid-level architects who have been heavily involved with this particular design’s formulation (A1 & A2). This design review spanned some one and half hours and focused on the facade, atrium and associated street-scape of a single mixed-use building. Whilst already well developed, the detailed design of the building is still not finalised, and therefore still open to

quite substantial changes, either instigated by the architects themselves, or one of the many other stakeholders in the project (including the local client, his numerous advisers, as well as a number of other organisations who have a stake in the project).

Up until this point in the meeting there has been detailed discussion about the street-scape alongside the building that is the current focus of their attention, and how they would like to develop this as a street café to be used during the cooler periods of the year. We join the conversation as the architects who are based in the Middle East office are bringing MD up-to-speed on one particular aspect of the design: the positioning of some canopies that will be affixed to the outside of the building in order to provide a shaded seating area. However, MD is having difficulty conceptualising the positioning of a canopy that will be used to protect the area from the searing sun, and in particular its location on the two dimensional drawing of the building that is laid out on the desk in front of him. In response to MD's request for help (fragment 3, line 1) the others present first turn to the drawing, two of the architects (M1 & A2) reaching in to point directly at it, the third (A1) leaning across making as if to point too, but then retracting his hand as the others dive in (lines 3-5).

At this point MD indicates that he has located the canopy, apologising as if the responsibility for their troubles was his alone (line 6). Meanwhile M1 turns to the model on his right, still with his left hand on the drawing, and begins to illustrate the location of the canopy in three dimensions using his right hand in relation to the model (line 8). He then returns to the drawing on the desk with both hands before turning to his left and, now leaving his right hand on the drawing, begins pointing towards the posters-on-the-wall at the back of the room, encouraging MD to direct his attention there (lines 8-10, figure 3), MD turning to look at these, before looking briefly back at the model. Meanwhile M1 has moved away from the table in order that he can more clearly point towards the-poster-on-the-wall, although this is still some distance away (line 12), before returning again to point at the drawing once more (line 15). Whilst this has been occurring A2 has been rummaging through a pile of illustrative three dimensional renderings of the building to MD's left and, as the focus returns from the-poster-on-the-wall, he is ready with an example of the-building-as-it-will-become, which illustrates the eventual location of the canopy. MD glances at this before raising a question about the level of the canopy (lines 20-21), indicating that, now at least, he is sure of its location.

In this fragment we have seen the important role that pointing with one's hands plays - when combined with talk and the artefacts at hand - in both making one's knowledge of the plan

01 MD hang on (0.2) so where's the canopy here
 02 (0.4)
 03 M1 erm: (0.2) in there (0.2) wh ĩ ere that
 04 A2 ĩ where there's a green edge=
 05 M1 =whe - whe - so this is li ĩ ke - parisian (0.6) so we're out here
 06 MD ĩ oh:: sorry (0.4) there's a canopy
 07 (0.4)
 08 M1 there's a lower canopy coming out here (0.2) right (0.8) and then
 09 (0.4) which (0.2) if you look up on the wall there (0.2) on the
 10 middle [page] (0.2) there
 11 (0.2)
 12 M1 let me just wa ĩ lk [over there] so you can see it
 13 MD ĩ yeah - yeah (0.2) yeah I know (0.4) yeah there
 14 (0.6)
 15 M1 that is - that there (0.2) is this boulevard
 16 (0.6)
 17 MD yeah
 18 (0.6)
 19 M1 so: (0.2) there's a canopy along here (0.6) ĩ like a parisian
 20 MD ĩ but that's at a lower
 21 level
 22 A2 yeah=
 23 M1 =yes (0.2) like a parisian (0.4) a parisian style (0.2) sort of
 24 cafe

Fragment 3.

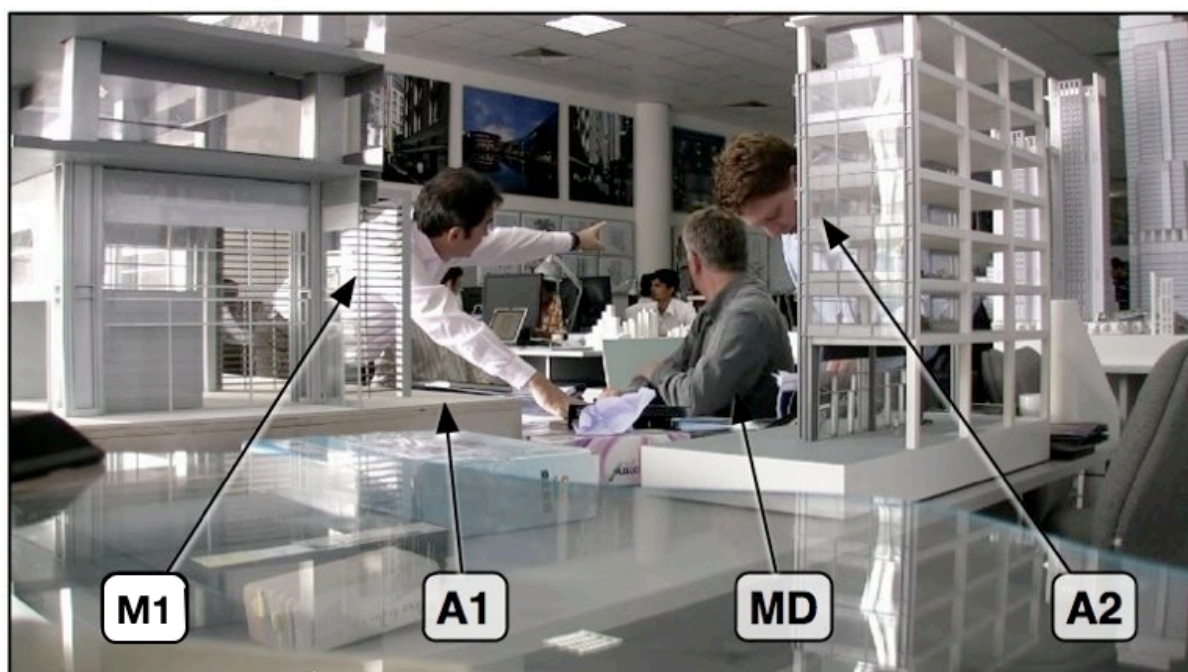


Figure 3. M1 directs MD's attention to the posters-on-the-wall at the back of the room (lines 9-10).

manifest to those around you, as well as assisting others in the formulation of their own understanding, so that they too can share your vision. MD's trouble is simple, but the array of resources called upon to assist him contextualise his understanding of the-design-as-it-currently-stands and the-building-as-it-will-become is complex and far reaching, encompassing the plan as it is laid out before them to renderings of the building on the wall's of the office, all supported by the selection and highlighting of the relevant information by his peers.

4.4.2. Instantiating the 'design philosophy'

For the next fragment we join a formal design review regarding a large project within the United Kingdom and which lasts some two and three quarter hours. The meeting is being held in the practice's London headquarters and in attendance are a number of the organisation's Directors (D1-4), the Managing Director (MD), as well as four junior architects and assistants from the team of the Director presenting his project (D1). The project is early in its development and is still in the Master-planning stage⁶. Because of a quirk of the planning regulations at the future building's location, the practice has had to submit coloured renderings of the design in elevation⁷ and this has prompted a long and detailed discussion regarding the current design of the facades of six of the buildings in particular - the criticisms centring on their 'looking like a trade fair'. There is concern amongst the other Directors, and MD in particular, that as a practice they will find it difficult to design six buildings that do not appear either too similar, or that are differentiated in such a way that the variations appear too contrived.

In response to these concerns D1 attempts to outline his overall approach to the design of the buildings, make his understanding of the design-as-it-currently-stands available to the other architects present through a series of lists (fragment 4, lines 6-22). He prepares those present

⁶ Master-plans are a plan for the overall layout of the urban landscape, rather than the specific designs for the individual buildings. An architectural practice can be commissioned to formulate a master-plan, which may or may not go on to form the basis for a development project. If it does go on to form a project there is no guarantee that the same architectural practice will undertake this further work, indeed the plan on the wall under the elevation at label A, figure 4 is a previous master-plan covering the same site undertaken by another practice in the past.

⁷ Elevations (a side view of the design) are one of the three primary representations of a design available to architects, the other two being plans (a top down view of slices through the design) and sections (vertical slices through the building at various points and angles).

for his oncoming account with a typical list projecting component (Selting 2006), with the appeal that ‘you gotta do one thing right’; something which is acknowledged by D2 in particular - to whom this claim appears to be primarily directed - with a nod (line 4). As he works his way through each list he uses a range of bodily motions to support the points that he is making, using these to draw upon some of the artefacts at hand, as well as the other architects present in the meeting. As he enumerates the first list - an overview of the general approach that he has taken - he illustrates his point with a three dimensional outline of the building, using both hands to suggest the mass of the-building-as-it-will-become as he plonks it down on the desk in front of them (fragment 4, item 1). During the production of the second list in the series - in which he refers to the location of the sun and the effect that this will have on the design of certain elevations in terms of glazing and shading systems (fragment 4, item 2) - he first sweeps his hands and twists his body to the ‘south’, and then to the ‘north’. He closes this list with the suggestion that there will be ‘four simple plain buildings’, illustrated by again setting out the square of the building in 3D, the one he has just plonked down on the desk (line 14 and shot A, figure 4).

01	D1	Yea:h - I suppose what I too - I took as a (0.4) as a principle	
02		(0.8) uda (0.6) cause you (0.4) you gotta do: one thing right (0.4)	
03		you go ʃ tta do	
04	D2	└ mmm	
05		(0.4)	
06	D1	you gotta develop one thing (0.6) I thought (0.4) I li - I like	} 1
07		buildings with four elevations (0.4) an actually I like to have a	
08		theme around all four elevations (0.2) I don't like just to put	
09		elevations on different buildings (0.8) as a basic starting point	
10		(0.2) but then you know that your sun (0.2) your not going to get	} 2
11		the sun on the north (0.6) so you could probably add a lot more	
12		glazing (0.4) your going to get a lot of sun on the south (0.2) so	
13		you have a whole shading system comes in (0.8) and then (0.6) over	
14		that (0.6) four simple plain buildings (0.2) 'cause the key to all	} 3
15		of this (1.2) is: (0.2) just (0.2) simplicity (0.2) it all starts	
16		(0.4) as - as a precast concrete frame (0.6) with a set grid (0.4)	
17		that's the basic building block (0.4) and you set this simple	
18		facades up (0.4) and then then (0.4) as you get into the - and we	} 4
19		haven't done it yet (0.6) as you get into the environmental	
20		response of all:: these buildings (0.6) what they are (0.2) where	
21		they are (1.0) and e- then (0.2) all of the buildings will: (0.2)	
22		become informed by their own architecture (0.2) I'm sure of it	

Fragment 4.

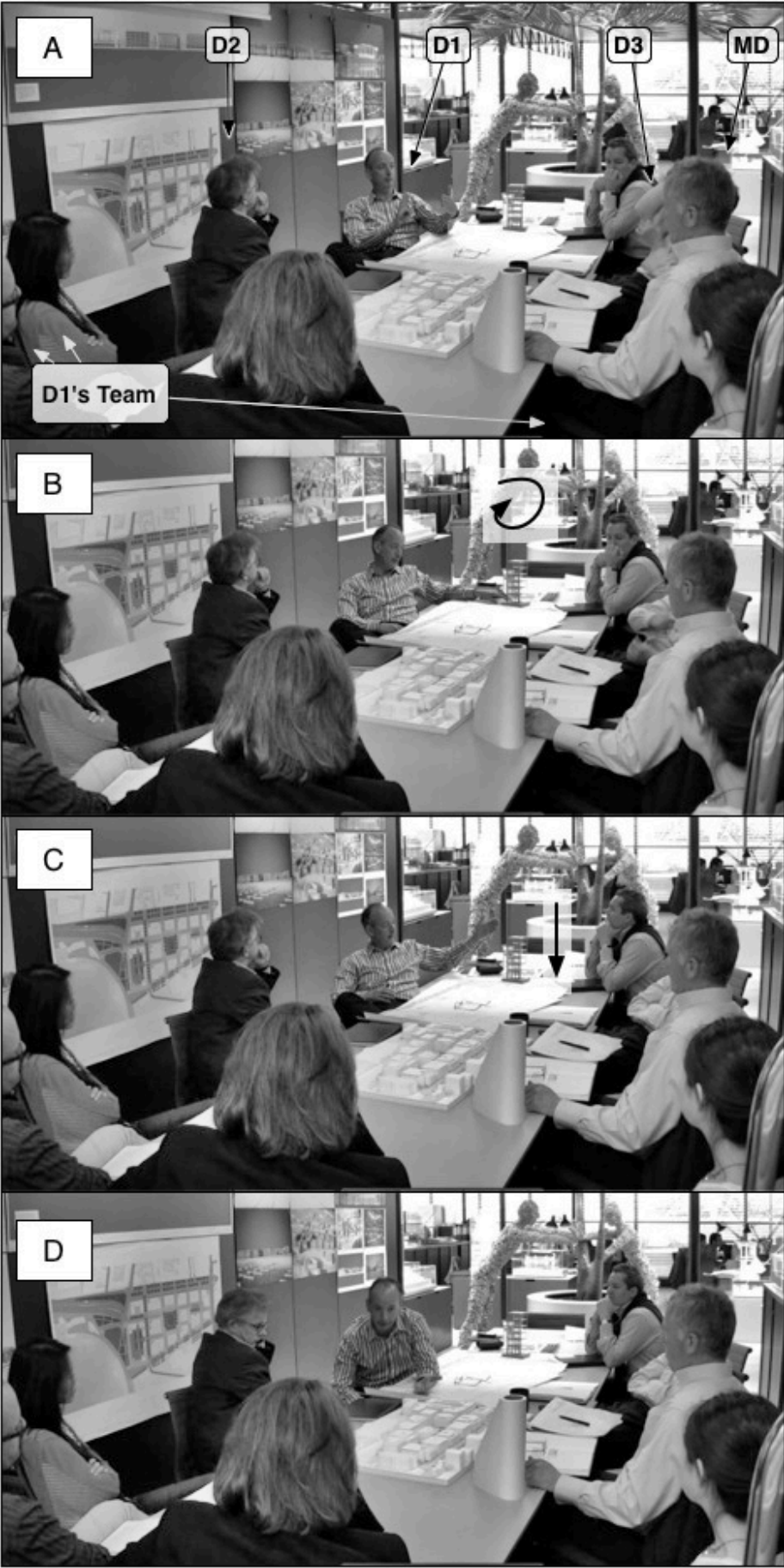


Figure 4. D1 lists of the properties of this particular design.

At this point in the conversation he turns to the small structural model to his left, pausing as he looks directly at it for a time, reaching out and twisting it slightly so that it is now at 45 degrees to the mid-line of the table (shot B, figure 4), before suggesting that ‘the key to all of this is... just simplicity’ (lines 14-15). As he enumerates some of the properties of this ‘simplicity’ he sweeps his hand up and down the height of the small model of the future building’s underlying structure, most of those present now turning their attention to it as well (fragment 4, item 3 & figure 4, shot C). As he begins the fourth and final list he leans forward and reaches out towards the three-dimensional model of the Master Plan on the desk in front of them, reminding those present that these buildings have a specific purpose and a local context, both of which will mean that ultimately the buildings will ‘become informed by their own architecture’ (fragment 4, item 4 & figure 4, shot D).

In response to the ongoing critique of his designs, D1 attempts to make explicit to those around him the approach that he has taken to formulating these particular buildings: in effect a partial account of his interpretation of the practice’s design philosophy. His understanding of this aspect of the plan is quite different to that typically presented in discussions of the management of knowledge, which often focuses on an individual’s knowledge of its technical properties, rather than the more abstract notions that inform their underlying approach to the creation of such a construct. In particular we have seen how he makes his understanding of the plan manifest through talk - supported by the mobilisation of his own body and the artefacts at hand - when trying to get across more than he is able to say in just-so-many-words: the imaginary three dimensional building he places on the desk in front of them; the small, scale model of the building’s substructure that he delicately draws into the conversation; or the large 3-dimensional foam model of a distant city laid out on the desk in front of them, and which he appeals to when reminding those present that these buildings are part of a greater whole.

4.4.3. Drawing on distal clues

An understanding of the-design-as-it-currently-stands, as well as the-building-as-it-will-become, is an essential part of presenting oneself as a competent member of the group, the practice, and the profession as a whole. In the fragments presented here we have seen how no one representation is capable of fully standing-in for ‘the plan’, or an individual’s understanding of it; but rather how each-next representation carefully drawn into the conversation serves to complete another part of the picture, until such time that a common-enough understanding of it is achieved - one that is sufficient for work to go on. Here we

also begin to get a sense of the reflexive back-and-forth flow between indexical gesture and talk, with one preparing the ground for the other, such as D1's subtle reaching out for the small model to his left, before producing a list of its properties to support his claim of 'simplicity'. This simplicity is something which forms a fundamental part of this particular practice's approach to doing design, and so is a list that any competent member of the group should know, and which therefore rarely sees the light of day.

The essential role that the indexicality of such gestures plays in establishing mutual orientation and common understanding within interaction is well established (Hindmarsh & Heath 2000, Zemel *et al* 2007), and others have illustrated the role that they play in coordinating interaction specifically within design-review-like meetings (Tory *et al* 2008, Lymer, Ivarsson & Lindwall 2009). Here we can see how such gestures - which appear designed to encourage the other architects present in the meeting to confront various aspects of the plan in order to motivate a particular understanding of it - gloss the meaning of their own operation (Hindmarsh & Heath 2000): it is not the gestures which form the focus of the participants' attention, but rather the artefacts to which they refer. Others have noted that our ability to touch and talk about the resources immediately at-hand adds another dimension of experience to our understanding of them, enabling us to say more than we can with words alone (Goodwin 1997). However, it is not these local artefacts to which their gestures and talk ultimately refer, but rather they are a route to motivating a particular understanding of constructs that are far removed from their current circumstances, both spatially and temporally: namely the-building-as-it-will-become.

In these fragments we have seen two examples of the mundane reality of 'being an architect': the daily struggle to keep those around you - both within the organisation and further afield - aligned with your vision as you try to formulate a building that will find its rightful place in the practice's corpus. To support them in the accomplishment of this end the architects have a range of tools and technologies to help formulate, utilise, and explicate their knowledge of the plan, but the most effective and the most frequently called upon remain those which have been available to them since the profession was first established: conversation with peers supported by the materials closest hand. These include representations of the-design-as-it-currently-stands, such as rough sketches on cheap disposable tracing paper, scale models made from hand cut plastics and wood, and large format paper plans of the-building-as-it-will-become in plan, section or elevation. However, although the artefacts that support these conversations play a fundamental role in the

achievement of mutual understanding at the point of each-next-change-to-the-plan, their ephemeral nature will mean that they may well be unavailable for inspection even just a few days or weeks after their creation and use, let alone to anyone reusing the formal representation of the ‘finalised’ design details, should they get called upon again in the future.

4.5. Knowledge of the corpus

Whilst each-next-building is designed from scratch, and to the requirements of the clients and other stakeholders, the work of doing design ultimately occurs within the context of the practice’s *design philosophy*: the underlying approach that this group of architects takes to the formulation of its designs. The most tangible manifestation of this approach is the practice’s corpus of ongoing and completed works, which stand in for the capacities and capabilities of The Organisation as-a-whole (designs can be considered complete without there being a physical building, such as competition entries). Through conversation and demonstration, current work can be informed by, juxtaposed against, or be developments of designs from the practice’s past. Architects at all levels can be rebuked for not formulating design details that follow ‘the Hamptons way’, and most aspire to have their contributions find their rightful place within the practice’s ever growing corpus.

4.5.1. From particularities to ‘good architecture’

In the next fragment we re-join the London design review as D1 continues to defend the design-as-it-currently-stands from the unrelenting critique of his colleagues. At this point in the conversation those present are in the process of reiterating the problem with which they are currently faced: that they are trapped between a design that is too simple, and therefore appears homogenous, and one whose patterned approach would just look ‘a mess’ were it to be accentuated further. To illustrate this point D2 lists some examples produced by other practices where they have attempted to solve similar difficulties, but in his opinion failed: The Black City and Elevator Square, both in London. These are acknowledged by D3, who adds that whilst they are a commercial success, they are a bit of an ‘architectural assemblage’, something which they are keen to avoid with the current design.

D2 then asks those present to look back at some of their own projects from the past, noting that there are lots of ‘accidental’ and ‘particular’ things that have happened, and which they as a practice have grasped and turned into ‘good architecture’. His list contains three of the practices most well known buildings, together with the secondary factor that was involved in

ultimately making the designs what they became: worthy additions to its corpus of works (fragment 5, lines 7-11, Figure 5). The existing buildings at Fern house, which would encapsulate their design (Figure 5, point A); the historic brick arcade at Dukes, which would become the foundation of their new design (Figure 5, point B); and the classic English landscapes that surrounds Sherborne, within which their design would have to comfortably sit (Figure 5, point C). He then urges those present to try to find those particularities here, because without them they may struggle to formulate a set of designs that they would be comfortable calling their own (lines 16-18).

In this fragment we have seen D2 put forward a list of examples from the practice's corpus as illustrations of 'good design', and his suggestion that the way in which these came about might inform a solution to the problem with which they are currently faced: a series of designs that look too similar and therefore do not, as they presently stand, qualify for their own place in the corpus. Specifically we see the use of a list of buildings, each of which is paired with the particularity that - whilst out of their initial control - went on to inform some of the defining features of these influential designs, and which ultimately contributed to their success. The existing corpus of designs is an ever present phenomenon in this particular

01	D2	I suppose the only thing (0.2) I alw- (0.2) I always think (0.4)	
02		that there's - tht (0.2) you know when you look back at lots of our	
03		projects (0.2) is that (0.4) there's lots of (0.8) there's lots of	
04		(0.4) accidental things (0.2) there's lots of particular things	
05		(0.4) happen that we grasped (0.4) and=	
06	MD	=yep=	
07	D2	made good architecture out of (0.2) whether that was Fern House	}
08		(0.4) whether that's the arcade (0.2) you know the existing blocks	
09		at Fern House: (0.2) there's the arcade at Dukes (1.0) pastoral	
10		landscapes at Sherbourne (0.6) there's (0.2) there's quite	
11		particular things that twist it and I thin - I suppose that the	
12		only thing that I think is that you: (1.2) [so] maybe (0.4) you	
13		know we could try an: (0.8) find particularities to make things	
14		(1.2) cause as - I do agree with you (0.2)	
15	MD	like what we're seeing	
16	D2	it - I - I think it would be - be really quite hard to invent	
17		(1.4) just (0.4) just in terms of facta [de [you could have] (0.2)	
18		lots of different things	
19	D1	[but what you could do	
20		though=	
21	MD	=well - I think=	
22	D2	=because we had accidents (0.6) [things] to react to: (0.4) and	
23		that might be a::	

Fragment 5.

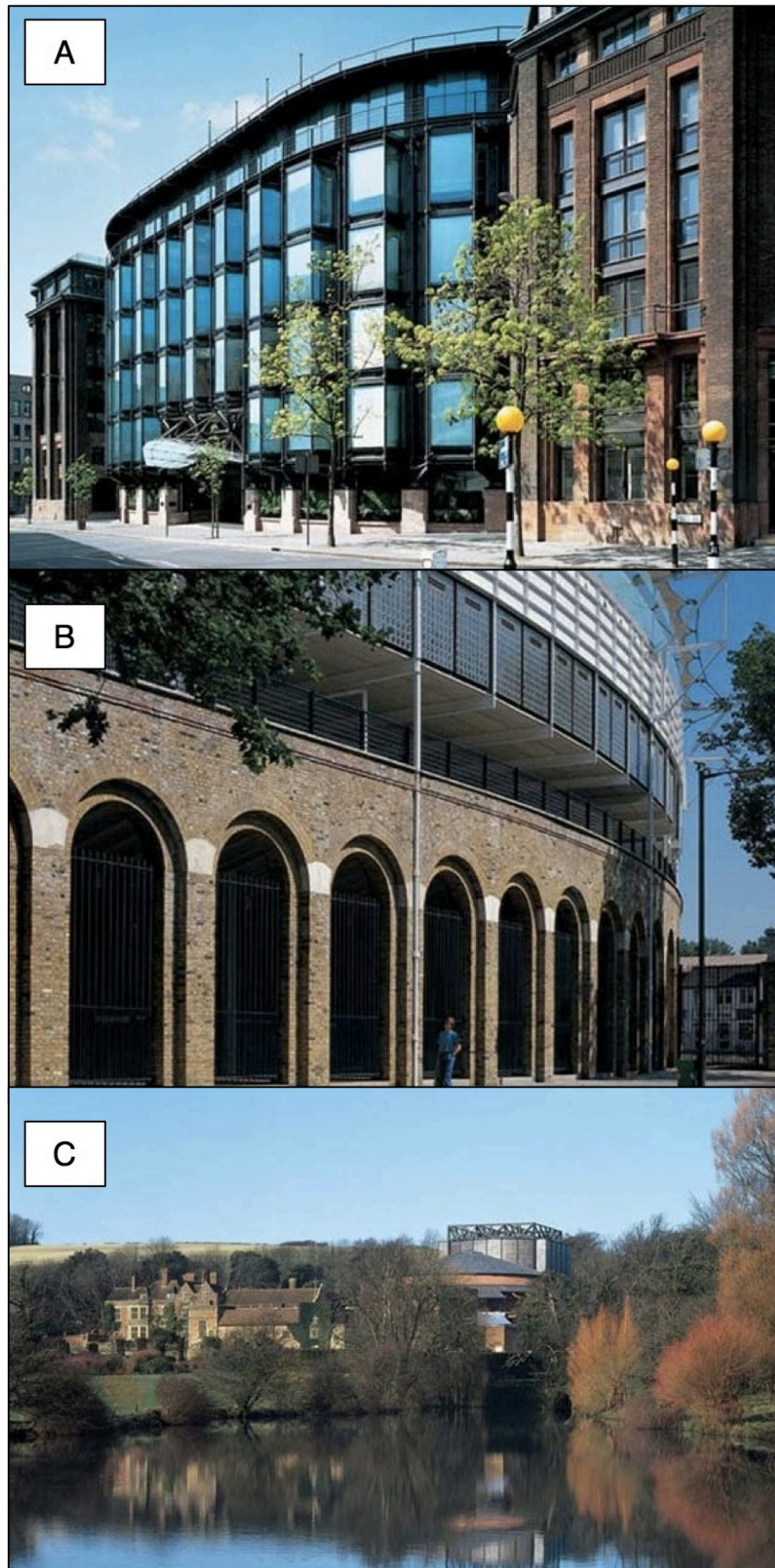


Figure 5. A list of examples from the corpus.

practice, and is available through the-posters-on-the-wall that cover all the available wall space, and the scale models which cover every flat surface. However, the most important way in which the corpus is made manifest is through discussions with the senior architects who helped to create it. Through lists of completed designs, and their most important attributes, the work of those attempting to formulate each-next-change-to-the-plan is placed into the context of that which has gone before, in order that they too might, through advancement, pattern or juxtaposition, use them to make their own contribution to the practice's burgeoning corpus. However, such lists are necessarily an incomplete description of both what is meant by such a nebulous notion as 'good architecture', as well as how one might go about using 'accidental' and 'particular' things in its production. As others have noted, there is always more to a set of instructions than can be explicitly stated in just-these-circumstances (Garfinkel 1972b), and so those present must always do more to interpret just what is meant by the provision of just-these-examples.

4.5.2. Invoking 'the hamptons way'

In the following fragment we stay with the London design review as the architects continue to struggle with the appearance of the buildings, something which they keep returning to throughout the meeting's two and three quarter hour duration. In an effort to defend his work D1 attempts to remind those present just how much has actually been accomplished in terms of being able to design a series of buildings that might find their rightful place in the practice's corpus. This is first achieved by listing the types of buildings that the clients had originally wanted: beginning with their demand for 'iconic' buildings, their request for circular buildings, or buildings with curves on them (fragment 6, lines 2-4); none of which are attributes that the practice would feel comfortable having associated with their designs. As the list closes he suggests that this would have led to a very different conversation than the one they are now having: one where they would be having to deal with 'transfer structures everywhere' (lines 5-7) (these are needed to support the structure of such oddly shaped 'iconic buildings', transferring the weight of their appendages safely to the ground).

He then claims that the clients themselves have moved a long way in terms of appreciating what it is the practice is attempting to achieve - guided by its design philosophy - and goes on to juxtapose what the clients had wanted with a new list: one that shows how they have not only relinquished their original requests for 'iconic' buildings, but have themselves now taken on-board some of the key principles of the practice's position (lines 8-12). In this new approach they are able to 'express' the underlying concrete frame of the building, exposing

01 D1 right - they've met us half way (0.2) we started off the
 02 conversations (0.4) with (0.2) why can't we have an iconic building
 03 (0.2) why can't we have a circular building (0.2) why can't they
 04 have curves on them (0.6) and we've won this whole argument about
 05 the bas:ement - and the buildings relating to them (0.6) we could
 06 be having a completely different conversation where we've got
 07 transfer structures everywhere (0.6) you know (0.2) because of that
 08 (0.8) so they've (0.2) they've moved a long way towards: - a-eh -
 09 acknowledging: (0.4) expression of concrete frames (0.6) granite is
 10 in the plinths (0.2) white:s good - a good material (0.6) a -a
 11 formal (0.2) ah: (0.2) ah: (0.2) approach to all these buildings
 12 (0.2) they've met us that way (0.6) if we (0.4) if we push it in
 13 going with identical architecture on all the buildings (0.6) we're
 14 on a hiding to nothing

Fragment 6.

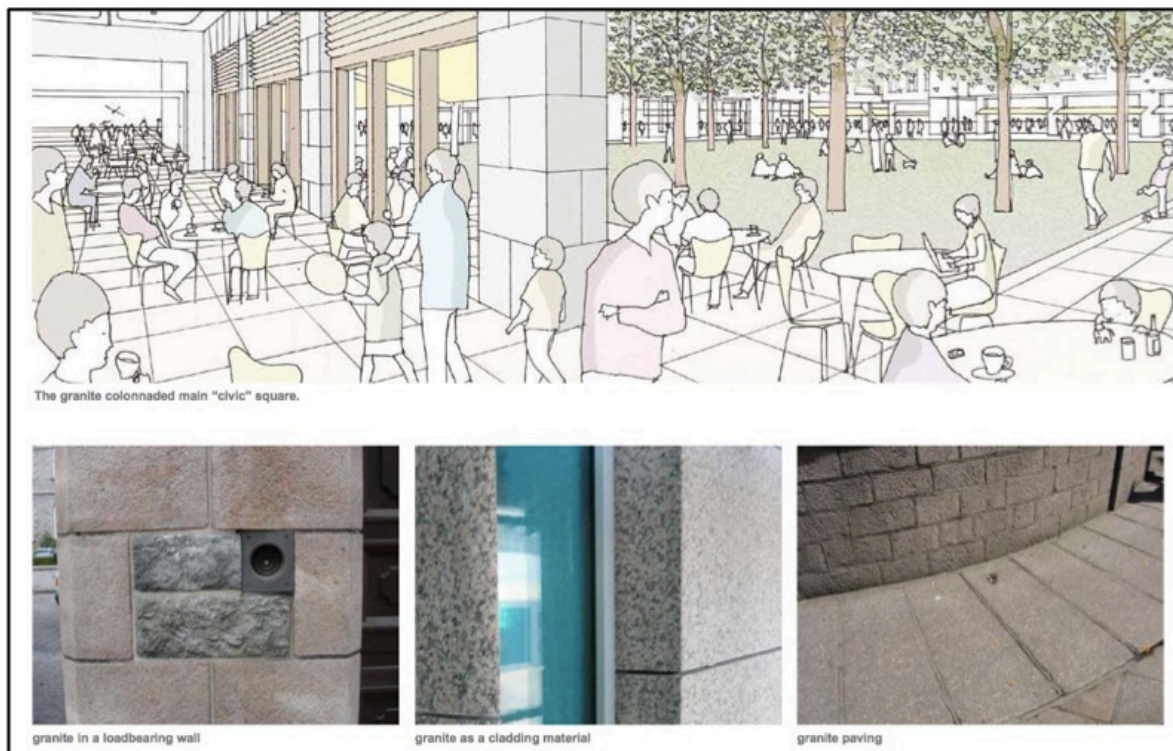


Figure 6. Examples from the practice's consultation documentation from this project encouraging the use of granite as a building material.

it for all to see; decorative granite colonnades have been transformed into more subtle and functional granite plinths that will support the weight building above; and the white of the raw materials will be a feature, not hidden behind cosmetic facades. All-in-all a much more 'formal' approach to the design of these buildings, and one that will result in designs that might find their rightful place in the corpus.

In this fragment we have seen D1 highlight to those present the good work that he has done in bringing the client's expectations into line with those of the practice, something that will enable them to produce a 'good design' - one that is worthy of inclusion within the corpus - and without which their current troubles would be much worse. Specifically we see two very different conceptions of 'doing design' juxtaposed against one-another in the form of a pair of lists: the first, a list of what would most certainly not be a suitable addition to the corpus, and something that the clients themselves had initially wanted; followed by a list of more desirable attributes with which they can now approach the design of these particular buildings, and which might provide them with the opportunity they are all seeking. Client expectations play an important role in informing the outcome of a design, but so too does the architects' own desires to produce a building that both they and the practice can be proud. 'The Hamptons way' serves as an important moderating force in ensuring that individuals produce consistent designs that lack the attributes - such as 'curvy walls' - which they consider to be unnecessary to the production of a successful design. However, the full nature of this approach is never described *in toto*, but rather is only ever hinted at, such as through listing just-those-properties that are relevant in just-these-circumstances.

4.5.3. Leading by example

Maintaining an awareness of the practice's past and present outputs is an essential part of being able to produce each-next-change-to-the-plan that is in line with 'the Hamptons way'. In this set of fragments we have seen how the architects utilise their knowledge of the practice's own corpus of works to contextualise their current troubles and help to ensure that they produce solutions that are in-line with those that have gone before. However, this knowledge extends beyond a simple awareness of the corpus as a catalogue of previous designs from which they might find inspiration, and includes a deep knowledge of particular buildings, their properties, how these properties influenced the design and construction process, as well as a subtle appreciation of the commonalities that are shared across many of their designs, and which combine to form the basis for the practice's design philosophy. The moderating force that this design philosophy plays is an important part of ensuring that individuals produce consistent designs which lack the many attributes that those who helped to define it consider to be unnecessary to the creation of a successful building: 'curvy walls' being an example frequently cited.

In these fragments we have seen the architects utilising a series of prototypical three-part lists (Jefferson 1990) to get across their understanding of what does, or does not, constitute a

Hamptons building. In particular we see the use of demonstrative lists (Sanchez-Ayala 2003) to flesh out their initial claims: that there were a number of particularities in some of their previous projects that they as a practice grasped and used to produce ‘good architecture’; and that much has been achieved in convincing their clients to allow them to design a building of which they can all be proud. Similar to what Garfinkel terms ‘ad hocing procedures’ - the often open-ended nature of the categorising activities utilised by a setting’s members in order to make objects in that setting meaningful (Garfinkel 2004 [1967], 1972b) - these lists of just-these-buildings or just-these-properties temporarily stand in for the practice’s corpus *in toto*. Whilst such lists might be considered as a partial instruction-set for the design of a Hamptons building, they are necessarily a trivial gloss for the actual work of ‘doing design’ - something which is acknowledged by the architects themselves - and one that enables them to mean more than they could possibly say in-just-so-many-words. However, in order for these lists to carry their intended currency there is an expectation on those present that they share a certain degree of understanding in common regarding the contents of the practice’s corpus of successful works, and therefore references to them are simply a reminder of what they all - as competent members of this particular group - should already know.

Others have noted the important role that such exemplars play in standing in as publicly specifiable examples of a tacitly held background understanding (Abel 1981), and we can see here how these lists of buildings or their properties temporally stand as a guide to how one might go about producing ‘good architecture’ in the context of this particular practice. However, whilst calling upon existing designs offers potential solutions to their current troubles, these fragments also highlight how their approach to doing design can adapt to the vagaries of each-next-situation. This adaptability ensures that whilst particular design patterns often appear through many iterations of the practice’s corpus, these patterns can also be seen to evolve over time. This evolution is both a product of the realities of each-next-situation - as the ideals represented by their underlying design philosophy come up against the practicalities of constructing just-this-building - but is also an achievement of the individuals whose job it is to make the design manifest, as they seek to make their own mark on the designs on which they are working, the practice’s corpus, and the-profession-as-a-whole.

4.6. Knowledge of the profession

As a profession architecture has a long history and a central role in all modern societies. In

the UK, architects undergo an extended and arduous period of training - taking a minimum of seven years - and their professional responsibilities are governed by legislation. The architect's knowledge of the outputs of the-profession-as-a-whole - both now and in the past - enables them to situate their current activities within a vast body of works, as well as offering inspiration for the application of new techniques and technologies in the formulation of their latest design (something for which this practice is particularly well known). Through formal training events, the architectural press, site visits, and the sharing of personal experiences, the architects stay up-to-date with the ongoing development of the professional community of which they have worked so hard to become a member.

4.6.1. Experience informs design

In the following fragment we re-join the design review in the Middle East several minutes later, as the conversation turns to the lobby of the building, which the street café discussed in the first fragment adjoins (section 4.4.1). M1 has previously expressed concern regarding the scale of the lobby, and in particular its relationship to the overall size of the building and the adjoining street-scape. At this point in the conversation the practice's model-maker arrives at the meeting table and delivers two small cut-out human figures that M1 had previously requested, and which are at the correct scale for the large model on the desk in front of them. The architects regularly work with scale models of the building-as-a-whole - or more commonly some sub-section of it - in order to gain a more accurate sense of the-building-as-it-will-become, but this is an unusually large model which took several members of staff to man-handle in from the back of the model maker's van and safely onto the desk.

M1 carefully places the figures in the entrance to the building (line 1, fragment 7 & figure 7), prompting MD to note how big the entrance-way is (line 4). M1 acknowledges this by suggesting that it is 'Canary Wharf scale' (line 6) (which are some of the largest buildings in the UK). However, MD then attempts to re-contextualise this suggestion by reminding them of the numbers of people using the site: the 'numbers of people are big numbers' (line 8). Again this is supported by M1 who notes that there will be some twenty thousand people living and working on the site, as well as visitors coming from the convention centre next door; itself a recent addition to the plan (lines 10-17). MD responds that he doesn't think that you can reduce its width, but then attempts to reformulate his response (lines 19-22). However, before he has had time to establish a stable conception of the point he is trying to make M1 calls upon another example from afar: the Piazza St Marco arcade in Venice, noting that it is only four and a half meters wide, and that there are 'piles... hoards of people

01 M1 ok that's the scale of a person (0.6) yeah (0.4) thats (0.4) thats
02 ah
03 (2.2)
04 MD its its big isn't it (0.4) that
05 (0.2)
06 M1 its Canary Wharf scale
07 (1.0)
08 MD actually though - numbers of people are big numbers (0.2) so:
09 (0.6)
10 M1 twenty thousand people (0.6) on - living (0.2) and working on the
11 [site]
12 (0.2)
13 MD yeah (0.2) yeah ʘ [inaudible]
14 M1 ʘ and there'll be more visit (0.4) there'll be more
15 visits - visitors coming from the convention (0.2) because now its
16 a convention centre (0.4) next door to it (0.4) the'll be whole
17 hordes of people coming over=
18 A2 [there's a con]
19 MD =yeah I don't think (0.2) I don't think you could reduce the width
20 of this (0.2) I mean what you could (0.2) you could arguabl:y::
21 (0.6) actually what you could (1.4) you could rescan the:: (0.4)
22 that might be ʘ [better actually]
23 M1 ʘ but you know tha- (0.2) you know that the: (0.6)
24 Piazza St Marco arcade
25 (0.4)
26 MD yeah (0.4) ʘ yeah
27 M1 ʘ in (0.2) in the- (0.2) down there (0.2) its only four
28 and a half meters wide (0.6) theres piles (0.2) hordes of people
29 going past it=
30 MD =yeah
31 (0.4)
32 M1 I measured it once (0.2) to sort of (0.4) because I thought hows
33 this working because it feels really good
34 (0.2)
35 M1 =its tall an narrow
36 MD =I mean (0.4) I'm meaning the: (0.2) the ah: (0.2) entrance (0.4)
37 closing ʘ the entrance down
38 M1 ʘ yeah (0.4) narrow it down a bit

Fragment 7.



Figure 7. D1 adds the figure to illustrate the scale of the model on the desk.

going past it' (lines 23-29). He then goes on to claim that he even measured this particular example once because of his interest in how it came to 'feel' the way it did (lines 32-35), noting that it too was tall and narrow, very much like the modelled space they now see before them.

In the absence of the-building-as-it-will-become the architects must make use of the materials at hand in order to gain an appreciation of the scale and proportions of the buildings that they are designing. Whilst plastic and wooden models can assist in this process they are inevitably limited in their ability to provide a proper sense of the human scale of either the various representations of the designs, or the-buildings-they-will-become. By placing their current work within the context of spaces formulated by other architects that they themselves have experienced first-hand, they can begin to get a sense of how the designs that they are currently trying to create might 'feel' when they are finally made manifest. In particular we see how M1's personal interest in how these other spaces feel is deep enough for him to make measurements of their dimensions whilst on vacation in order that he too might someday use this information as a pattern for formulating his own designs; designs that might themselves engender the same high regard from his professional colleagues.

4.6.2. A series of ends and beginnings

In the following fragment we re-join the London design review as those present continue to express concern regarding how the-design-as-it-currently-stands will be received by some of the other stakeholders invested in the project. D1 concedes that they have found it difficult

to design a set of buildings with ‘sufficient commonality’ that they give a sense of being part of a unified quarter, whilst at the same time not being too similar. He goes on to acknowledge some of the political problems that they have faced in getting the designs to their current stage, and which have meant that certain contrived differences have had to be introduced, where they would perhaps have preferred consistency.

In response to this, D3 reiterates the problem with which they are currently faced, but this time with a slightly different formulation: how do you produce a ‘mega scheme’ without it becoming ‘terribly imposing’ (fragment 8, lines 2-3). To illustrate this point he calls upon examples from Turin, Italy where they have some ‘stonking great buildings... enormous arcades’, but where they ‘get away with it’ (lines 3-10). D2 responds to this with a slightly different example of his own, this time a little closer to home: the shopping arcades on London’s Regent Street, originally laid out by John Nash. However, before he has completed his point MD adds yet another: Edinburgh New Town, now a UNESCO World Heritage Site (lines 15 + 18). Following this brief and unremarked interruption D2 continues to develop his point, extending one he made earlier in the conversation: that as an ordinary member of the public, you never really experience the design from one view point, but rather as a series of events as you travel down the street (lines 19-22). Reaching out across the model on the desk in front of them, he then illustrates this point by highlighting different aspects of the design, and how these might constitute such events (lines 20-26). D2’s proffered approach to their current troubles - a reminder that the future users of the-building-as-it-will-become will experience it as a series of ‘ends and beginnings’, rather than as a unified whole - is supported by a demonstration of the events that one might experience as one travels down the streets of the model laid out before them. However, the events he speaks of in his list are not properties of the-design-as-it-currently-stands or even the-building-as-it-will-become, but rather those of his previous example from London’s Regent Street, illustrated by his metaphorically walking down the street with his fingers, overlaying their physical model with these events in three-dimensions and real-time (figure 8).

In this final fragment we have seen how the architects call upon their knowledge of the-profession-as-a-whole in order to contextualise their current troubles, providing juxtapositions as warning or patterns for possible solutions. D3’s initial offering of an example where others have solved a similar problem - the design of a large structure that is not too ‘imposing’ - appears partially played down by D2 as he reminds those present that the problems with which they are presently faced are partly a product of their privileged

01 D3 I mean (0.6) its a debate you have from [Gorgonzola] onwards don't
 02 you (0.4) how do you do a mega scheme (0.2) you know (0.4) without
 03 it becoming (0.2) sort of (0.4) terribly imposing (0.2) Turin (0.2)
 04 for me (0.2) is a good example (0.6) where you get some stonking
 05 great buildings (0.6) enormous: (0.2) arcades: (0.4) and they sort
 06 of link up with old ones (0.2) and somehow (0.8) its a little bit
 07 fascist (0.2) you've got these massive big buildings there (0.4)
 08 but you kind of get away with (0.4) partly because its a generous
 09 [topping] off with all the arcades (0.6) and then the shops: (0.4)
 10 and re [tail immediately add in
 11 D2 [but are- arent (0.2) I mean there (0.4) are there (0.2)
 12 are there things (0.4) I mean (0.2) if you look at the sort of
 13 (0.4) you know (0.4) kind of (1.2) you know (0.8) the scale of
 14 (0.2) of nap (0.2) of na [sh (0.6) on ah:: regent street
 15 MD [yeah (0.2) I was going to say
 16 (0.4)
 17 D2 I mean:
 18 MD Edinburgh new town=
 19 D2 =yo- don't (0.2) you don't see it in one view point (0.6) like you
 20 w- (0.2) you know you experience Nash in London (0.4) in the same
 21 way you experience this street (0.8) you know its all by the same
 22 architect but it- there events: (0.6) that make (0.2) ends and
 23 beginnings (0.8) or (0.4) you know (0.6) theres a bit (0.6) theres
 24 a (0.2) theres a (0.4) theres a (0.8) theres a big onion dome (0.2)
 25 you know (0.6) on this building (0.2) and a big onion dome on that
 26 one

Fragment 8.



Figure 8. D2 animates Regent Street in London over the model if their own design as he metaphorically walks down the street.

position as architects with respect to the-design-as-it-currently-stands (line 19): that what the future users of the-building-as-it-will-become will experience as a series of architectural events, they experience as conversations, drawings, models and posters-on-the-wall - all from a partial and very privileged perspective.

4.6.3. Invoking the experience of ‘good design’

In this final set of fragments we have seen how the architects call upon their knowledge of the profession as-a-whole in order to establish a shared understanding of their current troubles, providing both warning, juxtaposition and pattern for possible solutions. Here the privileged nature of their perspective is at its most apparent, and is instantiated through conversational references to sites that are very far from their own work laid out on the desks and pinned to the walls around them - spatially, historically and experientially. These demonstrations of their ‘profession vision’ (Goodwin 1994) include their ability, through the artefacts at hand, to ‘see’ aspects of the design that will never be available to its other stakeholders, and yet which they, as professional architects, will spend time and energy agonising over. The architect’s ability to formulate such juxtapositions is an important part of their professional training (Lymer 2010) and their learning to see buildings in professionally competent ways results in their noticing the finer details of buildings designed by other architects that they have experienced first-hand in the past.

In the final fragment we have also seen another use of demonstrative lists to establish a common understanding in support of the points being made: how to ‘get away’ with the use of ‘stonking great buildings’ without the scheme becoming ‘terribly imposing’; and that large buildings are never experienced in the whole - as they themselves are experiencing them now - but rather as a series of ‘ends and beginnings’. Further, these demonstrative lists are themselves embedded within a larger, collaboratively produced list of examples of the work of other architects who have been faced with similar problems in the past, and in their opinion succeeded. The production of this list is shared by three different members of the group, indicating that the point being made is one that is both commonly understood and accepted. However, unlike their knowledge of their own corpus of works, their knowledge of the outputs of their professional colleagues is limited to the perspective of the buildings’ other users, albeit informed by their professional training, and so their discussions are limited to the experiences engendered by these designs, rather than the method of their production.

Here too we see the role that their personal passion for experiencing and producing ‘good

architecture' plays in informing their own understanding of why particular spaces work the way they do, such as their sense of the way a place 'feels', in order that this understanding might be applied to their own work. These personal recollections of experiencing the outputs of their professional colleagues enables them to imagine some of the experiences that will be engendered by the buildings they are currently envisioning, and specifically of the human scale of the-building-as-it-will-become. Here we get a sense of the architect's skills that go beyond mere technical competence, and towards the connoisseurship that Polanyi himself held in such high regard (Polanyi 1973), for these are people who are passionately committed to the creation of designs that will stand among those that they themselves are calling upon as exemplars, their skills as artists on display for all to see.

4.7. A tacit knowledge in action: knowledge of 'the hamptons way'

As we have heard in the previous chapters, there has been much interest from the likes of Knowledge Management in how the tacit knowledge of a setting's members might be transformed into an explicit product, one that can be captured and written to some substrate - such as a Knowledge Management System - in order that it can be made available to The Organisation's other members, both now and in the future. However, we have also heard that a number of authors have serious misgivings about the stance that disciplines like Knowledge Management take towards such phenomena, arguing that its patterned appearance is not caused by the following of a set of tacit rules - rules which such approaches require for their to be something to capture and share in a consistent form - but rather its appearance is merely in accordance with rules that can be applied to it during later analysis. Instead, those with such concerns have argued that we should approach such knowledges as situated phenomena - ones which can never be fully separated from the context within which they are made manifest - and that by turning to the likes of ethnomethodologically informed ethnography to transform their methodic production into an explicit topic of study we might better understand the often hidden work that they do. Those applying such an approach have amply demonstrated that our actions are largely guided by the current circumstances as they present themselves to us, and that notions such as 'plans' or 'rules' - whilst serving as an important part of the context within which situated action takes place - primarily come into force as post hoc justifications of that work (Suchman 2007).

Here accounts of four situated knowledges have been presented - knowledges that in other circumstances might have been characterised as being tacit in nature - and which play an essential role as part of the context within which the work of 'doing design' occurs in this particular practice. Whilst it is clear that in these situations the architects knew more than they were able to say in-just-so-many-words, we are not in a position to claim more about the nature of those knowledges than is provided for by the evidence we have before us. In particular, claims about their specific cognitive status, or that they were following sets of tacit rules in the production of their designs - rules which could, under the right circumstances, be transformed into an explicit product - are not evidenced in the data of these architects actually doing design in an actual work setting. Further, it might be argued that whether or not such knowledges can be made explicit is largely irrelevant, for it is their contextual nature that is the basis of their value to The Organisation, and that rather than attempt to de-contextualise and 'capture' them, we should be seeking to understand the skills and resources required for their development and expression by those who need to call upon them in the circumstances within which they are relevant.

However, the claim here is not that there is no such thing as a tacit knowledge, but rather that the use of the term should be reserved for those circumstances for which it was originally intended: the expressions of deep artistry and connoisseurship that goes far beyond that which can be accounted for by using explicit reports alone. Others have characterised the design process as the formulation of a persuasive argument that has three fundamental elements: its *logos*, which represents the technical reasoning that went into the design's creation; its *pathos*, which represents the emotion of a design, as well as its meaning as made manifest through our physical interactions with it; and its *ethos*, which represents the ideal character of the design, the design standing in for its creator as they would be, not as they are, such as the designer's concern for the expression of beauty (Buchanan 1985). Within this context, the architect's perpetually developing knowledge of the practice's underlying design philosophy - sometimes characterised as 'The Hamptons Way' or the practice's 'ethos' - is considered as an example of just such a tacit knowledge in action. Here the notion of a design philosophy stands in for the endless array of members' knowledges and procedures through which consistency is maintained across the designs of the practice's corpus - across decades of work and hundreds of individuals - and is something which those currently working on the practice's behalf are held accountable to as they work to make their own contributions to it. However, claiming that the design philosophy is an example of 'a tacit knowledge in action' tells us nothing about its nature, or

that of the procedures through which it is made manifest, and so - just as the architects themselves must do - we have had to look and learn for ourselves.

Others have noted the utility of analysing members' methods for giving and receiving embedded instructions as an approach to understanding the role of a tacit knowledge (Watson 2006), a prototypical example of which is 'the convict code', so adequately investigated by Wieder (1974). For Wieder, 'the code' served as a members' open-ended guide to appropriate parolee behaviour - within the context of the half-way-house where they were taking part in rehabilitation programmes - and was something that was only ever told for and in just-these-circumstances. He showed that as the nature of the circumstances that the parolees found themselves in changed, so too did the current meaning of the code, and that the notion that some fixed and totalising understanding of such a phenomenon could be established and explicitly stated was nothing more than an analytic convenience. Rather, it was only ever made available piecemeal, typically as a series of highly contextualised maxims, each of which was only rarely made manifest, with some of the maxims of the code identified by Wieder decontextualised as: Do not snitch; Do not confess; Do not use other members; Share with other members; Help other members; Stay out of other members' business; Don't trust non-members; and Show your loyalty to members (*ibid.* p. 115-117). However, as a result of its open-ended, partial and highly contextual nature, any one member of the community of parolees could never be in possession of a knowledge of the code's full detail - for one does not exist - but rather their understanding of it was limited to those facets that were relevant to them and their particular biographies.

Like the convict code, the practice's design philosophy is only ever told piecemeal; it is told from a range of seemingly disparate sources; its tellings are rarely announced as such; they are temporally distributed; each-next-telling is typically told as a gloss, rather than an explicit telling of 'the' design philosophy; and it is told for just-these-circumstances and in just-the-required-ways. In fragment 9 we see a partial telling of the design philosophy presented by a Part III Architectural Assistant (SO) who had been with the practice for about three years, and who was asked during a semi-structured interview to offer an account of some of the differences she perceived between Hamptons and other practices within which she had worked. She begins by making the claim that it easy to identify one of the practice's buildings because of the strict rules that informed its design (lines 6-8), something which provides a certain consistency that those designed by other practices might lack. However, when called to account for her claim by elaborating those strict rules she immediately

01 SO: er:m: (1.0) yeah there's a big difference er:m (1.0) because you
 02 know: (0.8) well first of all erm (0.4) the practice i worked in
 03 previously was erm (0.8) err very young so they haven't had a design
 04 ethos [yet established (0.4) so: erm (0.6) yeah there is a big
 05 difference I mean you know a Hamptons (0.4) building (1.0)
 06 you can distinguish cause it it does have (1.2) er:m: (2.0) i would
 07 say strict rules (0.8) in terms of design where as the previous
 08 practice just didn't (0.8) (that they were) you know was all over
 09 the place so
 10 SS: L(yeah okay)
 11 SS: how how would you describe those dis- those strict rule:s:
 12 (1.2)
 13 SO: t:h:h um er:m:: (2.0) °mm:↑mm° (3.2) i don't know how do you
 14 describe strict rule- i mean (0.8) i wouldn't say maybe strict rules
 15 is er:: (0.8) wrong wording but er: (1.2) you just know (0.6) it's
 16 not gonna to be curvy you know its gonna to be: (0.8) °oh my god
 17 () hah° (0.8) i dunno look around (0.6) °huh huh° just (1.2)
 18 explain me erm:=

Fragment 9.

struggles (line 13), first questioning whether one could give an account of such rules - which if they were 'strict' surely one could - and then downgrading her claim, eventually making the quite general point that they are 'not gonna be curvy': that they lack the curvy walls that are a common feature of the work of some other practices, but most certainly not this one. Finally she indicates that the answer to the question can be found by simply looking around (line 17), the interview taking place in one of the practice's meeting spaces surrounded by the models and posters-on-the-wall of the practice's corpus of works, after which - perhaps - the interviewer might be able to articulate to her what those strict rules actually are (line 18)! After this seemingly failed attempt to offer a meaningful account of the practice's design philosophy she goes on to explain how she came to her own understanding - for she is in fact perfectly able to identify and indeed contribute to the design of a Hamptons building - something that was achieved through a trial-and-error process of producing designs that were repeatedly rejected by more senior architects who 'told her off' until such time that she got it right.

In an interview several months later the nature of the practice's design philosophy surfaced once again, this time told by one of its Directors, someone who had worked her way up through the practice's hierarchy over nearly a decade with it. This telling of the practice's

01 DR you know you can see from the way that they've gridded up (0.2) its
 02 simple materials (0.2) there's very rarely any kind of (0.6) curvy
 03 walls (0.2) or erm: (0.8) funny (0.4) I mean there's slightly more
 04 (0.2) there's some slightly more interesting trends: coming out in
 05 some of our other buildings (0.2) like the Geological Survey (0.2)
 06 was s:: (0.2) was a real departure (0.2) for the practice and I
 07 think (0.6) you know the Stadium as well (0.2) there's some quite
 08 interesting formal things going on there (0.4) but very much within
 09 that (0.4) framework of like (0.2) you build something you express
 10 how you built it (1.0) you know that's sort of (0.2) quite strong
 11 (0.2) so that- (0.6) if you hang on to those ide:as: (0.4) you can
 12 a- (0.2) kind of pass with that (0.4) and also they're quite er:m
 13 (0.8) they kind of give (0.2) especially the youngsters (0.2) they
 14 kind of give them tool:s: to work with (0.8) so when you sort of
 15 say something like well there's a window you need to detail that up
 16 (0.2) you know (0.2) they're sort of thinking how's it look like
 17 (0.2) what's it look like on the inside and the outside (0.2) how do
 18 I get it (0.2) the sections as thin as possible (0.2) how do I push
 19 the materials to the limit (0.6) so you one (0.6) one concept (0.4)
 20 I mean I could write you a list of what it means to be a Hamptons
 21 building (0.2) you know (1.2) but it still wouldn't equal a
 22 Hamptons building (0.2) you know

Fragment 10.

approach to doing design was - by the very nature of the circumstances - told for a non-architect, but even so was packed with the types of maxims that Wieder identified as being the component parts of the convict code: their use of simple plan-based grids as the starting point for all their designs (fragment 10, line 1); their use of a small number of simple materials in each design, such as wood, concrete and steel (line 2); that their designs should lack the curvy walls that they find so troubling in the work of others (lines 2-3); that like all good structural expressionists, their designs should make the method of their own construction manifest (lines 9-10); that unlike other architects they should pay as much attention to the way their design looks on the inside as it does on the outside (lines 16-17); that the sections of the design - the space between the building's interior and the outside world - should be as thin as possible, something they go to great lengths to achieve through their use of modern materials and construction techniques (line 18); and that they should work to stretch each material to the limits of its capabilities, through which they will maintain the practice's reputation for innovation in design. Whilst this more confident and detailed account was provided for someone who lacked an architect's education, she notes

how these same maxims can serve as a guide for ‘the youngsters’ - those architects just beginning their careers with the practice, just as she herself once did - as they work to make their own contribution to its corpus of designs. However, her final point is perhaps most telling (lines 20-22): that despite her list of the attributes of their approach to doing design - a list that she could go on with if circumstances allowed - it still would not provide an explicit guide to the design of a building that the practice would be happy to call their own, for it is only by learning-through-experience that one can develop the skills necessary to stand as a competent designer of a Hamptons building.

Here we have seen that, whilst the nature of the design philosophy can be described through lists of maxims, such accounts are nothing more than a gloss for what it actually means to design a Hamptons building and must still be integrated into the practical performance of the art - they are not a replacement for that knowledge (Polanyi 1966, Tsoukas 2003). As with the convict code, the practice’s design philosophy is not something that is explicitly taught to new members as they join the practice, but rather surfaces during the mundane work of doing design - in the form of indexical gesture and talk, lists of exemplars, and a series of contextual maxims - as a guide to acceptable conduct for novice and experienced designers alike. Further, these are by no means ‘strict rules’ for being a ‘good architect’ or producing ‘good architecture’ in general, but rather they serve as pointers and clues to the bounds of acceptable behaviour within this particular practice, or as accounts of the adequacy of its work from the past. As a result it is up to the recipient to hear each-next-telling as a telling of ‘the Hamptons way’, to interpret just what this particular telling actually consists of, and just how it relates to the problem in hand. Like Polanyi’s students mentioned earlier (section 2.2.1), these are individuals who are reaching for a deeper understanding of their craft, and who seek to be guided by competent others as they develop their own abilities; in this case the senior architects who worked to define the practice’s corpus of existing works with which they spend their days surrounded. It is the power of ethnomethodologically informed ethnography - which by its very nature leads to the investigator spending time immersed in the setting under investigation, gathering data in a way that gives precedence to the methodic nature of the procedures that a setting’s members are themselves using to manage their own understanding - that facilitates the uncovering of such phenomena, allowing us to transform them into an explicit topic of study, but not an explicit product.

4.8. Feasibility

Much of this particular practice’s reputation is built upon their ‘obsessive’ attention to detail

at the building's finest scales, so it was only natural that it was thought that it would be here that any design reuse system should focus. However, it quickly became clear that there was much more to a design than was contained within the finalised CAD objects and their various formal representations, and that a system which could facilitate access to this wider contextual information might offer significant value to those working within the practice as they struggled to formulate each-next-change-to-the-plan that was in-line with 'the Hamptons way'. During the initial visits to the practice's offices in London it was observed that the architects were invoking an array of distinct knowledges when formulating their designs: four important examples of which are their knowledge of the artefact on which they were currently working, their knowledge of the-design-as-it-currently-stands, as represented by the plan; their knowledge of the practice's corpus of works and the current design's potential place within it; and their knowledge of the outputs of the-profession-as-a-whole, and the patterns, juxtapositions and warnings that these offer their own work. Further, through conversation with the architects, and observations of their work, the presence of an underlying design philosophy - sometimes described as the 'design philosophy', the practice's 'ethos', or 'the Hamptons way' - was identified as an example of a tacit knowledge in action; an understanding of which plays an essential role in the architects' ability to function as competent members of this particular organisation. The fragments presented in the preceding sections have illustrated the role that these knowledges - which might ordinarily be hidden from an investigator's undirected gaze - are playing in supporting these architects in the mundane work of formulating 'good architecture'. Specifically, these fragments have highlighted some of the practical procedures that these particular architects use to mean more than they can say in-just-so-many-words, through gesture and talk, calling upon some of the many resources which surround them throughout their working lives: the models and paper plans of the-design-as-it-currently-stands spread out around them on their desks; the posters-on-the-wall, which stand in for the-building-as-it-will-become or those from the practice's past; and - perhaps most importantly - each other and their experiences and understandings of being a competent member of 'the team', the practice, and the-profession-as-a-whole.

The reuse of existing designs as the basis for new work is a well established practice, both within this organisation and in the architectural, engineering, and construction industries as-a-whole. Further, there is nothing new regarding the utilisation of information management technologies to support such activity, and there are a range of commercially available

systems and services to support the organisational reuse of CAD objects⁸. Researchers have investigated the potential role that such systems might play as libraries of individual components (Regli & Cicirello 2000), their ability to imbue CAD objects with varying degrees of intelligence (Rosenman & Wang 2001), and to act as complex infrastructures that unify all the information associated with a given design from across The Organisation (Dong & Agogino 1998). However, despite the well established nature of such systems, the more conceptual aspects of a design's production - which are seen as being more informal and therefore cannot easily be captured (Fruchter 2003, McMahon, Lowe & Culley 2004) - are not yet adequately supported in commercial systems destined for everyday working environments (Baxter *et al* 2008). As a result there is ongoing interest in understanding how design knowledge might be 'captured' within such systems and re-presented to users at the moment of component reuse, with examples including the capturing of a design's history (Shah *et al* 1996), the relationships between its various individual components (Szykman 2000), or the context of its original production (Fruchter & Demian 2002). To-date, research into addressing such issues has tended to focus on the formalisation of design knowledge, converting it into an explicit object through approaches such as Protocol Studies (Purcell & Gero 1998), Sequence Analysis (Gaskin *et al* 2010) or those that focus on the production of Design Rationales (Regli *et al* 2000). However, the complex embodied, social and contextual nature of knowledges such as those uncovered in the previous pages means that they do not necessarily lend themselves to such approaches, something which may have contributed to the failure of such systems to find a natural place in practices such as the one investigated here.

The investigation presented in the preceding pages has attempted to take a step back from such formal approaches, instead asking what is it that the work of doing design actually consists of by examining some of the procedures through which these particular architects make their understandings manifest to those around them. Whilst others have examined the innovative and improvisational character of such work in relation to their use of CAD software (Luff & Heath 1993), the part that ad hoc assemblages of artefacts and practices

⁸ Adept for MicroStation [http://www.synergissoftware.com/features/microstation_integration.php], AutoDesk [<http://partnerproducts.autodesk.com/catalog/category.asp?category=1840>], CAD-Symbols Symbol Library Resources [http://www.caddprimer.com/CAD_Symbols_symbol_library/CAD_symbol_symbols_library.htm], Polantis 3d Catalogue [<http://www.polantis.com/>], The CAD Block Exchange Network [<http://cben.net/>], CAD Library [<http://www.cadlibrary.com/>], GrabCAD [<http://grabcad.com/>].

play in coordinating their activities (Schmidt & Wagner 2004), or the potential role of three dimensional collaborative workspaces for managing the contents of 'the plan' (Büscher *et al* 2000), here we have focused on the essential role that some of those knowledges which might ordinarily be hidden from view play in the design process in order that they might be more effectively supported by Knowledge Management's technological interventions in the future. What we find when we examine this work from within the ethnomethodological frame is that it is an irredeemably social activity consisting of a wide-ranging negotiation - socially, technically, and temporally - regarding the nature of just-this-design, and which involves an ever changing group of actors and artefacts. During this ongoing negotiation the-design-as-it-currently-stands is juxtaposed against those that have gone before, or the architect's imaginings of the-building-as-it-will-become, and subtly and repeatedly re-worked until it meets the various requirements of all of the building's stakeholders; not least of whom are the architects themselves, and their desire to produce 'good architecture'.

Despite the essential nature of these brief moments of shared understanding in deciding how they will go on, any record of them will be entirely absent from the formal record of the design process and its outcomes. Others have argued that in order for a design to be truly reusable those wishing to call upon it in the future must be able to gain at least some understanding of the context within which it was created (Fruchter & Demian 2002, Demian & Fruchter 2006), and here we have begun to get a sense of what some of the more subtle facets of that context actually look like, and the difficulties that will be faced by those who must re-contextualise the products of that work in the future, such as the ephemeral nature of many of the resources that we have seen called upon to establish the meaning of a design in the moments of its creation: posters-on-the-wall can be pulled down in time for the next meeting; models can be broken up and their parts reused due to a lack of storage space; and staff move on to other projects or practices. The end result is that the only resource available to the current members of the practice when looking back on the designs of the practice's past may well be the formal set of paper documents or digital files that are the final manifestation of 'the plan', and which are a scant representation of the actual work done in formulating the-building-as-it-became.

5. Describing Hidden Knowledges

5.1. Introduction

In the previous chapter we saw the utility of ethnomethodologically informed ethnography as an approach to uncovering the part played by those knowledges which might ordinarily be hidden from the undirected view of both The Organisation and its analysts during the work of 'doing design'. The foremost problem faced by those seeking to support such phenomena in everyday work settings is the achievement of an adequate understanding of the work that they do in the actual moments of their manifestation; an understanding which Knowledge Management and its agents have sometimes been unable to achieve in a comprehensive and consistent manner. By utilising such an approach to transform these normally hidden resources into an explicit topic of study, those with an interest in providing ongoing support for their development, maintenance and application on The Organisation's behalf are able to gain a deeper understanding of the role that they play within actual work settings, one which fully acknowledges their irredeemably situated nature.

Despite its interesting nature, the achievement of such an understanding is only the first step in the collaborative process of establishing effective technological interventions in the workplace, and it must therefore be capable of being made available to a wide range of stakeholders - including organisational sponsors, those who will develop and deploy a new technology, and not least its eventual users - if it is to make a contribution to the successful formulation of a new Knowledge Management System. The sharing of the requirements for such systems, formulated on the basis of an investigator's original understanding of the work of a setting's members, is typically achieved through formal information representations - such as the Use Cases of a Software Requirements Specification (SRS) - the aim of which is to ensure that all of those invested in a new system understand the problems that it is attempting to solve, and the form of the intended solution. However, there are ongoing concerns regarding the effectiveness of such devices for sharing a sense of the more subtle aspects of the work of a setting's members with those who will eventually make a system manifest, something which can contribute to the failure of new technologies to meet the actual needs of their eventual users.

In this chapter we will examine the central role that descriptions of work settings and practices play in transmitting the investigator's original understanding of them to those invested in the success of new technological interventions: namely from the requirements

gathering specialist - be that a distinct individual, or a facet of the developer's role - to those who will design, develop, deploy, and ultimately use a new Knowledge Management System. As we have already seen, there is much concern regarding the tendency of some of those developing accounts of work to reify what are irredeemably local, partial, multiple and contestable knowledges, or to generalise them into abstractions, particularly when addressing those knowledges which might ordinarily be hidden from view, such as a tacit knowledge. Here we will explore the role that descriptive devices which take a more dynamic and open-ended approach to offering an account of such phenomena might play in sharing an understanding of them, ones which are both stable enough to establish a common understanding amongst a variety of stakeholders - in terms of their existing knowledge and experience - whilst also remaining adaptable enough to account for variations in conceptions of such phenomena both within and between settings. Specifically we will examine the role that *Pattern Languages* have played in addressing some of these issues in other areas, and whether they might offer particular utility with regards to describing the part played by hidden knowledges in actual work settings. Finally, using the four prototypical patterns identified during the investigation presented in the previous chapter as inspiration - a knowledge of the artefact, plan, corpus and profession - the basis of *A Pattern Language for Knowledge Management Systems* will be presented, the aim of which is to facilitate the establishment of a common understanding of the work that such hidden knowledges are doing amongst all of those working to make new Knowledge Management Systems a success.

5.2. Descriptions of work

Be it articulating our understanding of work from the past, attempting to inform decisions about how best to go on with our current efforts, or our imaginings of the future role of new technological interventions - descriptions of work settings and practices play an essential part in establishing a shared understanding of the activities of The Organisation's constituent members amongst the ever-shifting group of stakeholders invested in the successful completion of their work. However, these descriptions of work are typically created by and for non-members - such as the technical specialists brought in to implement new Knowledge Management Systems - and so those responsible for their creation must not only develop their own knowledge of the settings under investigation, but must also work to articulate that understanding in such a way that those who lack any first-hand knowledge of it themselves will find meaningful. To support them in their efforts researchers and practitioners with an

interest in workplace knowing have utilised an array of devices to provide both an account of their phenomena of interest, and to serve as a substrate upon which their original understanding of them can be captured and reused again in other circumstances. These range from from the highly normative through to the deeply descriptive, and include formal process-based accounts of work, an array of conceptual frameworks and models that provide a structure within which findings can be analysed and presented, and long-form narrative descriptions of the nature of particular work settings and practices.

Those taking a more formal approach to providing an account of the knowledges of a setting's members typically proceed by attempting to break them down into their component parts so that they can be measured, analysed, and re-presented in a highly structured form. Within this context the nature of workplace knowing can be presented as *tabular data*, showing the results of statistical analyses including means, standard deviations, and confidence levels, and which aim to expose the strength of the causal relationships between the selected phenomena (Colonia-Willner 1998, Berman, Down & Hill 2002, Politis 2003); as linear *flow charts* that depict the lifecycle of knowledge as it passes through its various incarnations, and which aim to identify the points at which category transformations occur (such as from a tacit to explicit knowledge), or where interventions might be implemented to the best advantage of The Organisation (Pan & Scarbrough 1999, Fruchter & Demian 2002, Hasan & Crawford 2003); or as diagrammatic concept maps that visually illustrate the structure of a knowledge's *component parts*, showing how they interact with one-another in order that the reader might gain a comprehensive picture of the factors that influence their nature or availability (Hedlund 1994, Beckett 2000, Gassmann & von Zedtwitz 2003).

However, such accounts can come to offer a highly normative view of knowing, one where a small number of reified statistical products or abstract visualised elements are brought into the analytic foreground, and where the messiness of its original manifestation is largely erased from the final record. Some have argued that these simplified descriptions promote Taylorist conceptions of work and lead to the creation of distorted 'organisational maps' which can blind The Organisation to non-canonical practices - such as informal work-arounds, which are viewed as being deviant and in need of remedy - despite the fact that these may be the very practices that help define its success (Brown & Duguid 1991). As we heard in section 2.3.1, ethnomethodological analyses of such accounts have shown that much of the work that goes into their creation can be elided from their final representation - be it an illustrative diagram or an academic publication - denying the reader any sense of the

irredeemably social context within which those acts of knowing actually occurred, but which are essential if our understanding of their meaning is to serve anything more than a passing interest. This problem can be further compounded by the fact that the members of a setting do not always possess knowledge of the theoretical constructs that those using such approaches ask them about in their questionnaires and interviews - the notion of 'a tacit knowledge' being a germane example - so they may fail to tell the investigator all of the pertinent information: *for surely it's simply something that everyone already knows!*

In chapter two we heard that frameworks are a common device called upon to represent accounts of the nature of tacit knowing, typically offering the investigator a range of variables and dimensions within which their data can be located - theoretically, analytically, and presentationally. Such frameworks provide investigators with a consistent structure within which their own corpus of works can be presented, but perhaps more importantly, one that can be used by those undertaking similar work in other circumstances. Frameworks range from *conceptual*, which aim to provide a structure within which philosophical or theoretical musings on the nature of knowing in the workplace can be presented, and which can then be used by those working to understand the part played by such knowledges in their own circumstances (Cook & Brown 1999, Von Krogh, Nonaka & Aben 2001, Boisot & MacMillan 2004, Schultze & Stabell 2004); *Analytic*, which provide a context within which data analysis can occur by locating it within a standardised structure, which itself can range from the abstract (Sveiby 2000, Brydon & Vinning 2006, Erden, von Krogh & Nonaka 2008) to the situated (Fujimura 1987, Star & Strauss 1999, Baxter & Sommerville 2010); through to *presentational*, which offer a structure within which descriptions of work can be arranged, and again can span from those that take a more formal approach (Baxter *et al* 2007, 2008) to those which seek to acknowledge the contextual nature of knowing (Hughes *et al* 1997, Boiral 2002).

Despite the utility of having a pre-defined structure within which accounts of knowing can be presented, the use of frameworks inevitably influences the outcome of the analysis and presentation of data, introducing a normative force which risks pushing the investigator towards highlighting certain aspects over others: indeed this is seen as one of their primary benefits. Notwithstanding the ongoing popularity of such frameworks, a number of investigators continue to use verbose descriptive accounts of workplace knowing, offering the reader a less structured, but potentially more comprehensive sense of how they actually manifest themselves in work settings and practices. Here narrative accounts can be broadly

grouped into three categories: *Light-weight accounts*, which provide the reader with a brief high-level discussion of the settings or practices under investigation, but lack any detailed description of how they actually manifest themselves in the current circumstances (McDonald & Ackerman 1998, Gabbay & le May 2004, Demian & Fruchter 2006); *Descriptive accounts* that provide a richer sense of specific settings and practices, but which do not delve into the deeply contextual nature of hidden knowledges, with the risk that what is left out of an account being as important as what is kept in (Collins, Shukla & Redmiles 2002, Schmidt & Wagner 2002, Ackerman & Halverson 2004, Reichling, Veith & Wulf 2007); and *long-form accounts*, which provide the reader with a detailed and comprehensive description of both the setting and the work of its constituent members as they go about their daily lives, and which include many of the prototypical studies examining hidden knowledges in action (Collins 1974, MacKenzie & Spinardi 1995, Collins 2001, Horning 2004, Boland, Lyytinen & Yoo 2007, Myers 2008).

The use of detailed narrative descriptions is not a common practice within Knowledge Management, particularly those falling into the long-form category, but it is here that we find the most comprehensive accounts of hidden knowledges in action, ones which provide the reader with the deepest sense of their subtle characteristics, including:

- Collins' account of the development of the TEA laser - highlighted in section 2.2.3 - which provides a description of some of the hidden knowledges that went into its production, and in particular the informal mechanisms by which they spread throughout the trans-atlantic scientific community via tenuous interpersonal relationships (Collins 1974);
- Horning's comprehensive account of the hidden knowledges of sound recording engineers, such as their tacit knowledge of the subtleties of adequate studio microphone placement, and how the increasing pervasiveness of black-boxed technologies has shifted the locus of these knowledges away from the physicality of their previous skill-sets, such as those associated with the 'cutting' of wax or lacquer recording disks (Horning 2004);
- Or MacKenzie & Spinardi's thorough account of the hidden knowledges of nuclear weapons designers, and the central role that they have played in limiting the spread of such weapons to rogue states and terrorist groups (see 2.2.3 for more detail), and which examines the fine detail of some of the knowledges that ultimately led to their success (MacKenzie & Spinardi 1995).

The authors of each of these accounts have gone to great lengths to provide the reader with a deep sense of some of the hidden knowledges at work in their chosen settings, something which it is difficult to achieve using devices that require that the investigator pare down their original understandings in order that they can be re-presented within a predefined structure, or transformed into constructs that can be statistically analysed and presented in tabular form. Some have argued that the identification of the underlying presuppositions of work - that can be brought to the fore so effectively through long-form narrative accounts - is an essential part of fully understanding the nature of that work, and if a system's designers lack an adequate knowledge of what makes it possible for a setting's members to go on with their efforts, then how can they hope to build technological interventions that effectively support them in the work that they do (Rawls 2008b). As we have seen in the preceding chapters, to support them in generating such understandings, a number of investigators have turned to Ethnomethodology in order to develop a more situated understanding of the work of a setting's members, an approach which acknowledges that all of those invested in the development of new technologies each have their own '*distinct social worlds, shop floors, and associated knowledges*' (Suchman, Trigg, & Blomberg 2002, p. 167).

5.3. Ethnomethodological description

From an ethnomethodological standpoint, adequate description is a mundane part of our everyday lives: we share stories of events from the past with friends and colleagues, and we issues and receive descriptive instructions that help guide the successful completion of future actions. Indeed, an ethnomethodologically informed description of a setting might be seen as utterly mundane to its members, for it is simply an account of what they all already know (although it may not normally be articulated as-such - if at all). As we have seen, Ethnomethodology's interest in consciousness, motivation and the knowledges of a setting's members is limited to their observable-reportable character, and so those with an interest in the formulation of an effective account of situated action focus on providing a description of just those practices that they see before them, rather than attempting to offer an explanation of the cognitive machinations that may - or may not - have caused them. Garfinkel believed that Emile Durkhiem's aphorism - which states that Sociology's fundamental principle is the correctness of social facts - has led to sociologists making the mistake of treating these social facts as theoretical or conceptual constructs, whereas they are actually very concrete things that are produced through recognisable social practices (Rawls 2002). Taking such a stance towards social orders can lead to the creation of transcendent philosophical or

theoretical pictures which begin to stand in as abstract accounts of what are irredeemably situated phenomena, and that categorising activity using such constructs risks telling us nothing about what makes an activity just-this-activity in just-these-circumstances. In the last chapter (section 4.7) we saw that - like 'the convict code' - the design philosophy of the architectural practice serves as both a members' guide to acceptable behaviour in the here-and-now, as well as a members' account of their actions from the past. Such 'occasional corpuses of knowledge' - what a setting's members know, and how they know it - are a self-explicating phenomenon, something which is achieved through an array of members' methods (Anderson, Hughes, & Sharrock 1985), and we examined some of the methodic procedures through which four such knowledges were made manifest within that particular social milieu. However, whilst the creation of adequate accounts of such social action was Garfinkel's primary concern, he considered that even though it is easily achieved, and easily recognised, it is intractably difficult to describe procedurally (Garfinkel 1996).

Following criticisms of the likes of Pleasants (section 2.2.5) we must be cautious that, when attempting to create accounts of situated knowledges, we are achieving no more than offering an unnecessary re-description of the phenomenon of interest in a philosophical, theoretical or technical language (Pleasants 1996). If we are not then we run the risk that our discoveries may be no more than an artefact of our analysis, or the descriptive device used; not a problem that the members of a setting actually have, or would even recognise as a class of problem. The concern for the ethnomethodologist is that extending oneself beyond this point can lead to analytic irony, or an investigation becoming a desktop exercise in philosophical puzzle solving, rather than an empirical investigation grounded in the reality of a setting's members. Even renowned ethnomethodologists, such as Michael Lynch, acknowledge that they can be tempted to make grand transcendental statements about the practices that they see before them, and that we must constantly work to allow a setting's members - through our dealings with them - to teach us about their reality, rather than take an analytically presumptuous stance to our conceptions of it (Lynch 1999). Whilst theory is of course important, and it is impossible to completely expunge any notion of an *a priori* theory from our psyche before undertaking an investigation, we must still be cautious not to allow it to come before our experiences and understandings of the current circumstances (Hutchinson, Read & Sharrock 2008). If we are not then we are at risk of being deceived into thinking that, because we have solved the philosophical or theoretical puzzle, we have somehow created a more accurate account of the reality of a setting's members than they themselves are capable of conceiving (Pleasants 1999).

Over-reliance on philosophical and theoretical abstractions as accounts of work can lead to some of the problems faced by the likes of Knowledge Management during the implementation of its technological interventions - highlighted in the earlier chapters - which it can be argued are partially brought about by the inappropriate use of explanatory devices to account for the nature and role of its phenomena of interest. However, some have pointed out that Ethnomethodology rejects the notion of ideal types, not abstractions, and that for the ethnomethodologist, an abstraction such as the notion of turn taking in conversations must be manifest in the particulars of the current circumstances (Dourish & Button 1998). Others have specifically argued that the investigator's role is therefore to formulate a description of the workings of the Documentary Method of Interpretation (see section 3.3.4) as experienced by the investigator in just-these-circumstance (Suchman 2007). Within this context successful ethnomethodological descriptions can be considered as the depiction of competencies, but also competent depictions - descriptions that any competent member would recognise - and which can be written and read as instruction-sets: how might the description of the problems faced by the members of this particular setting, and the procedures they are calling upon as solutions, be written and read instructionally. Here abstract constructs such as 'a tacit knowledge' lose some of their problematic status, for we can begin to ask what it is that the work of doing-tacit-knowing-in-just-these-circumstances actually looks like, and use our original understanding as the basis of an adequate description of that work, one which acknowledges its fundamentally situated nature, but which avoids drifting into the creation of causal explanations for which we lack any supporting evidence.

Because investigators from any discipline cannot include all the potentially discoverable information in an account of a setting or practice they must attempt to strike a balance between choosing what to leave out and what to keep in, between the description of specifics and the formulation of generalisations; choices that are invariably made by the author, not the members of the setting under investigation. It has been suggested that, despite the utility of ethnographically informed approaches that we saw demonstrated in the previous chapter, we should still be cautious about the elevation of the hidden contingencies of work away from their settings of use - in the form of generalisations - some arguing that they can be 'utterly misleading' (Schmidt 2000, p. 143). Others have warned that undertaking such investigations is an inherently interpretative enterprise, with the investigator's interpretations inevitably distorting the data (Dourish 2006), and that they are therefore vulnerable to sliding into the use of abstractions for which the mainstream Social Sciences

have been criticised (Crabtree *et al* 2009). Even staunch advocates of taking a situated approach have argued that ethnography is still a second order accounting, made up of the juxtapositions and alignments of the stories of a setting's members with those of the ethnographer (Suchman 2000b). Despite these words of caution, the proponents of ethnomethodologically informed ethnographic accounts have argued that they are the least vulnerable to such concerns because - when done appropriately - they exist at the lowest level of abstraction, and therefore stand the greatest chance of maintaining a meaning that those from the settings under investigation might recognise (Hutchinson, Read & Sharrock 2008). To achieve this end the investigator must be aware of what is taken for granted in their own accounts - their own use of the *etcetera clause* (Section 3.3.4) - as well as constantly checking who a given problem is actually a problem for. Investigators should therefore describe what it is that they actually see, not what it is that they think they see; refrain from philosophical puzzle solving, and instead examine things empirically; attempt to do away with explanation, and focus on description; and describe the facts as they present themselves, rather than offering an analysis of them (Pleasants 1999). Ethnomethodology embraces the ad hoc nature of everyday life, accepting that this unruliness is as much a part of producing sociological descriptions as it is any other aspect of our daily lives, its acceptance of the etcetera clause an acknowledgement that no definitive descriptions exists, and that one must always do work to reconcile a description and that which it describes (Sacks 1963). All renderings of reality are therefore a contingent accomplishment (Pollner 1991), and what is written down is inevitably a flawed account which can never be complete, even for just-these-circumstances (Suchman 2007), for there is always more to say than can be said in-just-so-many-words.

5.3.1. Descriptions for system design

Despite their compelling nature, some have sought to remind us that the design of new technological systems is not the product of an ethnomethodological analysis, but rather an ethnomethodological account: that it is not the role of Ethnomethodology to invent the future and the fact that it is an ethnomethodologically informed account is something which should be transparent to those who wish to use it to enrich their own understanding (Dourish & Button 1998). Others have noted that it can be difficult to present such accounts in a format that can be readily assimilated by system designers (Hughes *et al* 1994), and as a result they can often be perceived as being unsystematic, their discursive nature not lending itself to the identification of discrete design options. As a result investigators can sometimes

feel under pressure to translate their somewhat poetic accounts of work into something more tangible for system designers - be it in the form of general guidelines or specific 'cookbooks' (Plowman, Rogers & Ramage 1995) - designers preferring accounts that decompose work down into its component parts in order that they can more easily conceive of the actions that the system must perform (Hughes, Randall & Shapiro 1993). Further, a number of authors have pointed out that the findings from time-consuming and expensive ethnographically informed studies can rarely be reused in other circumstances (Hughes et al 1997), preventing the accumulation of a corpus of design knowledge (Martin & Sommerville 2004, Martin, Rouncefield & Sommerville 2006), such as could be achieved by modularising the findings from such investigations (Anderson 1998).

As we have heard, there are a complex array of competing tensions effecting the utility of an account of knowing in the workplace for those working to design new technological interventions based upon the understandings that it represents. On the one hand we have the desire to avoid the creation of abstract accounts of reified phenomena which ultimately tell us little about the actual work that occurs in the settings under investigation, and which can lead to systems that are 'designed from nowhere' (Suchman 1993). No matter what their source or intent, such accounts inevitably come to represent idealisations or typifications of work, and necessarily involve the deletion of certain contingencies, leading to differences between the investigator's original understanding and the final record of their efforts (Suchman 1995). On the other hand we are faced with the problematic status of long-form narrative accounts that have been shown to provide an effective description of the the work of a setting's members, as well as the social milieu within which that work is irredeemably located, but which do not lend themselves to the formulation of the concise statements that system designers would like to use to help them in their efforts.

In order to resolve these tensions some have sought to remind system designers that it is the actual achievement of work by a setting's members that they are aiming to support with new technological interventions, not our abstract conceptions of it (Schmidt 2000), and we should therefore move from generalised accounts of work to specific descriptions of it, freeing ourselves from the constraints of normative explanations, and their flawed claims to objectivity (Suchman 2000c). Instead we should use this shift to form new representations that can merge disparate knowledges together into a new multiplicity of representations: why pursue the unobtainable ideal of objectivity when the alternative offers so much more (Suchman 1995)? Here the investigator's efforts can become re-focused on formulating a re-

specification of their experiences of the work of a setting's members - rather than attempting to construct a theory, or even specific design recommendations - a re-telling that articulates the nature of just-these-practices within just-these-circumstances (Suchman 2007). Within this context descriptive devices that could facilitate the creation of accounts of actual work practices and settings, whilst at the same time offering those responsible for the design, development and deployment of new Knowledge Management Systems a palatable and portable representation through which they might easily come to their own understandings of the work that they are aiming to support, could offer real utility to all of a system's stakeholders, while also helping to prevent some of the most common causes of project failure.

5.4. Pattern languages

First formulated by the polymath Christopher Alexander in the mid-1970s (Alexander, Ishikawa & Silverstein 1977, Alexander 1979) the notion of a 'pattern language' was advanced as a device for supporting the design and construction of buildings without the necessity of producing formal architectural drawings and plans, or even the involvement of a formally trained architect, and which is achieved through the establishment of a shared working language - a *lingua franca* - that can be understood by all those involved in the building's creation. The original Pattern Language for Architecture described a set of archetypal components - based upon existing observable-experiential patterns found within the built environment - of which all buildings are said to be comprised (Alexander, Ishikawa & Silverstein 1977). They are presented as 253 discrete patterns across a range of spatial and conceptual scales, from the geographic distribution of towns and cities, right down to individual architectural details, such as the form of a window frame. Each pattern in the language presents the reader with a set of experiential clues to understanding the nature of the problem that a particular solution is attempting to address, and what you must do in order to recreate the common solutions to that problem in other circumstances. It is accepted from the outset that the individual patterns that make up the language will constantly evolve as our understanding of their real-world manifestation changes, and so each part of the language can be adapted independently of the whole without threatening its overall integrity. Further, the fact that each person that applies a pattern will do so slightly differently - and apply it differently in different circumstances - is also a fundamental part of the approach's utility, and so the language is not offered-up as a formal instruction-set, but rather as an open-ended guide to the possible solutions to a given problem, one that allows its users to

adapt it to their own circumstances, leaving room for them to bring their own experience and imagination to bare on the form of the final solution.

Structurally pattern languages are made up of a series of interlinked patterns, with each pattern existing within the context of all of the other patterns in the language, both in terms of a network of interrelated patterns, but also a hierarchy of patterns, with larger patterns being partially composed of smaller ones. Within a language the individual patterns are organised around broad conceptual structures that map to our experiences of the world around us - rather than a formal categorisation or typology - and which are designed to aid the discovery of those patterns that are relevant to the current circumstances. This is achieved by placing groups of related patterns into a wider narrative structure - the summary of the language - which offers the reader a high level overview of the problem domain covered by the language, whilst serving as a map to assist the reader in quickly navigating its structure. Indeed, the entire structure of the language, from its title right down to the form of its individual patterns, serves as a highly scalable conceptual map that quickly guides the reader to the most appropriate solution to their current troubles. However, despite this overarching structure, pattern languages are specifically designed so that a sub-set of patterns can be extracted from the language and used independently of the whole - in the form of a smaller stand-alone language in its own right - allowing the breadth and depth of the language to scale to meet the problems that those who are calling upon it actually face.

Within the context of this overarching structure each pattern focuses on a different class of problem as it would be experienced within a given setting, such as the roles played by the people who work within it, the temporal flow of activities, or the spatial layout of artefacts. Each of the language's patterns is presented through a simple template which encapsulates a description of a problem as it is experienced by those who have been faced with it, as well as an account of the different solutions that have been observed as providing a successful resolution. Each pattern begins with its own *descriptive title*, that allows it to be quickly located within the summary of the language, and which is supported by an *illustrative picture* that makes the pattern more memorable to its readers. Where relevant each pattern then has a section that locates it within the context of the language's *coarser narrative structure*, linking it to any larger patterns to which it contributes. This is followed by the *headline*, which provides the reader with a concise overview of the pattern's problem definition. Next is the *problem description*, which is the 'why' of the pattern and is based on a summary of observations of recurring instances of the problem. This is articulated in such

a way as to capture their essence, whilst maintaining the pattern's 'fuzzy edges' so that it is both adaptable and can be related to other patterns. Each pattern then presents the reader with a set of pointers to a *solution to the problem*, in terms of a description of how things should be, and which describes the '*field of physical and social relationships which are required to solve the stated problem effectively, in the stated context*' (Alexander, Ishikawa & Silverstein 1977 p. XI). Finally is a section that sets up the narrative context for any *smaller patterns* that contribute to this one, in order that the reader might be quickly directed to any further patterns that may be relevant to their current troubles. In the presentation of both its problems and their solutions, the descriptive power of the language's patterns lies in their focus on the interaction between people and their immediate circumstances, and in particular the notion of an active, living community through which a shared understanding of the nature of problems and the discovery of appropriate solutions are made manifest. Patterns intentionally contain little technical detail, and instead are presented as a series of archetypes which aim to make direct contact with our own experiences of the world around us. As a result individual patterns can have a somewhat open-ended or ambiguous feel, but this is by design, for the aim of the pattern is not to offer a definitive solution, but rather to support the reader of the pattern in the discovery of their own solutions to the problem in-hand.

Alexander claimed that his pattern language was foundational, and could therefore be used as a basis for not just all other architectural pattern languages, but any pattern language used to describe other aspects of our everyday lives. Since their initial formulation pattern languages have gone on to play a role in a range of other disciplines, including the Biological Sciences, where they have been used as a descriptive metaphor in the field of genetics (Newman & Bhat 2009), pedagogy, where they have been used to guide the creation of learning resources (Sharp, Manns & Eckstien 2003), but most commonly they have been called upon by a number of sub-disciplines of the Computer Sciences, where they were first used to ease the conceptual transition from the procedural to the Object Orientated Programming paradigm (Gamma *et al* 1998). They have since become an established tool within Software Engineering where they have proven particularly successful in areas that are amenable to the modular nature of the patterned approach, including introducing consistency into system safety and security (Fernandez & Pan 2001, Armoush, Salewski & Kowalewski 2009), wider system design (Arteaga *et al* 2008, Druckmiller *et al* 2010), as well as providing guidance on the design of user experiences and interfaces (Malone, Leacock & Wheeler 2005, Wania & Atwood 2009). Of particular relevance to the

current work, a number of authors have highlighted the utility of pattern languages for those undertaking investigations in everyday work settings in order that they might inform the requirements for new technological interventions, such as those focused on Computer Supported Cooperative Work (CSCW). Within this context investigators have turned to pattern languages as a tool for articulating their original understandings of the settings under investigation in such a way that is both palatable to system designers (Erickson 2000a, 2000b), but which also facilitates the portability of their findings from one setting to another (Martin, Rouncefield & Sommerville 2006, Martin *et al* 2001). Despite not being widely deployed within Knowledge Management, a number of authors have also examined the role that pattern languages might play as a mechanism for supporting its interventions, for example as a way of leveraging lessons learned during Knowledge Management Systems development from one project to the next (Manns 2001), as a method for capturing and transferring corporate knowledge (May & Taylor 2003, Hughes 2006), or as an approach to formulating the requirements for Knowledge Management interventions in small businesses (Wildner 2008). In all of these applications pattern languages have been called upon to establish a common understanding of a discipline's problems, as well as the adequacy of its accepted solutions, in order that those attempting to solve their current troubles might be guided by the experiences of those who have successfully addressed similar problems in the past.

As we have heard in the preceding pages, providing an account of the patterned nature of our everyday lives is of central interest to investigators from a range of disciplines, not least of which is Ethnomethodology. For the ethnomethodologist our experience of the world as one that is shared in common with those around us is primarily achieved through our perception of its patterned nature, something which we use as a resource to make our observations of the actions of others intelligible as examples of just-this-type-of-action (Rawls 2008a). This notion is most fully expressed through the Documentary Method of Interpretation (see section 3.3.4), which is a members' methodic procedure for recognising and interpreting common occurrences of social phenomena: where each manifestation of a phenomenon is treated as pointing to an underlying pattern; where the pattern is recognised through its concrete occurrences; and where each-next-occurrence is interpreted within the context of that pattern (Garfinkel 1972c). Like Garfinkel, Alexander's interest is in the patterned nature of the world around us - in this case our experiential relationship with the built environment - and the role that our understandings of, and perhaps more importantly our ability to articulate, those patterns plays in guiding us in our search for answers to the

timeless question: *'how do we go on?'* However, whilst those undertaking a formal analysis of such phenomena seek to expose the mechanisms that are thought to have caused them, Alexander's language, like an ethnomethodological description, does not attempt to say more about the manifestation of its patterns than the observable, reportable and describable evidence allows for.

In the section 5.2. we examined a range of devices used by investigators to present an account of workplace knowing to those who seek to design, develop and deploy new technological interventions, with the most promising - in terms of its offering the investigator the opportunity to share a deep sense of their original understanding - being long-form narrative accounts. However, we also heard that there are those who have concerns regarding the utility of such accounts, because their unstructured and verbose nature does not lend itself to the actual information needs of a system's designers, who must make sense of the social milieu within which their systems will eventually be located if they are to avoid creating a system that is at odds with the ways in which people actually work. In order to address such concerns a number of investigators have specifically examined the role that pattern languages might play as a device for representing findings from the application of ethnographically (Erickson 2000a, Hughes *et al* 2000, Crabtree, Hemmings & Rodden 2002) and ethnomethodologically (Martin *et al* 2001, Martin & Sommerville 2004, Martin, Rouncefield & Sommerville 2006) informed approaches to the other stakeholders invested in a new system. Here the focus of the language is shifted to offering a descriptive account of the activities, interactions and artefacts that are commonly found within work settings - rather than the wider built environment - with individual patterns concentrating on factors such as the temporal flow of activities (Erickson 2000a), the cooperative interaction between a setting's members (Martin & Sommerville 2004), or the nature of our engagement with workplace artefacts (Hughes *et al* 2000). The work of these authors has shown that pattern languages offer a useful device through which an investigator's detailed understandings of practices and settings can be presented in a form that is palatable to a range of stakeholders, not least of whom are those who will work to make a new technological intervention manifest.

The initial impetus for calling upon pattern languages as a descriptive device varies, but two themes dominate: the establishment of a shared language that can be understood by all of the stakeholders invested in a new technological intervention, and the modularisation of the understanding generated through investigations undertaken within the situated paradigm in

order that they can be generalised and applied in other circumstances. The development of a commonly understood language which can facilitate inter-discipline communication - and in particular bridge the conceptual gap between the technical specialists typically tasked with building new Knowledge Management Systems and the system's eventual users - is of central importance to those creating technological interventions within the context of the situated paradigm, where the perspective of a setting's members is seen as playing an foundational role in designing a successful system. Here system design is acknowledged as a communicative process, with pattern languages serving as a shared meta-language that can be formulated and owned by all of those involved in the realisation effort. However, unlike the formal taxonomies and ontologies that are now so common within Knowledge Management (see Maedche *et al* [2003] for a useful overview of their application), pattern languages offer more than a shared vocabulary: instead serving as a conceptual, experiential and perspectival scaffold within which all of those involved in the design process can develop and articulate their own understandings of the work that the system must eventually do (Erickson 2000b). In particular their creation offers those who may not possess the technical training, rhetorical skill, or political power to make themselves heard within more formal design processes, the opportunity to influence the outcome of a new technological intervention that meets their actual needs, rather than their needs as perceived by others (Erickson 2000a). For Erickson, these *lingua francas* should be the property of the collective as-a-whole, rather than any one individual or sub-group, and can therefore undergo constant evolution as the nature of work settings and practices change, or the language is applied in the search for solutions to new problems. Maintaining a pattern language in this way offers those who are new to a setting an established basis upon which to ground their own understanding of the specific circumstances they are now having to design for, providing a conceptual structure within which a dialogue with a setting's members can begin.

A number of authors have argued that pattern languages provide a useful device through which the original understandings of those undertaking field work within the situated paradigm might be mobilised in order that they can be applied to other circumstances and settings. Such an approach has much in common with the use of pattern languages within Software Engineering, where they are used to increase consistency and developer productivity by supporting the reuse of standardised design elements for solving commonly experienced problems (or even to serve as an advisory against common bad practices, in the form of 'anti-patterns' Brown *et al* 1998). Here the language's patterns are treated as a substrate upon which the investigator's findings from a setting can be captured in a modular

form, one that lends itself to their being transformed into generalisations whose utility extends beyond the current circumstances, supporting the drawing together of a corpus of different studies into a repository of general design knowledge (Martin *et al* 2001, Martin, Rouncefield, & Sommerville 2002, Martin & Sommerville 2004). Indeed, it has been argued that because ethnographically informed techniques are unlikely to ever be a part of mainstream system design, pattern languages offer the discipline's researchers a device for mobilising the detailed understandings of those who are in the privileged position of being able to undertake such studies so that their findings can be applied by general practitioners (Martin, Rouncefield & Sommerville 2006). Within this context the pattern language becomes more akin to the presentation frameworks discussed in section 5.2, allowing findings to be re-presented within a structure that can be utilised across studies, either as a source for questions and hypothesis, or as a series of standardised concepts that can be applied in a range of circumstances (Erickson 2000b).

However, as we have already heard, the production of general guidelines necessarily involves the reification of what are irredeemably situated phenomena - or their treatment in abstract - in order that they might be made relevant to the widest range of circumstances. Indeed, this is evident in some of the patterns produced within the context of Knowledge Management (Manns 2001, Wildner 2008), which have lost their connection with the actual work of any particular settings' members, and instead present a gross generalisation of a notional problem and its idealised solutions. Using them in this way risks transforming a pattern language into just another normative force, where the rich detail of the original investigation is steadily eroded over time as individual patterns are adapted to fit the current circumstances. This is particularly problematic for those facets of a setting or practice that might ordinarily go unnoticed - such as the hidden knowledges of a setting's members - and which could easily be erased through the creation of generalisations, as time, distance and an untrained eye make them appear incidental to our current understanding of that work. Some have tried to guard against such concerns by embedding the rich detail of the original investigation within individual patterns so that those who reuse them again in the future can re-orientate themselves to their original intent when applying them to their own circumstances (Martin & Sommerville 2004). Those taking such an approach argue that where abstractions are used they are not formal ones, but rather are accounts of the observable features that can be identified across different settings, and so must be described accordingly (Martin, Rouncefield & Sommerville 2006). Investigators formulating cross-cutting, topic-based descriptive structures that span individual patterns in this way must

therefore be especially cautious that they are not generating a subtle normative force, either through the pattern's creation, or its subsequent readings.

5.5. A pattern language for knowledge management systems

Alexander believed that by tapping into what he called '*the timeless way of being*' it was possible to access our underlying sense of place - something that is evoked by the patterned nature of the world around us - and therefore design buildings which directly appeal to the human spirit. The aim of the original Pattern Language for Architecture was therefore to capture what he called '*the quality without a name*' (Alexander 1979), a notion that represents our recognition of 'good architecture' even though we may not be able to explicitly articulate what that means in practical terms: '*This quality is objective and precise, but it cannot be named*' (*ibid.* p. ix). For Alexander the creation of a new building was a process of 'unfolding', within which its individual components were opened out to fill the available physical space - guided by the language's patterns - until such time that the quality without a name emerged from the sum of the new structure's parts: its patterns. Despite its highly subjective and experiential nature, he argued that this quality is objective at source - for it is the product of the physical world around us - and through the use of his pattern language he sought to expose its properties in order that we could design buildings that directly appeal to it¹. The original pattern language therefore serves as a system of constraints that narrows down the range of possibilities, whilst leaving space for the reader to develop their own sense of these qualities so that they too can begin to dwell within the building's design, eventually becoming connoisseurs of the beauty of well designed spaces in their own right.

Despite Alexander's attempts to create an objective representation of it, the quality remains something that can never be captured by a single name - indeed readers familiar with Garfinkel's work would recognise his own attempts to explicate similar notions through long arrays of interrelated words that could only be understood as-a-whole (see Garfinkel 1996, p. 11 for an extreme example). Within the context of the current work, these experiential understandings can be considered as examples of a hidden knowledge in action, and we saw them manifest themselves on a number of occasions in chapter four (most notably in section

¹ Some have been slightly critical of the positivist nature of this stance (Martin & Sommerville 2004).

4.7), where the members of Hamptons were unable to offer an explicit account of their experience of the practice's designs in-just-so-many-words, and yet prove themselves to be highly competent architects on a daily basis. Here it is argued that their ability to illuminate the ineffable makes pattern languages particularly suited to supporting the description of such intangible phenomena in a way that appeals to their experiential nature, and therefore keys into our own understandings of the world around us. In the next section a summary of *A Pattern Language for Knowledge Management Systems* will be presented as an approach to describing workplace knowing that focuses on the multiple, local and partial nature of the knowledges of a setting's members, one that is both more palatable and portable than academic accounts of such phenomena, such as that set out in the last chapter.

Whilst the aim of the original Pattern Language for Architecture was to inform the construction of new buildings, here the purpose of the language is to inform the implementation of new technological interventions through the establishment of a shared understanding of the knowledgable work that they aim to support, and in particular of those knowledges which might ordinarily be hidden from an undirected view. Specifically the aim of the language is to assist those involved in the design, development and deployment of Knowledge Management Systems in achieving their own understanding of the work that such knowledges do in the moments of their manifestation, one which is accountable to those who will eventually use the system to support their work. Within the current context the use of patterns is therefore focused on serving as *an aid to a sluggish imagination*, one that is more akin to the tutorial exercises that characterise Ethnomethodology's system of apprenticeship, and which offers those who lack the training or experience to notice such hidden phenomena a set of pointers or clues through which they might begin to formulate their own understandings of the work that they do. In the last chapter we saw that the problems faced by the members of the architectural practice - within the context of those that Knowledge Management is brought in to address - could be characterised as their reaching to achieve or articulate a knowledge of just-this-thing, such as an artefact, plan, corpus, or profession. It is argued that placing the array of members' knowledges at the centre of our account in this way facilitates the asking of questions such as: how is a knowledge of just-this-thing being practically achieved in just-these-circumstances; how is it being made manifest in response to just-these-troubles; what work is it doing to help solve just-these-problems; and how is it being actively managed by those who need it the most with the tools available to them?

Whilst Alexander claimed that his pattern language was foundational, and some have successfully applied his approach to articulating the investigator's original understanding of work settings (Erickson 2000a), a number of researchers have gone on to replace his original pattern structure - set out in the last section - with one of their own. Whether it be the introduction of an array of sub-categories into the pattern's template - a common feature of their use within Software Engineering (e.g. Gamma *et al* 1998, Robertson & Robertson 2006) - or a decoupling of the problem-solution pairing - such as those using patterns to understand novel problems for which there may be no established solution (Crabtree, Hemmings & Rodden 2002) - many applications of the approach now bear only a nominal relation to Alexander's original Pattern Language for Architecture. Within the context of system design some have argued that the expressive power of the original pattern language is limited by its relating problems to common solutions and that maintaining this relationship further constrains their application to specific settings (Martin *et al* 2001). In order to address such concerns these authors have identified a range of recurrent topics found across the existing corpus of workplace studies - including the sequentiality and temporality of work; its divisions of labour; the ways in which people orientate to plans and procedures; and how work is coordinated amongst distributed individuals - and used these to define a pattern template with a structure that is specifically designed to serve as a descriptive device for ethnomethodologically informed investigations (Martin & Sommerville 2004). The patterns produced in this context are each supported by one or more vignettes showing the actual work of a setting's members, each offering a textual or pictorial description of the work being undertaken, as well as an account of the social practices through which the work is being achieved. Individual applications vary, but a common structure for the presentation of these vignettes includes: The cooperative arrangement of individuals and resources; The mechanisms for the representation of activity such as an action plan; The ecological arrangement of individuals and artefacts, such as their spatial layout; Coordination techniques in terms of the practices and procedures through which coordination is achieved; and the community of use, which aims to describe the work of the group under investigation (Martin, Rouncefield & Sommerville 2006).

Whilst breaking a pattern's structure down into an array of different subcategories - or decoupling the problem from its solutions - might be appealing in certain circumstances, it is argued here that the simplicity of Alexander's original template still has much to offer those seeking to use patterns as a descriptive device, and so we will stick to his prototypical form. Each pattern therefore serves as a description of what problem a given knowledge is being

called upon to solve, the tensions that are evident in the situations within which these problems occur, and the solutions that the members themselves are calling upon to make that knowledge relevant to the current circumstances, in the form of the methodic procedures through which it is made manifest. Within this context the problem of the pattern becomes one that the members of a setting can be evidenced as actually having, and which can therefore be couched in language that they themselves would understand as a class of problem, even if they would not normally articulate in these specific terms. The natural corollary to conceiving of the pattern's problem in this way is that its solution becomes the observable-reportable methodic procedures through which it is being addressed by just-these-members as they bring just-this-knowledge to bare on the problem at-hand. However, it is important to note that this is not an attempt to create a typology of members' knowledges, for no claims are being made about their content or veracity, nor is there any attempt being made to capture them on anyone's behalf; rather the language as-a-whole should be read as a corpus of the members' methods that are being called upon to develop and apply their knowledges to the problems that they face in their everyday work. *Thus the language serves as an explication of ad hocing procedures, the Documentary Method of Interpretation, and glossing practices in action* (see section 3.3.4).

As with other pattern languages created within the situated paradigm, here the problem definition and its solutions are supported by data drawn from ethnographically informed investigations of work (including those undertaken by other researchers), which are presented within the pattern's template in order that those reading a pattern can understand its original intent as they apply it to their own circumstances. By presenting our understandings of the work of a setting's members in this form the aim is that all of the stakeholders in a new Knowledge Management System will be able to form a clear, stable, and shared conception of the practical problems that it is attempting to solve, one that appeals directly to - or directly supports - the kinds of solutions that those from similar settings have formulated for themselves, rather than it simply becoming an abstracted set of descriptions of somebody else's problems. In particular, by eschewing the abstract representation of reified phenomena so common within the literatures of Knowledge Management, the aim is that the language will serve as a guide to understanding the work that those knowledges which might ordinarily be hidden from view are doing in a given setting, one that provides a more appropriate balance between abstraction and re-description than more formal approaches, and one whose open-ended nature can serve as an adequate gloss for those aspects we lack accountable evidence for.

5.5.1. Summary of the language

The full language is available in appendix A1 and the four knowledges identified in chapter four have been highlighted below, and join those from a second case-study investigation presented in the next chapter.

We each possess an array of knowledges that are applied to the successful completion of our work. Each of those knowledges are both a personal and collective achievement as we constantly reach for *just-the-required-understanding* in *just-these-circumstances*. The methodic procedures through which this never-ending pursuit is achieved are available to all of a setting's members in and through the work that they do, and are the very basis of a *knowledge-of-just-this-thing* as our understandings coalesce in pursuit of a solution to the perpetual puzzle: 'how do we go on?'

Our knowledges of geographies

Our knowledges of different geographies - including our understanding of the lay-of-the-land, specific places, or the current location of distant others - supports our contextualisation of spatially relevant institutions, actors, activities and artefacts, and play an essential role in coordinating work that might be distributed across a range of spatial scales - from our immediate circumstances to those that are taking place many thousands of miles away:

1. Knowledge of the lay-of-the-land
2. Knowledge of place
3. Knowledge of location

Our knowledges of institutions

Our knowledges of the institutional landscapes within which our work is situated - including those who dictate our work, whose rules and regulations guide our current efforts, or whose systems and services we call upon to assist us with our work - allows us to contextualise actors, activities and artefacts within the wider institutional structures that are part of our everyday lives:

4. Knowledge of the institutional landscape
5. Knowledge of the rules & regulations
6. Knowledge of the systems & services

Our knowledges of actors

Our knowledges of the social collectives through which work is coordinated - including our understanding of the standards to which they aspire, to which we will be held accountable, their internal machinations, and their individual capacities and capabilities - allows us to situate our own efforts within context of those around us:

7. Knowledge of the customers and clients

8. Knowledge of 'the team'

9. Knowledge of the experts

Our knowledges of activities

Our knowledges of activities - including our understanding of the outputs of our immediate colleagues or those of the profession as-a-whole, as well as the appropriate conduct of the processes & procedures through which they are created - helps guide us in our search for the most appropriate solution to our current troubles:

10. **Knowledge of the profession**

11. **Knowledge of the corpus**

12. Knowledge of processes & procedures

Our knowledges of artefacts

Our knowledges of artefacts - including our understanding of their affordances, their current status, or their nature as just-this-artefact - supports our efforts in making them relevant in the current circumstances:

13. Knowledge of the workscape

14. **Knowledge of 'the plan'**

15. **Knowledge of the artefact**

5.6. Summary

In this chapter an approach to sharing the findings from ethnomethodologically informed ethnographic investigations which appeals to the direct experiences of both the author and the reader has been presented, one that offers particular utility for describing those knowledges which might ordinarily be hidden from view. In the first section we examined the important role that description plays in articulating the investigator's original understanding of the work of a setting's members, and noted some concerns regarding the

status of accounts formulated using a range of more formal approaches, with some arguing that the task of the investigator should be to produce a faithful description of that work, and not concern themselves with an explanation of its causes. It was then noted that, whilst long-form narrative accounts have the capacity to offer the deepest description of work, they are not ideally suited to the information needs of those who would utilise such understandings during the design, development and deployment of new Knowledge Management Systems. In response to similar concerns in other areas, we then examined how pattern languages have been called upon as a device which avoids some of the problems associated with more formal approaches - such as their tendency to create abstract accounts of reified phenomena - whilst offering a more palatable account of the role played by situated phenomena in actual work settings. Finally the basis for A Pattern Language for Knowledge Management Systems was presented, the aim of which is to provide a conceptual scaffold within which the investigator's original understanding of such phenomena can be developed, articulated and shared with all of the stakeholders invested in the success of a new technological intervention.

In the next chapter an evaluation of the approach presented in the previous chapters will be presented within the context of a second case-study investigation examining the re-development of a Knowledge Management System to promote the reuse of existing knowledge in a very different setting than the one discussed in the last chapter: a Government agency in the United Kingdom.

6. Designing for Hidden Knowledges

6.1. Introduction

In the last chapter we heard about the potential utility of pattern languages as a device for representing an investigator's original understanding of the work done by hidden knowledges in actual work settings, and making this understanding available to the other stakeholders invested in a new Knowledge Management System - not least of whom are those who will labour to make the system manifest. However, the identification and communication of appropriate user requirements is just one aspect of implementing a successful technological intervention, and such understandings must be transformed into appropriate system functionality if it is to be integrated into the work that a setting's members do.

As we have heard, when faced with such intangible and ephemeral 'intellectual assets' as the hidden knowledges of The Organisation's constituent members, a common reaction from the conventional Knowledge Management community is to attempt to transform them into an explicit resource in order that they can be written to some substrate - such as a Knowledge Management System - and reused by The Organisation's other agents, both now and in the future. Here - within the context of a second case-study investigation - we will continue to examine the appropriateness of such a stance, and evaluate whether the approach to uncovering and articulating the requirements for such systems outlined in the previous chapters might lead to the formulation of technological interventions that are more closely aligned with the actual needs of a setting's members, rather than their needs as conceived by those taking a more formal stance towards their work.

6.2. Knowledge reuse

As markets mature, and projects become ever larger and more complex, there is constant demand that those knowledges developed during work undertaken on The Organisation's behalf be captured so that they can be reused again in the future: whether it be to learn lessons from the failures of the past, or simply to increase efficiency by avoiding our having to re-invent the wheel each next time a problem arises (von Krogh 1998, Baxter *et al* 2008). Call centre staff reuse existing solutions to help solve customer problems (Collins, Shukla & Redmiles 2002, Erden, von Krogh & Nonaka 2008), technicians utilise the past experiences of others to solve their current troubles (Orr 1996, Lutters & Ackerman 2007), corporate

lawyers reuse existing technical documents when creating new contracts (Blomberg, Suchman & Trigg 1996), and architects reuse past designs when formulating new buildings (Schmidt & Wagner 2004). In all of these settings existing corpuses of information - created during work undertaken in the past - are made relevant in just-these-circumstances to assist those seeking to resolve their current trouble: namely *'how do we go on?'*

However, as we have heard and seen in the preceding chapters, The Organisation is also reliant on an array of knowledges that are hidden from an undirected view, and which are only manifest in and through the situated practices of its constituent members; be they based upon physical interactions or those mediated by technology. This inherent tension: between the corpuses of information under The Organisation's direct command & control - sometimes characterised as representing explicit knowledge - and the hidden knowledges of its constituent members, whose ongoing availability are vulnerable to the mobile and ephemeral nature of people - and which are often characterised as a tacit knowledge - is a common theme within the literatures of Knowledge Management (Cook & Brown 1999, Hansen, Nohria & Tierney 1999, Schultze & Stabell 2004), and is one that it is often tasked with resolving through its social and technological interventions. Within this context the primary task of Knowledge Management might therefore be conceived as the transformation of the knowledges of a setting's members into a format capable of being written to some substrate - such as a Knowledge Management System - assigned to the relevant categorisation frameworks, provided with a navigable structure, and then re-presented through an appropriate device, in order that those needing to achieve the same degree of understanding again in the future might do so in a timely and efficient manner. However, the Taylorist ideals that often underly such efforts implicitly rely on both the possibility of transforming the partial, multiple and contested nature of irremediably situated knowledges into a static information construct that is capable of being 'captured', as well as the presence of the persistent and stable institutional interfaces that are required if they are to be appropriately reinterpreted when called upon at some as-yet-unknown point in the future.

Those working on The Organisation's behalf to address such issues are faced with a number of difficulties, not least of which is the willingness of its constituent members to engage with Knowledge Management's initiatives, no matter their source or intent. The issue of motivation as it relates to the management of knowing in the workplace has been thoroughly examined elsewhere (Osterloh 2000, Ardichvili, Page & Wentling 2003), with the most pressing problem being that it is rarely explicitly acknowledged as part of one's job

description to partake in such efforts, and so additional incentives must be introduced to encourage people to do work that is often over-and-above that which is required for them to complete the task in-hand (Collins, Shukla & Redmiles 2002). These include the *extrinsic rewards* delivered through The Organisation's staff appraisal processes, such as increased wages (von Krogh 1998, Osterloh 2000), and *intrinsic rewards* such as increasing one's status with one's peers, or promoting a sense that one is contributing to the development of a shared repository, the progress of The Organisation, the profession, or even society as-a-whole (Hendriks 1999, Erickson & Kellogg 2000, Amar 2004). Conversely, a number of factors that dissuade individuals from engaging with The Organisation's interventions have also been identified - including issues around our trust in the intentions of both one's peers and those of The Organisation as-a-whole, a lack of confidence that we have anything of value to offer, or simply the personal costs of contributing to the system (including the potential loss of power that comes from enlightening one's colleagues) - all of which can encourage the hoarding of information within personal repositories that are cut off from Organisational access and oversight (Hull 1999, Ardichvili, Page & Wentling 2003, Brydon & Vinning 2006). Ultimately however, any intervention must show itself to have direct value for a setting's members if they are to engage with it fully - rather than it simply being another management initiative being applied to them from 'above' - and the only way to achieve this end is to understand what support they themselves actually need to help them in their efforts, and to work towards *enabling them to create something that has more to offer than the ad hoc alternatives that they are in a position to create for themselves*.

Even in those circumstances where a setting's members are motivated to engage with Knowledge Management's interventions, the designers of its Knowledge Management Systems are still faced with the practicalities of transforming an individual's understandings into a format that is capable of being 'captured', located and understood by others in the future, and in the likely absence of the record's originator. In the last chapter it was noted that the management of knowledge within organisations is often seen as a flow or cycle (section 5.2), as a transformation occurs from data through information and on to knowledge (or vice versa [Tuomi 1999, Braganza 2004]), as well as between tacit and explicit knowledge (Nonaka 1994, Cook & Brown 1999). Some have argued that it is only explicit knowledge that can be managed through technology (Markus 2001), whilst others are critical of attempts to use it for the codification of tacit knowledge, arguing that such approaches are founded on a number of category mistakes: namely confusion regarding the relationship between information and knowledge, in that they are complementary

phenomena, rather than sitting on a continuum; and to confuse the sharing of information, in the form of words and descriptions, with the transfer of knowledge and capabilities (Nightingale 2003). Such criticisms have led to their own array of theoretical models and frameworks as researchers and practitioners have sought to clarify the distinction between these different phenomena in order that Knowledge Managers might be clear about the actual target of their interventions (Tuomi 1999, Ambrosini & Bowman 2001, Stenmark 2001a, Boisot & Canals 2004, Braganza 2004, Muller-Merbach 2006). However, despite the ongoing appeal of these philosophical and theoretical ‘pictures’, there remains much confusion regarding just what it is that is being captured and managed within Knowledge Management Systems, with many claiming that their approach is capturing knowledge when they are in fact serving as a repository for information based upon people’s understanding, or simply information about it.

As we heard in the preceding pages, all representations of knowledge - be they those of the investigator’s understandings of a setting, or the knowledges of a setting’s members as they are re-presented through some system - are representations from somewhere (Suchman 1995), and so those created in another time or place can come to take on a contested nature as attempts are made to re-interpret and re-negotiate their meaning in the current circumstances (Suchman 1993). As with other aspects of managing knowing in the workplace, there are those who have taken more formal approaches to remedying this situation, ones that stress order, reason and objectivity, and which seek to map out the full detail of an individual’s understanding within a predefined structure of interrelated properties. Nowhere is this more evident than through the creation of design rationales, whose product is typically a graph-based structure which aims to expose all of a given ‘knowledge object’s’ interdependencies, treating our understandings as being based on a set of discrete facts and decisions that are capable of being transformed into a self-contained explicit construct (Moran & Carroll 1996, Regli *et al* 2000). However, some investigators have argued that where there is a complex of interacting phenomena it can be difficult to document knowledge in a meaningful way through such approaches (Collins, Shukla & Redmiles 2002), whilst others have suggested that the highly structured nature of these representations can lead to problems with effectively drawing them into new contexts (Tory *et al* 2008, Lymer, Ivarsson & Lindwall 2009).

As we saw throughout chapter four, a setting’s members can do much subtle and often hidden work to negotiate a common-enough understanding amongst their peers, such as

through the use of talk, gesture, and the delicate drawing-in of artefacts from near and far to support them in their current efforts. A number of investigators have argued that it is its very contextual nature that made the information present within such situations useful in the first place, and that the absence of any sense of this context within the final record of it can present problems for users of the product of that work in the future (Markus 2001, Ackerman & Halverson 2004, Lutters & Ackerman 2007). As a result the interplay between the original context within which a solution was first formulated, the decontextualisation that typically occurs as an abstract representation of that work is recorded on some substrate in the form of information, and the re-contextualisation work that must be done by those attempting to reuse that information again in the current circumstances remains one of the key issues identified within the knowledge reuse literature (Markus 2001). Problems with the re-contextualisation of information are particularly relevant where consumers of that information are expected to share high degrees of knowledge in common with its authors, such as the sparse records that Doctors make about their patients which are intended to be read by other Doctors, and therefore merely provide a set of subtle pointers and clues to the phenomenon that they represent (Heath & Luff 1996, Markus 2001). However, such common knowledge can erode over time or with organisational distance - such as can be caused by institutional change events, or simply the natural turnover of staff - with the increasing 'knowledge distance' between the record's creator and its eventual user leading to its original meaning being difficult to re-constitute from the available representations (Star 1992, Subrahmanian *et al* 2003).

A number of authors have argued that taking a more situated stance towards supporting reuse can help to alleviate the contextualisation problem by acknowledging that the local experts who may have a deep understanding of the work that reuse efforts are to support are best placed to reduce the knowledge distance between the creators and users of that information (Ackerman & McDonald 1996). Such '*knowledge intermediaries*' can come to play an essential role in ensuring that information finds its way into work processes, its value for the current activities is promoted, facilitate access to the corpus of existing information, as well as applying their own expertise to the interpretation of that information during the moments of reuse (Blomberg, Suchman & Trigg 1996, Demian & Fruchter 2006). In such circumstances the corpus of information comes to serve as a pedagogical tool - a *knowledge foundry* - within the context of which a master-apprentice relationship can be established (Lave & Wenger 1996), and new users guided towards their own understandings of both the corpus and its contents (Bannon & Bodker 1997). However, the practical role

played by human intermediaries in the effective creation, management and use of repositories of reusable information is often significantly underestimated by The Organisation, and something which is at direct odds with its desire not to become reliant on the hidden knowledges of ephemeral domain experts for the success of its outputs. Compounding such concerns, it has been suggested that the turn to new organisational forms - such as the use of more fluid multifunctional teams - means that there may not be the opportunities for individuals to develop a deep understanding of such repositories, and so there is a risk that the knowledges necessary to access and incorporate them into their work may be lost (McMahon, Lowe & Culley 2004).

Within this context how might we begin to re-conceive the underlying problem that The Organisation and its Knowledge Managers are attempting to solve with their technological interventions? Whilst simply creating a static repository of information artefacts may be adequate for many purposes, in those circumstances where the work undertaken within a setting relies heavily on the hidden knowledges of its members - such as those that are highly complex, lack clear boundaries, or which involve high degrees of personal commitment and creativity - more is required than simply presenting users with an ever growing corpus of structured information. Further, the hidden knowledges of a setting's members - such as a tacit knowledge - do not always lend themselves to the transformations necessary for them to be written to some substrate in the form of information, and so we must seek alternative approaches if we are to offer effective technological support for their development, maintenance, and application on The Organisation's behalf. In the next sections we will begin examine how such a stance could be applied to supporting the actual work of a setting's members - guided by the Pattern Language for Knowledge Management Systems presented in the last chapter - in order that we might provide more appropriate technological interventions to nurture those knowledges which might ordinarily be hidden from view.

6.3. Natural Environment Agency

Formed in 2006 following the amalgamation of three existing Government bodies, the Natural Environment Agency is the non-departmental public body (NDPB) tasked with delivering the UK Government's environmental agenda throughout England (separate bodies operate within Wales and Scotland). The Organisation has a wide range of legislative and regulatory responsibilities which can be broadly divided into four groups: the protection of high value **designated sites**, including overseeing the condition of some 4,000 Sites of

Special Scientific Interest, the direct management of over 200 National Nature Reserves, as well as advising Government on the management of over 30 landscape-scale Areas of Outstanding Natural Beauty and nine National Parks; ‘Policing’ national and local **planning systems** to minimise the environmental impact of new developments and promote the Government’s sustainable development agenda; Fulfil a range of **regulatory obligations** on the Government’s behalf, include the issuing of wildlife management licences, the enforcing of regulations relating to the environmental damage of land, and the monitoring of unsustainable livestock management practices; and to promote the **sustainable management of land** through a range of funded schemes that offer land managers financial incentives for implementing sympathetic management practices.

The Organisation currently has approximately 1,800 members spread throughout England - several hundred recently took voluntary redundancy as part of the Government’s highly publicised cuts in the 2010/11 fiscal year - with some 20 offices from Truro in the South West to Newcastle Upon Tyne in the North East (there have also been a large number of office closures in recent years as The Organisation has sought to rationalise its estate, reducing the number of small ‘satellite’ offices). The internal structure of The Organisation broadly maps out the responsibilities that it is tasked with executing, with staff divided into ten delivery-based ‘functions’, as well as seven that fulfil its ‘back-office’ services. As with all Government bodies, the Natural Environment Agency is a very hierarchical - but meritocratic - organisation with nine ‘grades’ of staff spanning from the Chief Executive down to Administrative Officers, who fulfil general office duties. Further, The Organisation’s staff can be broadly split between those that have a specialist or professional training - with particularly high status being given to those with environmental specialisms - and those who have a more general administrative background, with ongoing efforts to reflect this split using ‘matrix-like management’ ways of working. However, as is often the case with large ‘public bodies’, staff can stay with the same institutions throughout their careers, and so even those who might be considered to be in generic roles can have a significant breadth of experience and expertise in a wide range of topics.

Here we will focus on just one area of work covered by The Organisation: the delivery of a number of ‘agri-environment’ schemes, collectively known as Environmental Stewardship, which the Natural Environment Agency is responsible for administering on the Government’s - and ultimately the taxpayers’ - behalf. The schemes are designed to offer land managers - predominantly farmers - a financial incentive to offset the costs of

implementing environmental improvements to their land, ranging from changes in land management practices (such as the reduction of agricultural inputs e.g. fertilisers and pesticides), through to the restoration of physical features (such as hedgerows or derelict historic buildings). Whilst simple in their intent and public presentation, these schemes are highly complex and wide ranging Governmental instruments for instituting environmental and societal change, backed up by significant legislative, financial, organisational and technical resources, and which operate from the scale of individual features - such as a pond or hedgerow - through to whole landscapes. With an annual budget of over £300 million of both UK and European monies, the schemes represent a significant investment on behalf of the taxpayer in the improvement of their natural environment - one that is largely hidden from their undirected view. Because of their breadth, and the requirement for organisations spending taxpayers' funds to be accountable to both National and European Governmental oversight, these schemes are highly bureaucratic, both for an applicant wishing to join them, but particularly for those responsible for designing and administering them throughout their decade-long life-span. Further, depending upon the monies available in any given year, entry onto the schemes can be competitive, and so those applying for a place on them must provide significant quantities of information about their businesses and the land that they are committing to the scheme, and be willing to sign a binding 'agreement' that will itself typically last 10 years. Because of the 10 year duration of each agreement, The Organisation must therefore maintain the capability to administer each scheme for a minimum of 20 years, and is currently managing a number of 'legacy' schemes that have long since ceased taking on new members, but which are still demanding significant organisational resource to manage.

Within this broader context we will focus on the two functions which are primarily responsible for the successful delivery of the schemes: the **Customers Services function** - whose role includes the administration of the schemes - and the **Land Management function** - whose role includes the provision of technical advice to those with schemes on their land - although as with any large institution, there is much overlap between the work of the different organisational units.

6.3.1. The customers services function: 'the administrators'

The Customer Services function focuses on the relationship The Organisation has with those who will actually deliver on its duties on-the-ground: including those it pays to perform certain tasks. The function is home to some 300 staff responsible for administering the

Environmental Stewardship schemes - '*The Administrators*' - whose role it is to fulfil two primary tasks: transforming an application to join the schemes into a new agreement - 'processing an application'; and the administrative maintenance of that agreement throughout its 10 year lifespan, such as the making of payments on a periodic or ad hoc basis for works undertaken.

In order to join the schemes a potential applicant must complete an 'application pack' - sometimes supported by a specialist contractor - through which they will provide a vast array of information about their business, their land, and the proposed works, in order that the potential value-for-money of their application can be assessed. Upon receipt of a new application the administrators must ensure the validity of the information supplied, the management options proposed, and any financial liabilities that will be incurred on a periodic or ad hoc basis. Applications have traditionally been made on paper forms, through a small number of annual 'application windows', but there is increasing appetite for these to be delivered digitally, particularly as they can be large complex documents in their own right, and must be keyed in to various information systems in their entirety. This move fits with a wider organisational ideal to go paper-free - something that it has been pursuing for much of the last decade - with all paper receipts relating to the schemes now being centrally scanned and uploaded to an Electronic Document Management System (EDRM). However, the original paper documents (or a print out of their digital versions!) are still the primary working currency for staff as they process an application; documents that could well be re-scanned several times so that their accumulated annotations and amendments can be captured within the EDRM that stands as the official record of any agreement¹.

Because there are a vast array of potential interactions with other schemes delivered by both the Natural Environment Agency and a number of partner public bodies - from local councils through to the European Union - each activity proposed within the application (of which there are often several hundred) must be 'cross-checked' in order to identify any potential conflicts, the most significant of which is 'double-funding': being paid from two or more streams of public monies to do the same activity. If these various checking procedures are passed then a formal application is initiated, and the work handed to 'the advisers' to negotiate the technical detail of the potential agreement with the applicant (see section 6.3.2). However, if any potential issues are exposed then there can be a protracted

¹ The many affordances of paper have been covered elsewhere, and are equally manifest as a driver for turning to paper in this setting (Heath *et al* 1994, Luff & Heath 1998, Rouncefield *et al* 1999, Schmidt & Wagner 2004, Norrie, Signer, & Weibel 2006).

negotiation with applicants as their application is refined in order to fit it within the confines of the rules & regulations of the schemes. Once the applicant signs their agreement they are transformed into an 'agreement holder' - or more formally a 'customer' as The Organisation has worked to become more 'customer focused', although the former is still the most frequently used label - and the agreement moves into a phase of ongoing management, during which the administrators are responsible for making payments for works completed and changes to the contractual arrangements as the agreement holder's relationship with the scheme evolves. 'Amendments' to an agreement are a common occurrence, and can be requested at any time - including the addition or removal of works, changes in the official status of a piece of land, through to changes in the ownership of some or all of the land covered by the agreement - all of which must be negotiated and agreed with The Organisation, and formally recorded in the agreement's documentation.

'Payments' to agreement holders can be made on a periodic basis - such as those made annually for implementing ongoing changes to management practices - or on an ad-hoc basis - such those that are made for specific tasks e.g. the building of a new dry-stone wall. Depending on the scale of the works that have been agreed, individual payments can range from a few tens of pounds through to several hundred thousand, with individual administrators having varying degrees of 'power to sign-off' on large sums of money, itself a product of their grade and experience (£250,000 is a respectable value for a mid-level manager). Individual agreement holders are responsible for ensuring that the works that they have agreed to undertake are completed to the required specification, and they can be audited at any time by other Government agencies whose role it is to check that taxpayers' monies have been appropriately spent, and whom can initiate a 'claw-back' if they are found to be lacking: a compassionless process through which any monies received will be returned to the taxpayers' purse. At the end of the period covered by the agreement it will be 'closed' and the agreement holder's relationship with The Organisation will come to end, as does their responsibility to maintain the work practices covered by the agreement.

6.3.2. The land management function: 'the advisers'

The Land Management function has a range of duties that centre around the delivery of the Natural Environment Agency's obligations on-the-ground, primarily relating to the Environmental Stewardship schemes. Within this wider group are some 400 advisory staff whose duties include supporting the schemes through the provision of technical advice and guidance to customers, partner organisations and other staff, both during the application

process, but also throughout the life of an agreement: *'The Advisers'*.

As we have heard, once the scheme administrators have finished the initial processing of an application it is handed off to the advisers so that they can negotiate its technical properties with the applicant, and in particular the validity of the management options applied for and appropriateness of the management techniques proposed (both of which have significant cost implications for both the applicant and the taxpayer). The nature of the relationship between advisers and those whom they advise varies greatly, from a very formal relationship with large estates and 'agri-businesses' where information is communicated through letters and meetings with business managers, through to long-term personal relationships with 'small-holders' who treat the adviser as a member of their wider community, and who call on them regularly to help interpret the minutiae of their agreements or to advise on the best management practices for their valued sites. However, each adviser may be responsible for as many 60 active agreements - as well as the current year's cohort of applicants for their 'patch' - and so the amount of time that they can dedicate to each of them is inevitably limited, and must also compete with other demands on their time, such as being asked to help out with scheme administration when the administrator's workloads are especially high. Ironically, it is often agreement holders with the smallest parcels of land who have the sites of highest environmental value - and therefore the most demanding agreements - and so they may require a disproportionate amount of the adviser's time to support them in meeting the obligations of their agreement. In many ways this ongoing 'care & maintenance' work is the most highly valued aspect of an adviser's role, where they get to go 'on-site' and engage directly with land managers about the environmental enhancements that they are making to their land, and where the environmental benefits that the whole Organisation is working towards are most evident. However, this is also the aspect of their work that incurs the highest cost to The Organisation - in terms of both time and money - and so it is the first to get scaled back in times of financial difficulties, leading many to raise concerns that The Organisation fails get the best value for money from its investment in either them, or the agreement holders that they are seeking to advise.

As a group, a large proportion of the advisers possess undergraduate and post graduate degrees, often in a land management related field such as the Environmental Sciences or Agriculture, or have a number of years of prior experience in the Land Management or Agricultural sectors, and so they are typically well qualified to fulfil their primary role. However, the work undertaken by agreement holders can be both highly technical and very

obscure, and so the advisory teams are backed up by a number of tiers of specialists, ranging from local experts with a deep knowledge of specific geographical areas - and who may or may not be Organisationally sanctioned 'Experts' - through to 'national specialists' who may be Nationally or even Internationally renowned. There are various mechanisms through which specialist advice can be requested, including a number of formal channels through which they can be escalated, but the most common is via the extensive networks of interpersonal relationships that exist in organisations that have a long heritage (many staff have been with The Organisation's forebears since it was part of the now defunct Ministry of Agriculture of Fisheries and Food in the 1980s). However, the relationship between the advisers and the Organisationally sanctioned Experts can be somewhat strained at times, with frustrations on the adviser's side because these individuals are often unavailable to them for direct consultation - particularly new staff who do not yet have extensive personal networks - and anxiety of the side of the specialists because, with such a large group of advisers, if they were seen to be too available they would never get off the phone! As a result, significant investments of time and money have been made in developing an array of systems and services that both the administrators and the advisers can access as the first-port-of-call for information to support them in pursuit of solutions to their current troubles, and which intentionally stand between the delivery staff and The Organisationally sanctioned Experts.

6.3.3. The role of Information Technology

Information technologies are increasingly seen as one of the primary mechanisms through which Government bodies can achieve good value for taxpayers' monies, and so there has been significant investment in ensuring that the equipment available to workers is of a high standard: the majority of staff are now equipped with well specified laptops as their primary computer, and all have either an IP-based phone, mobile phones, or Blackberries. Staff are therefore considered to be highly flexible in terms of both working times and locations (promoting an equitable work-life balance is a constant theme within public bodies), and many offices now run on low occupancy rates, with a rapidly growing proportion of staff working from home some or all of the time. As a result of these long-term investments there is now a heavy reliance on information technologies to deliver The Organisation's duties: from basic infrastructures such as the Government Secure Intranet (GSI) over which all intra-governmental networked communications travel, through to an array of browser-based services that staff - and increasingly stakeholders - can access from any location with an

Internet connection. These services now range from administrative systems for ordering train tickets and claiming expenses, through to Management Information Systems that senior managers and Government Ministers use to track The Organisation's progress towards its quarterly or annual objectives.

The move to browser-based services has been marked in recent years, and staff spend an increasing amount of time working through the browser (currently version 7 of Microsoft's Internet Explorer, two versions behind the current release!), where once they might have used bespoke desktop applications (some of which are still in use as they are needed to support the legacy schemes, including a number of DOS-based databases) or the Microsoft Office suite. Indeed, the Environmental Stewardship schemes are wholly administered through a taylor made system delivered entirely through the browser - Origin - that was designed and implemented alongside the schemes themselves (and not without many of the troubles that often plague large Government IT projects). Origin is made up of a suite of interconnected server-based tools through which the entire agreement can be administered, including a Geographic Information System for mapping the location of works, workflow systems to manage the various processes, a large transactional database through which payments are made, and an Electronic Document Management System that serves as a document store for the numerous letters, forms, maps and contracts that will be passed back and forth over the lifetime of an agreement.

During the design and early deployment of both the Environmental Stewardship schemes and the Origin system it was anticipated that it would be possible dissolve the administrative function, with the advisers doing their own 'paper' work, and those who previously had fulfilled an administrative role being taught to take on front-line advisory work. In this prototypical example of Organisational misconception, there was a complete disregard for the differing nature of the skills that support the various roles, or indeed whether those involved in each wanted to actually take on the work of the other (sometimes people who work in offices actually like working indoors!). As a result the distinction between the two roles has become increasingly re-established in The Organisation's structure, and the work done by the administrative teams now placed on a higher footing than it perhaps once was.

Surrounding the Origin application are a constellation of secondary systems and services that provide support to staff delivering the schemes, including extensive reporting functionalities and an array of data connections to other Government agencies. Due to the long-running nature of the schemes, as well as their sheer administrative and technical

complexity - something which makes it difficult for any one individual to be fully conversant in all their facets - The Organisation also maintains a number of systems and services that are specifically focused on the provision of technical guidance to staff and stakeholders. The vast majority of this guidance is now available digitally - via The Organisation's various Internet and Intranet properties - each of which is designed to service a specific aspect of the schemes, or a particular group of stakeholders from within the organisation or those outside of its bounds. For historical reasons these are known internally as 'Technical Information' systems and services, and are designed to support staff in achieving the understandings necessary for the effective delivery of the schemes - from their knowledges of the nature of the schemes themselves, down to informing their selection of the most appropriate approach to the management of individual works delivered through the agreements:

- **The Corporate Internet** site is primarily focused on delivering information to stakeholders, not least of whom are those making applications to the Environmental Stewardship schemes. However, where information is likely to be of value to both the public and staff it is hosted here in order to reduce duplication and the risk that staff and stakeholders are using different information. The Internet site is edited by a small group within the External Communications function, and delivered through the Tridion Content Management System;
- **The Corporate Publications & Products Catalogue** is an Internet site hosting The Organisation's official publications, ranging from corporate brochures through to an extensive corpus of technical reports documenting the findings from research and development activities over a number of decades, including a growing array of technical guidance documents. The catalogue is jointly curated by the External Communications and Evidence (who fulfil the Natural Environment Agency's research and development activities) functions, through a bespoke development on Google's App Engine 'cloud-based' platform;
- **The Corporate Intranet** site offers a high level map of The Organisation's functions, systems and services, and serves as the 'staff handbook' containing guidance on staff management, etc. Whilst there are high level overviews of The Organisation's technical areas, the Intranet contains minimal technical information about the schemes themselves. The intranet is edited by a small group within the Internal Communications function and delivered through Microsoft's SharePoint platform;

- **The Corporate Directory** serves as a searchable list of the Organisation's constituent members and provides an extensive range of fields for metadata - such as educational background, specialisms, and areas of interest - although completion rates are patchy. However, this is not the only corporate directory, for there is also one for the Natural Environment Agency's parent Government department, and which allows staff to search across all of the department's various agencies. Although seeded automatically via Active Directory, both corporate directories are largely self-service, and are overseen by the Systems, Knowledge and Information function. The Natural Environment Agency corporate directory is also based on the SharePoint platform;
- **The Operational Guidance Site** is the primary portal for those seeking technical guidance relating to the schemes, and hosts many tens-of-thousands of pages of content ranging from the past and present scheme handbooks containing its rules & regulations, maps of its processes & procedures, through to management guidelines for targeted species and habitats. The site also hosts a number of sub-systems relating to the delivery of the schemes, such as an extensive Question & Answer system (see section 6.4.4), as well as a number systems for managing and reporting issues with the Origin system. The majority of the site is based on static 'Classic' Active Server Pages and is managed by a disparate group of some thirty editors who are spread throughout The Organisation's functions, and with no centralised control (oversight of the server itself is maintained from within the Systems, Knowledge and Information function). Many of these individuals are also the original authors of the guidance (and some were involved in the actual design of the schemes), and so whilst there is often low technical skills, there is often high attachment to their 'area';
- **The Technical Information Exchange** is a bespoke collaborative platform targeted at The Organisation's technical specialists - both official and unofficial - and consists of a large number of subject-based sites which span organisational units, each with blog, wiki, and discussion group functionalities. The exchange also hosts a number of sub-systems, including a database of research projects (known internally as 'evidence' projects), an evidence transfer register (which is used to track knowledge transfer activities both internally and with stakeholders), an Operational Guidance catalogue (which also serves the Operational Guidance site, and provides staff with a centralised searchable catalogue of technical guidance material), a searchable database of case-studies, as well as a number of smaller specialist systems. The Technical Information Exchange is coordinated from

within the Evidence function, but there is minimal curation. The membership of individual subject-based groups is self selecting, with no Organisational mandate on who can join, and editing permissions are granted to the group as-a-whole, who then decide amongst themselves on the content and structure. The Technical Information Exchange is based on 'Classic' Active Server Pages, with a Microsoft Access datastore;

- Despite the availability of these services, the delivery of adequate solutions to the problems faced by staff is not without its difficulties, the most significant of which is the fact that much of the management and implementation of The Organisation's technology is now outsourced to a large multi-national service provider. Whilst this provides benefits in certain areas, it limits what The Organisation can do in terms of small development projects which might offer real value at the local level, but which are prohibitively expensive to implement. As a result there is significant reliance on **Microsoft Excel** (and to a lesser extent **Microsoft Access**) as an ad hoc solution to locally manifest information and knowledge management needs - which themselves have now largely become obscured from The Organisation's view as staff have come to understand that no help is available - with even the smallest tasks often leading to staff having to update a small array of spreadsheets, themselves located on any one of a number of locally or nationally shared drives.

As we can see (figure 9) there is a complex array of loosely coupled systems which support staff as they go about the day-to-day work of delivering the schemes, and which offer those seeking solutions to their current troubles a number of distinct sources of technical information from which they can try to extract an answer. These technologies have been in place for varying lengths of time - from a few years to over a decade - and undergo constant revision as the focus of the schemes, or even The Organisation itself, have changed. As we heard, the primary problem facing staff had been seen as a lack of adequate technical guidance - and which manifested itself in increased demand on the time of The Organisation's Experts - and so significant effort has been invested over the years in creating comprehensive corpuses of technical guidance in support of the schemes. As a result they have 'gained mass' on an ongoing basis, and their sheer scale is now not to be underestimated: for example one sub-site dedicated to the support of the technical aspects of the Environmental Stewardship schemes - as opposed to their administrative side which has a number of sites of its own - has some 17,000 pages of guidance, whilst the Technical Information Exchange contains over 30,000 information objects (documents, blog records,

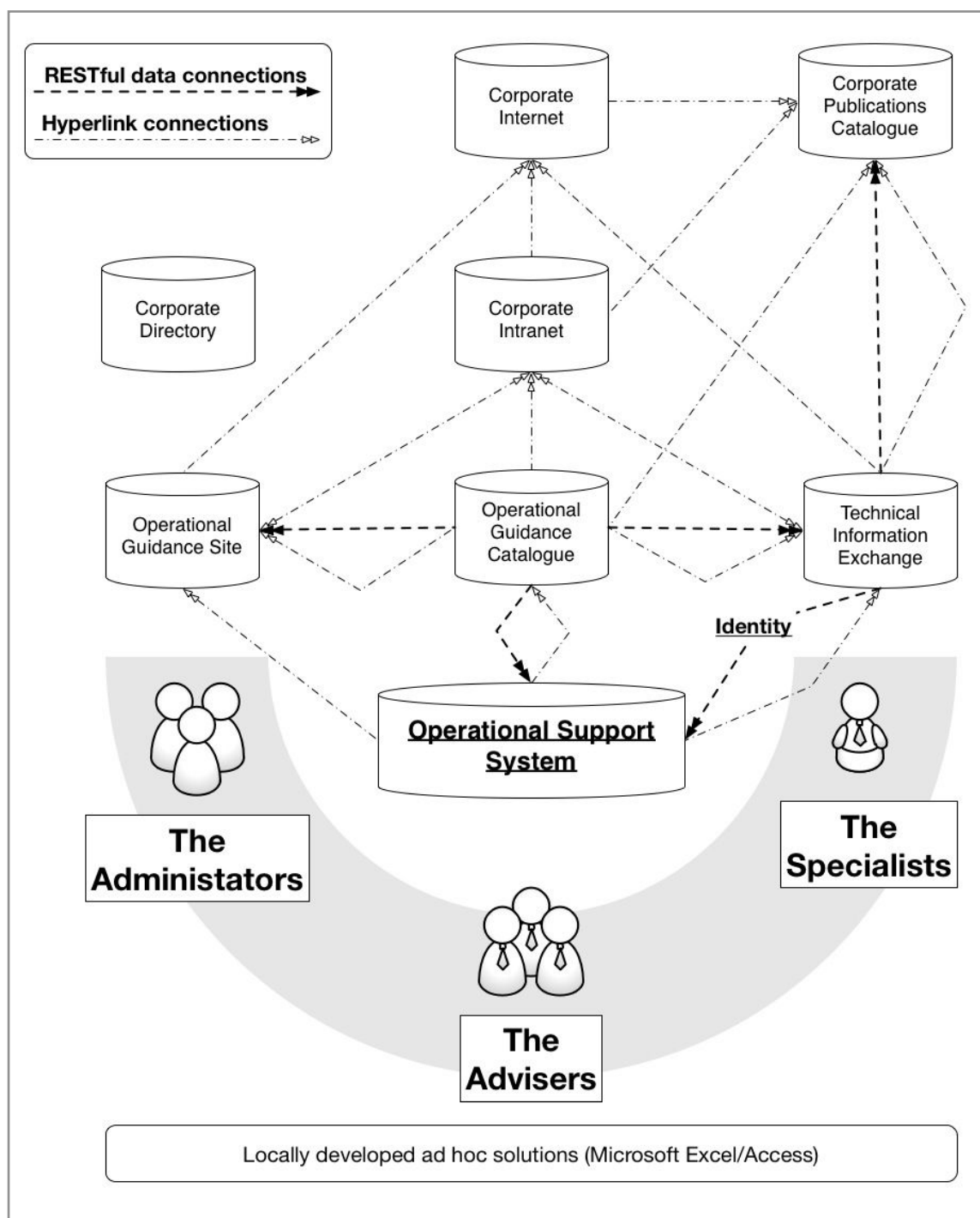


Figure 9. An overview of systems dedicated to providing technical information to the Natural Environment Agency's delivery staff and stakeholders.

discussion posts, etc). Whilst an individual member of staff is not expected to be fully conversant in the contents of these corpuses of information, they could be required to call upon any part of any one of them in the course of their day's work. As they have grown the problem faced by staff has therefore shifted to one of finding the right information, and so efforts were made to improve the 'find-ability' of information through upgrading the search

and navigation functionalities, both within and between the different corpuses. This included the creation of a ‘catalogue’ of guidance which provides The Organisation’s Experts with a mechanism for identifying the key technical resources for a given work area - no matter where it is located - allowing staff to search and navigate a much smaller subset of the various corpuses of technical information from a single location, one that it is highly structured and rich in metadata. Despite - and in many ways because of - these improvements, so the problem has again shifted: to one of digesting the sheer volume of technical information that is available on any given topic, and during the time available when it is actually required.

6.3.4. The operational support system

The current work is part of the long-running effort to improve access to the substantial corpuses of technical information that support staff in the delivery of the schemes, and centres on a redevelopment of the Question & Answer service that is a sub-system of the Operational Guidance site. The *Operational Support System* is an extensively used ‘Q&A’ system that was originally set-up to support the delivery of the then fledgling Environmental Stewardship schemes, and which has gone on to become the first port-of-call for administrators and advisers seeking an official response to troubles that they might be having with an application or agreement. The system now covers a broad range of topic areas: from the vast array of rules & regulations that dictate the structure of the schemes themselves, the complex processes & procedures through which they are administered, to site specific technical issues relating to their delivery on-the-ground. The system itself has a broad user-base with some 800 unique users posting questions over the last five years, which represents a large proportion of the rolling population of administrators and advisers over that period (there has previously been no mechanism in place to measure usage by those simply searching the system for an existing response). There is also high awareness of the system - from delivery staff through to middle and upper management - and out-of-context references to the system, or one of its ‘queries’, are common-place.

The individual queries clearly reflect the inherent complexity of the schemes, and it is easy to see why it might not be possible for an individual to simply infer an answer from an existing corpus of guidance, or their own experiences:

Following a compliance monitoring inspection I have some queries raised by the Agreement Holder in relation to options¹ EE5² (4 metre buffer strip on intensive grassland) and EE7 (buffering in-field ponds in improved permanent grassland and

arable land). The agreement had several 4 metre buffer strips under option EE5. The Inspector³ has disallowed some of these as he has stated that the parcels are cultivated land, e.g. in maize, in wheat or in stubble. We received approval to accept these as EE2 (4 metre buffer strips on cultivated land) via another Q&A as they have the same points⁴ allocation and similar management. The Agreement Holder has queried this and stated that on the original application the buffer strips were in fields in intensive grass and when the Inspector visited they were in an arable crop. The intensive grass is a 1 year ley which is part of their rotation.

1. 'Options' are the component parts of any agreement and relate the technical properties of the scheme to the physical features to be managed (there are some 300 options across the three Environmental Stewardship schemes, each with up to 30 management 'prescriptions').
2. Each option has an alpha-numeric code which identifies the scheme it belongs to, as well as the topic area covered, and which is often the primary currency of discussions between staff as they talk about an agreement (E = Entry Level Scheme, E = Options for buffer strips and field margins, and a numeric counter).
3. 'The Inspector' is from another Government agency responsible for auditing the agreements, in this case checking to make sure that the agreement holder is complying with the conditions under which they can receive the European Union's farming subsidy: the Single Farm Payment.
4. All of the schemes are 'points' based, so in order to qualify you must accrue sufficient points through identifying environmental features on your land.

As we can see there is a complex interplay of different factors that can bare down an individual's need to post a question and - as is often the case - a significant amount of knowledge is required simply to parse out the question being asked: In this case advice is being sought regarding how to deal with the claims of The Inspector, who sees an arable field as a temporary feature - which disqualifies the option used - and the agreement holder, who sees it as a permanent feature and so his land once qualified, and will do so again in the future.

Whilst anyone can submit a query, all responses are curated by a small group of dedicated staff who typically forward the requests on to The Organisation's specialists and experts via email, before posting the response on their behalf. However, they also possess a deep

understanding of the schemes in-their-own-right and so answer many of the queries themselves, particularly those relating to the existing corpuses of responses or technical guidance. Because of the cautious nature of such settings, there has been little appetite for giving the wider populous a direct voice within such a system, largely from a fear that inappropriate advice might be given, or that bad-practice might propagate. However, investigations showed that it is common practice to print out a copy of a query and attach it to an agreement (requiring it that be scanned and added to Origin), or add it to a personal or shared ring-binder of key guidance, after which it becomes disconnected from Organisational oversight and amendment.

In response to the above request - and after being passed to two different members of staff - the response provided by the system's administrators was as follows:

When the application was made the field was down to an intensive grass ley, however, after one year it was put back down to arable and has remained so. As a result the buffer strips should be re-coded as EE2. This is acceptable as EE5 and EE7 have similar management requirements to EE2. The field should be coded according to the land-use which is likely to be relevant for the majority of years. NOTE: For agreements under the 2nd and later handbook editions, land that is in buffer strips EE1-EE3 which are part of an arable/grass ley rotation must be managed according to the requirements of options EE4-EE6 during the years when the buffer strips are adjacent to a temporary grass ley.

The recommendation offered to the requester is that they must re-code the sites to a more appropriate option, a move that is purely administrative as it has the same points and management requirements. However, this is a change that will effect both the administrators and the agreement holder, for the change must be made in Origin, but also reflected in the 'claims forms' submitted on an annual basis by the land owner. Here we can also see an additional dimension that staff and stakeholders must take into consideration: a new scheme 'handbook' can be released each year, which will contain a large number of amendments to the rules of the scheme, themselves initiated from a range of different sources: from The Organisation itself, its parent department, to those demanded by the European Union. Therefore, because each agreement is bound to the handbook of the year in which it was signed, the way in which an issue can be approached might be quite different depending upon its respective handbook (although some changes can effect all handbooks!).

Notwithstanding its apparent utility, with some 4,000 currently active responses the

Operational Support System has struggled to cope with the growing volume of information contained within it, the ongoing management of the corpus of requests which must be kept up-to-date as the schemes evolve, as well as a number of structural changes that have been made to The Organisation which have removed access to other sources of support - namely the role of 'Regional Coordinator' who served as a local intermediary between staff and various systems & services that support them in the delivery of the schemes - and which has led to a sharp increase in the number of new requests being submitted on a daily basis. The application itself follows the archetypal pattern for such systems, with a form for submitting new requests - including fields for establishing user identity; a form for administering responses - including an array of fields for categorisation and other metadata; as well as functionality for searching, navigating and reporting on the current state of the system, all fronting a simple relational data-model. However, the system's original design was largely based upon meetings held with middle managers, and so both its information architecture and user interface are a reflection of their conception of how such a system might be used by an as-yet-unknown group of users, to deliver an as-yet-to-be-rolled-out scheme. It was therefore unclear whether the system's high usage was a product of necessity rather than good design, and whether the system as it currently stood was meeting all of the actual needs of its various users - The Administrators, The Advisers, and those responsible for maintaining the system's contents - or whether, as is so often the case, staff were having to work around the system's limitations in order for it to assist them with going on with their efforts.

The aim of the current work was therefore to investigate ways of making the system more scalable - in terms of both its architecture and its ability to manage the growing number of requests - but also from a user experience perspective, so that those seeking an answer to their current troubles are better able to discover an appropriate solution, cutting down on duplicate or clarifying requests (a common occurrence within the existing system). Further, whilst originally developed to serve the delivery of the schemes, it was considered that the functionality might be of use to other business areas needing to offer similar support to their staff, and so the potential for expanding access to the system for other groups was to be investigated. This was to include re-examining the base functionality of the system to understand whether there were any extensions to it that might benefit all of its users, including its traditional user-base.

6.3.5. Knowledge reuse

To achieve these aims the approach outlined in the previous chapters was called upon to identify the properties that an updated system might usefully have, and in particular whether its application would uncover any knowledges which have previously been hidden from The Organisation's conception of those working on the schemes, and that a re-conceived system could be adapted to support. To this end a number of field visits were undertaken with a range of delivery staff lasting between one and four days (6 locations, 14 full days in total) and which took the form of a series of semi-structured interviews with individual staff members within each location visited - with themes centring on their use of the existing system and any problems that they had faced with it - followed by spending the remainder of the visit observing their work practices in an ethnomethodologically informed ethnographic mode. Due to the commercially, and sometimes politically sensitive nature of the work - and the highly cautious mentality within such organisations - it was not possible to utilise audio or video recordings, but access was otherwise unrestricted, and staff were keen to be involved in something that they could see was of direct benefit to them, glad to have the opportunity to directly influence the outcome of the project. To reflect the geographically distributed nature of the organisation, field work was spread across a number of locations, ranging from the South West through to the North West of England, with sites selected based on the availability of at least one member of staff who had made large numbers of requests to the existing system (>10 requests). The majority of offices visited were nondescript buildings in business parks, often with large open-plan rooms housing many tens of individuals, but some offices (most sadly now closed) were located deep within the rural communities that they served (and not easy to reach without a car!).

Upon first glance it might be difficult to draw a connection between these generic office backdrops and the environmental work that they support, but closer examination soon uncovers a range of artefacts that link them with the outside world, including maps of territories or posters of endangered species and habitats pinned to the walls; handbooks, leaflets and application packs for current and past schemes clogging the shelves; and annotated application or agreement maps and forms stacked on desks or strewn across people's workspaces. Within each office - some of which are spread across a number of floors - staff sit in small territory specific teams of up to a dozen individuals, which themselves are located within wider groupings of teams fulfilling the same role. As a result the physical layout of the offices serves as a rough map of the territories and tasks covered

by a particular team or individual, illustrated when introductions to the office are made by pointing to regions of the office and verbally pairing these with the geographical location of their work and its nature. However, in all of the offices there was a constant traffic between these different groups - physically as individuals go back and forth to one-another's desks, over the phone, or via email and instant messenger - as they seek clarification on the rationale for decisions made in the past, or to ask for assistance with how they might go one with their current efforts.

As we have seen, the schemes are highly complex constructs that span a range of conceptual scales, from the rules & regulations that define their nature, the processes & procedures through which they are administered, down to the technical properties of the individual works that are their final manifestation. There are a number of formal mechanisms through which The Organisation supports its staff in achieving an adequate understanding of the schemes, including: one-to-one training and mentoring by those who have 'been in' for a long time; group training events delivered by local or national specialists; live and recorded webinars announcing changes to the schemes or the processes & procedures through which they are delivered; as well as an array of newsletters and information notes sent to staff and stakeholders on a periodic basis. However, because of the sheer breadth and depth of their complexity, and the fact that there is constant revision occurring across all conceptual scales - from the individual applications and agreements to the schemes themselves - the daily work of both the administrators and the advisers is pervaded by an ongoing negotiation regarding how to most appropriately deliver just-this-conception-of-the-scheme in just-these-circumstances and in just-the-required-ways. This negotiation also occurs across a range of organisational scales, from colleagues who share the same bay of desks within an office; those who are within the same organisational unit, but who may be located at opposite ends of the country; through to formal requests that get passed across The Organisation's hierarchy - often via a request to the Operational Support System - such as requests to 'legal' where there are risks of liability, or those that go to the Senior Management Team where there are risks of political embarrassment.

Within this social milieu the Operational Support System has come to fill the conceptual space between the formal corpuses of technical guidance - 'The Guidance' - and the informal advice that staff give one-another as they negotiate their own understandings of the schemes. However, the majority of staff do not interact with the system in isolation, but instead there have been varying degrees of mediation between those seeking a solution to

their current troubles, and the system itself. These intermediaries fall into two groups: those organisationally sanctioned to serve as an interface between the system and the wider populous - in terms of both collating and validating questions before they are posted, as well as interpreting its contents (and who have now largely been removed from The Organisation's organogram) - and those who fulfil this role unofficially, and who have come to be held in high regard by their colleagues by virtue of showing themselves to be both willing and able to help them in their moment of need. These individuals play a typical intermediary role, maintaining connoisseur status about their particular areas of expertise, whether it be a deep knowledge of the scheme's rules & regulations or its administrative processes & procedures, an interest in the machinations of Origin or its supporting systems & services, or a passion for a particular technical area, such as species identification or habitat management techniques. The existence of these experts could possibly be inferred from their informational output - although most are low-key individuals just getting on with their day-jobs - but overwhelmingly they are known through the wider social networks within which staff operate, with requests for help sometimes being referred through a string of people before finding someone who is in a position to offer appropriate assistance. However, as The Organisation reduces its headcount - which typically means those who have been in the longest, and therefore possess the most experience, taking voluntary redundancy or early retirement - and offices close - which results in teams spending less time in each other's company - the availability of appropriate technological support for those reaching for an adequate understanding of the full complexity of the schemes becomes an ever more important part of ensuring that staff can go on with their efforts.

The general findings outlined in the preceding pages point to a pervasive and ongoing negotiation between staff of all creeds as they work to understand the full detail of the schemes on a moment-by-moment basis, often supported by local intermediaries who have earned the coveted title of 'guru', 'hero', or 'expert', and who provide an essential but often unacknowledged role at the interface between the formal corpuses of technical guidance and the understandings of their peers. As we heard in section 6.3.3. there has been a shift in the locus of the primary difficulties faced by staff as they work to discover how they should go on: from a lack of adequate technical guidance, to there being too much information on a given topic to conceivably digest in the limited time available. In some ways, as the Operational Support System has grown it too has become part of this problem and - as is so often the case - staff have created a number of locally manifest solutions to the problems that they are facing on a daily basis, but which The Organisation is unable to assist them

with (largely because it is unaware that such difficulties even exist). These general findings are therefore only part of the picture, ones that are available to all competent observers of these settings: not least of whom are the staff themselves, who are well aware of the failings and limitations of The Organisation's systems and services, and the workarounds that they must institute in order to reuse the experiences and discoveries of their colleagues so that they might go on with their current efforts.

As one spends time in such settings observing from an ethnomethodological standpoint, one quickly comes to notice an array of more subtle procedures through which staff are supporting their own - and each other's - understandings of the schemes; noticings that are largely unavailable when simply asking them about their work. These detailed noticings have been incorporated into the Pattern Language for Knowledge Management Systems set out in appendix A1, and join those from the previous field work presented in chapter four. Of particular relevance to the current discussion are their **knowledge of the rules & regulations** (5) that guide their work, their **knowledge of the systems and services** (6) provided by The Organisation, and their **knowledge of the processes & procedures** (12) through which the schemes are administered. In the next section we will examine a range of technologies that have been called upon to provide support for such hidden knowledges in other settings and then, using these collected noticings as a basis, ask whether the discussion outlined in the previous pages sheds any additional light on how they might be appropriately incorporated into the Operational Support System in order that it might be better equipped to support the ways in which The Administrators, The Advisers, and those who must manage the system actually manage knowledge in and through their everyday work.

6.4. Knowledge management systems

As we have heard and seen in the preceding pages, there are substantial pressures upon institutions to reuse their existing intellectual assets in the pursuit of organisational efficiency, and much research has been directed towards understanding the nature of this problem. As we have also heard, a common solution to this problem offered throughout the literatures of Knowledge Management is that of capturing the knowledge of The Organisation's constituent members by converting it into an explicit product which can be written to some substrate - typically a '*Knowledge Management System*' - in order that it can be reused again in the future. Broadly speaking, Knowledge Management Systems are a class of information technology that are targeted at capturing, managing and re-presenting the knowledge of human beings - typically on behalf of the institutions for which they work

- in order that the barriers that separate us can be efficiently overcome: namely time, space and organisational distance. The design, development and deployment of modern computer-based Knowledge Management Systems is a well established research area spanning from at least the early 1970s through to the present day, and significant amounts of time and money continue to be invested in their deployment within institutions of all sizes. Such systems represent an extension of a more established class of technology: *Information Systems*, which have long been in use to manage the growing corpuses of information that play a central role in the day-to-day running of all modern organisations; their primary differentiator being support for the assignment of meaning to the system's contents by its users. However, whilst the fine scale functionality of Knowledge Management Systems has become highly refined, the gross functionality of the majority of mainstream applications has not advanced significantly from those presented in the early part of the field's evolution (Akscyn, McCracken & Yoder 1988, Lucier *et al* 1988), or even those suggested at its genesis (Bush 1945). These networked, database driven, multi-user environments, provided functionality for the storage and retrieval of documentation via the desktop, the linking of individual information objects using hypertext, and supported digital communications channels between disparate users through electronic mail and bulletin boards. There continues to be much work on extending this core functionality and a large number of prototype systems targeted at supporting The Organisation in its efforts have been developed and deployed by researchers, but the transition into mainstream use of many of these innovations has ultimately been limited and most commercially available systems remain largely based around this model.

The majority of such systems achieve support for the reuse of knowledge by attempting to facilitate its transformation into information - either manually or through automated processes - so that it can be stored in a structured form within a database. The manual transformation of knowledge can take a number of modes, but most often occurs by way of a template-based interface through which a single individual enters one piece of 'knowledge' at a time, usually in response to questions that are hard-coded into a form's fields, and which were designed at some point in the past to prompt the user to articulate what it is that they know in such a way that aligns it with the pre-existing database schema put in place by the system's designers. Such systems have been highly successful in their primary role - *creating structured repositories of information based upon or about an individual's knowledge* - and are now a ubiquitous feature in organisations of all sizes as they seek to capture the understandings of their constituent members in a form that can be

more easily managed and reported upon. However - despite their ongoing success - such systems are particularly vulnerable to the capacity of individuals to divulge what it is that they know in the required ways (providing that the existence of such a knowledge had been noticed at all), and so a number of researchers have examined how the capture and conversion of knowledge could be automated in order to reduce the overheads associated with its acquisition, such as through the use of algorithms that can be applied to our outputs so that their hidden attributes might be exposed to the system (Markus 2001, Serdyukov *et al* 2008, Karimzadehgan, White & Richardson 2009). Some have even suggested that the high costs associated with knowledge capture will eventually result in such work being replaced by machine learning techniques (McMahon, Lowe & Culley 2004), although there is little evidence of this occurring any time soon. No matter the method of such efforts, the end product is typically a highly structured repository of information - sometimes characterised as a corporate or organisational 'memory' (Ackerman & Malone 1990, Beckett 2000), or as a complex of interwoven memories embedded within an array of individual and organisational processes (Ackerman & Halverson 2004) - and which can be browsed, search and analysed in order to assist users with their current troubles. In certain specialised circumstances such repositories can go on to form the basis for *Knowledge Based Systems* - such as an 'Expert System' - which seek to replace a user's need to directly understand the corpus of information that it contains (Tuomi 2002), an approach which has not been without its own set of problems (Whalen & Vinkhuyzen 2000, Gabbay & le May 2004, Suchman 2007).

As we have heard in the previous pages, despite the appeal of capturing the knowledge of a setting's members on some substrate and re-presenting it to them in a structured form, such an approach might not be best suited to supporting the full detail of their original understandings, and in particular those knowledges which might ordinarily be hidden from view. In order to address such concerns some researchers have suggested that certain classes of Knowledge Management System are particularly suited to supporting hidden knowledges - such as a tacit knowledge - with a number of authors turning to Nonaka's SECI model (section 2.3) to classify such systems with respect to the part that they play (Scott 1998, Alavi & Leidner 2001, Marwick 2001), including: The role of *groupware* and *expertise location* systems in directly transmitting tacit knowledge between The Organisation's constituent members; The part played by *discussion groups* and *question & answer* systems in transforming tacit into explicit knowledge; and the creation of new tacit knowledge using *visualisation technologies* and those that put information into context. Despite their ubiquity

within organisations of all sizes, it has been noted that these mainstream technologies still lack adequate support for those knowledges which might otherwise be hidden from view, largely because system designers often lack a deep-enough understanding of how they actually manifest themselves in everyday practice (Marwick 2001, Thompson & Walsham 2004). However, as we have seen in the preceding chapters, turning to the situated paradigm - and the tools and techniques that this makes available to us - offers an approach through which we can achieve just such an understanding, and therefore provides a basis upon which to re-examine - and potentially re-imagine - the nature of Knowledge Management Systems and the role that they play in supporting the actual work of a setting's members.

6.4.1. Systems for hidden knowledges

In section 6.2. we heard that many consider the most significant hurdle to the effective reuse of knowledge not to be whether it can be codified and captured on some substrate, but whether the information that is recorded is actually useful in its new form (Markus 2001). This sets up a perpetual tension between the originating context, the de-contextualisation that necessarily occurs as a discrete record is created within the system, and the future re-contextualisation of that information as it is made relevant in just-these-circumstances (Ackerman & Halverson 2004). A number of approaches to this problem attempt to record more contextual information within the system at the moment of capture, so that everything that is required to establish a record's intended meaning is available to the future user, such as can be achieved by documenting an expanded range of contextual metadata during the record's creation (Hinrichs, Pipek & Wulf 2005, Herrmann & Kienle 2008), including the use of formal ontologies (Abecker *et al* 2000) or the preservation of annotations made to records during and after the moments of their creation (Akscyn, McCracken & Yoder 1988, Tschaitchian, Abecker & Schmalhofer 1997, Norrie, Signer, & Weibel 2006). The aim of such efforts is often to create a comprehensive 'boundary object' - constructs that contain sufficient contextual information that they retain their intended meaning in a range of different circumstances (Ackerman & Halverson 2004) - including a trace of the 'meta-negotiations' through which that meaning was originally constituted (Lutters & Ackerman 2007).

Others have treated the problem as one of representation and proposed a range of constructs through which those knowledges which might otherwise be hidden from view can be offered-up to a system's users in a more digestible form, including:

- The use of **metaphors and analogies** to give hidden knowledges a voice, particularly

with regards to the complex and ambiguous flow of our experiences (Anderson & Sharrock 1992), such as through the use of metaphor as a template for the system's interface e.g. the 'desktop', fish-eye lens, map, and story (Fruchter & Demian 2002, Rilling *et al* 2008), the use of word associations to encourage the user to think laterally (Thomas, Kellogg & Erickson 2001), through to the system itself serving as an analogy enabling us to say more than we can with words alone, such as supporting the representation of embodied knowledge (Ambrosini & Bowman 2001, Myers 2008);

- It has long been argued that hypermedia structures would eventually replace the desktop metaphor (Akscyn, McCracken & Yoder 1988), and the increasing prevalence of browser-based systems supports the manifestation of the **system-as-a-map**, which can serve as a guide to complex domains (Fruchter & Demian 2002, Tory *et al* 2008). Such systems can be also called upon to map out terrains of responsibility - either metaphorical in terms of topic areas (Miller *et al* 2008), or physical geographical areas (Gasson 2005) - as well as show the interconnections between disparate information objects before facilitating zooming in to specific regions, such as can be achieved within virtual environments (Büscher *et al* 2000). Some have gone further, arguing that such structures come to form a representation of cognition itself, including that which is distributed across the membership of a social collective (Boland, Tenkasi & Te'eni 1994, Kim, Suh & Hwang 2003, Lin, Wang & Tserng 2006);
- The use of **exemplars** to enable us to pick up those aspects that cannot be passed on through the teaching of a set of explicit rules, but which can only be developed by assimilating prototypical examples from a corpus of existing works (Abel 1981). These experiential archetypes are said to serve as a set of pointers or clues, providing those calling upon them with a starting point for the creation of their own solutions based upon the successes or failures of those from the past (Schön 1988, Van Aken 2005), such as the searchable databases of free-text case studies and best practices that are a common feature of Knowledge Management's interventions (Garcia *et al* 2011). Within the design disciplines the use of exemplars is a common approach to both human (Abel 1981, Regli & Cicirello 2000) and machine learning (Summers, Bettig & Shah 2004), where access to a corpus of existing designs can be used to teach the essence of what a 'good design' looks and feels like. These include attempts to transform exemplars into a formal construct within which information about a design can be structured to aid relocation again in the future (*ibid*, Summers, Lacroix & Shah 2002);

- The telling of **stories** is a common and very natural mechanism for sharing our experiences with others, and there have been a number of attempts to support storytelling through technology in order to make it more efficient and scalable within large or distributed organisations. These include attempts to automate the presentation of project histories as a story, one that is generated from the individual contributions made to its corpus of documents (Fruchter & Demian 2002), or more narrative based approaches such as those based upon ‘learning histories’ (Markus 2001, Kamara 2003). Others have examined how stories might be given a more formal structure capable of being stored and retrieved from a system, such as the StoryML language developed by IBM (Thomas, Kellogg & Erickson 2001), or the use of highly structured scenarios through which it is said that a tacit knowledge can be captured and re-presented (Yu-N & Abidi 2000).

Despite the difficulties associated with the re-contextualisation of de-contextualised information, some have suggested that it is at this juncture that the most successful Knowledge Management Systems lie, ones that avoid the creation of disconnected repositories, and instead seek to resonate with the different contexts within which they will actually be used (Thompson & Walsham 2004). Notwithstanding The Organisation’s desire to break its reliance on such individuals, the solution often becomes one of supporting the identification of, and access to, those who were involved in the record’s original creation so that they might assist those wishing to call upon that information again in the future, helping them to re-negotiate the artefact’s meaning in the current circumstances (Tuomi 1999, Demian & Fruchter 2006). The prototypical solution to this problem is the ‘Corporate Directory’: a searchable list of The Organisation’s constituent members, together with an array of their attributes, such as organisational and physical location, roles and responsibilities, a mug-shot, and in some cases details of their educational biographies and personal interests (Marwick 2001). More involved solutions include the establishment of digital infrastructures that facilitate the representation of one’s skills and expertise - such as shared document repositories, online fora, or question and answer systems (Ackerman & Malone 1990, Ackerman & McDonald 1996) - and which serve as a guide to the identity of contributors so that users can go beyond the information offered by the system should they not be able to find the solution that they require. Some have argued that it is not enough for such systems to identify appropriate expertise, but that they must also support the selection of an appropriate expert, in terms of their location, availability, and willingness to offer assistance - such as can be achieved through representations of their current status or workload (McDonald & Ackerman 2000). Further, such systems should support the repair of

failed calls for help, for instance the ability to rapidly iterate through a list of experts should they fail to respond in a timely manner (McDonald & Ackerman 1998). Here the system becomes a tool for initiating both synchronous and asynchronous communications, themselves sometimes mediated by the system - such as through support for instant or direct messaging - and which serve to strengthen the weak ties that might otherwise make organisationally, spatially or temporally distant others difficult to call upon (Ehrlich 2003, Pipek & Wulf 2003). Others have attempted to automate the process of expertise identification through the use of software 'agents' which monitor a user's interactions with the system in order to algorithmically uncover their hidden knowledges (Stenmark 1999, Vivacqua 1999, Stenmark 2001b), or through the use of data mining techniques to analyse large corpuses of information for the patterns that they contain - such as corporate email systems or other large bodies of textual data (Campbell *et al* 2003, Balog, Azzopardi & de Rijke 2006, Yang & Huh 2008) - using the results to infer those topics on which an individual might be particularly knowledgeable. Within the context of such approaches the notion of 'The Expert' is broadened out to encompass all of a system's users - rather than just the Organisationally sanctioned Experts - making everyone potentially approachable by those requiring assistance (Pipek & Wulf 2003).

Rather than relying on individual experts and their expertise as the primary source of solutions to The Organisation's problems, a number of authors have examined how technologies might be better designed to facilitate the ongoing negotiation of the meaning of the information that they contain, in order that the demands of reuse might be shared amongst the organisationally sanctioned Experts, the system's other users, and the system itself (Gabbay & le May 2004, Demian & Fruchter 2006). Here systems considered to be most successful are those that do not attempt to separate knowledge from the context within which the act of knowing occurs, and that directly support the part played by the '*knowledge intermediaries*' that we heard about in section 6.2. - often a locally manifest social intervention in their own right - rather than try to subvert their role (Okamura *et al* 1994, Thompson & Walsham 2004) (whilst at the same time seeking to avoid the 'gatekeeping' practices that can come to exclude others' access to the system [Schultze & Boland 2000]). Within this context the work of intermediaries can range from harvesting information and adding it to the system; maintaining its contents (sometimes referred to as 'gardening'); guiding less experienced others as they navigate the system; re-contextualising the information that it contains for those less familiar with its heritage or meaning; using the system as a pedagogical tool to support the training of those new to the topic areas covered

by the system; as well as using their deep understanding of the system's contents to repurpose them to serve new uses (Blomberg, Suchman & Trigg 1996, Markus 2001, Demian & Fruchter 2006). This often unacknowledged role can be essential to the success of a new technology (Okamura *et al* 1994), and some have argued that system designers should spend time considering how they might directly support this work, rather than attempting to create an all-encompassing self-contained system which can end up serving nobody in particular, i.e. 'The Organisation', 'The Business', or 'The Users' (Fitzpatrick 2002, Gabbay & le May 2004, Cranefield & Yoong 2009).

In order to be successful such systems must resonate with the 'social scaffolding' that surrounds even apparently solitary tasks (Heath *et al* 1994, Whalen & Zimmerman 2005), such as through support for an awareness of the current status of others (McDonald & Ackerman 1998, Erickson & Kellogg 2000, Thomas, Kellogg & Erickson 2001); the mutual monitoring of work so that troubles can be identified and diagnosed by supportive others (Martin, Bowers & Wastell 1997, Whalen & Zimmerman 2005); facilitating the broadcasting of calls for help (Ackerman & McDonald 1996); support for distributed problem solving, such as through the provision of a platform for representations from a diffuse group of others (Reddy, Dourish & Pratt 2001, Ackerman & Halverson 2004); and even the empowerment of capable intermediaries so that they can modify the system to serve local purposes (Okamura *et al* 1994). Taking such a stance reaffirms that the technology is just one facet of the social milieu within which work is conducted - a truly socio-technical system (Baxter & Sommerville 2010) - and is best tasked with serving as a substrate for the ongoing negotiation of understanding that is such a feature of our reaching for new knowledge, supported by more knowledgeable others.

A number of authors have attempted to invert such a conception by reminding designers that the systems that they create are situated within a wider spatial, institutional, social, informational and material ecology, and that the affordances of this context are as much part of 'The System' as the technology itself (Bentley *et al* 1992, Suchman 1993, Rouncefield *et al* 1994, Hartswood *et al* 2003, Schmidt & Wagner 2004, Whalen & Zimmerman 2005). Characterising this wider conception of the system as a *Common Information Space*, investigators have examined the ways in which knowing is an ongoing accomplishment that draws on the full array of resources available from within this context, not just those provided by a singular technology as represented through a singular form factor - such as the desktop monitor - or even those considered by The Organisation as a sanctioned resource

(Bannon & Bodker 1997). Be it the practices that surround and support a medical patient records system, and through which the system's contents are made meaningful in the here-and-now (Reddy, Dourish & Pratt 2001); the distributed monitoring and control technologies of an airport, which support interpretive flexibility across geographical, temporal and organisational space (Fields, Amaldi & Tassi 2005); or the diffuse management of a waste water plant, and the contextually relevant information that is made available to those responsible for its management as they 'zoom with their feet' to discover the plant's current status and solve its troubles (Bertelson & Bødker 2001): an array of publicly available representations of information about the status of actors, artefacts and activities are called upon to establish just-the-required-understandings - understandings which themselves are available to all competent members of that setting. Within the context of this characterisation our conception of the work done by a *Knowledge Management System* is transformed, for it no longer serves as a passive substrate upon which a static, unitary information construct is stored, but instead is called upon to play an active part in the social and material milieu within which it is located, supporting a setting's members in their perpetual negotiation of a common-enough-understanding about how best to go on with their current efforts. Those taking such a stance argue that the model of Knowledge Management as being one of getting the right information to the right people at the right time is insufficient (Thomas, Kellogg & Erickson 2001), and that rather than trying to capture and re-present understanding in strictly structured constructs, the 'knowledge management system' should serve as a loosely-coupled set of resources that can be drawn into the current circumstances as-and-when they are needed, in the form required, and by whom - decisions that are a matter for a setting's members, not a system's designers.

Based on the discussion outlined in the previous pages, what properties might Knowledge Management Systems that appeal directly to the hidden knowledges of a setting's members usefully have if they are to support their open and dynamic nature, whilst providing a resource that has more to offer than the locally manifest ad hoc solutions that The Organisation's constituent members are in a position to create for themselves, but which may not meet its needs in terms of scalability, accountability and reusability:

1. **They should seek to augment rather than replace expertise:** Expertise can manifest itself in many forms, and much effort is expended by The Organisation to rid itself of its reliance on the understandings possessed by ephemeral individuals. Yet again-and-again we find that these same individuals continue to play an essential role in even the most

mundane of activities as their colleagues call upon them to mediate between their current troubles and the very systems put in place to replace them.

2. **They should be ‘socially translucent’:** We have heard that identity plays an essential role in discovering the locus of expertise, and technology has proven particularly adept at supporting the establishment of the current status and location of distant others. However, there is more to our understanding of the attributes of potentially helpful colleagues than the information that they generate, and so providing an ongoing trace of our interactions within and between such infrastructures becomes a valuable resource for establishing those best ‘qualified’ to help us with our current troubles (Thomas, Kellogg & Erickson 2001).
3. **They should be expressive:** As we increasingly move to technological infrastructures capable of the synchronous exchange of information across a range of views and form-factors, the capability of such systems to express our interactions with them becomes a valuable resource in the establishment of trust, accountability and awareness. Exposing the subtle gestures that are made as we work to constitute the system itself - e.g. bookmarking, starring, tagging, following, re-posting, etc - breaks our sense of being a singular user interacting with a dedicated system.
4. **They should be temporally flexible:** Whilst there are strong Organisational drivers for everything that we do to be exposed, systems should support temporal flexibility in terms of enabling work to be hidden at certain times, and visible at others - such as the release of unfinished work during calls for help, or the ability for information to fade or decay over time - a decision that can only be made locally (Star & Strauss 1999).
5. **They should support the experiential nature of knowledge:** As we saw throughout chapter four, experiential knowledge can play an essential role in our work as we juxtapose our experiences of the past, or those of our colleagues, with our current efforts. Supporting our physically or metaphorically pointing at distant exemplars, as well as the enactment of embodied knowledge as we attempt to say more than we can with words alone, provides a valuable resource as we work to establish just-what-it-is-that-we-are-actually-talking-about in just-these-circumstances.
6. **They should serve as a map of the domain:** As more and more documentation moves online previously unimaginable volumes of information are available at the tips of our fingers, something which can be both a blessing and a curse. The increasingly dynamic

nature of interfaces supports the system serving as both a metaphorical and literal map of the information that it contains, including the ability to zoom in and out so that an overview can be achieved at different conceptual scales.

7. **They should support the narrative nature of knowing:** The telling of stories has again and again been shown to play a central part in the establishment and maintenance of common knowledge and membership within communities-of-practice. Support for the telling of digital narratives can range from simply representing the system's contents over time (an increasingly common pattern within social networking sites), through to the drawing together of a narrative based upon our own selections along a vector of our own choosing.
8. **They should support negotiation:** We each possess differing interpretations of constructs such as 'the rules' or 'the proper procedure', whilst at the same time requiring the capacity to establish consistency, punctuation and closure in order that we can collectively go on with our efforts. The systems that we use should therefore support our ongoing negotiations as we collaboratively reach for just-the-required-understandings in just-these-circumstances, whilst providing clarity where collective decisions are reached.
9. **They should be open to re-negotiation:** All knowing is knowing from somewhere, and can therefore take on a contested character as understandings from the past are re-evaluated based upon the perspectives formulated in the current circumstances. Systems should therefore support the local re-negotiation of the information that they contain as we work to re-established a common understanding of its meaning in just-these-circumstances, including the potential to transform that information in order that it better serves us in our current and future efforts.
10. **They should be responsive to change:** The institutions for which we work are under constant flux across a range of conceptual scales, from the immediate circumstances within which work is conducted, to the radical restructuring of The Organisation's organogram. Systems should therefore be able to adapt and respond to this ever-evolving environment if they are to remain relevant during and after such transitions, something which it may only be possible to achieve locally.
11. **They should support local re-design:** System development inevitably occurs at a particular moment in time, and is typically undertaken by a group of people who will

not go on to be the actual users of that system. Meanwhile the context within which the system will be called upon will inevitably evolve over time, and so the re-design of the very system itself by those with the deepest knowledge of it - its actual users - can become a valuable resource in maintaining its ongoing utility long after the developers have moved on to other projects.

Despite their natural appeal, like the ‘convict code’ or the design philosophy of an architectural practice (see section 4.7), these maxims are not intended as an explicit guide to designing a Knowledge Management System, but rather simply serve as an inevitably incomplete set of pointers and clues as to how the designers of a new system might go on with their efforts as they search for appropriate solutions to the problems that they are attempting to solve with the-system-as-it-will-become. As a result additional work must always be done in order to make them relevant in just-these-circumstances and in just-the-required-ways, something which can be achieved by juxtaposing them with the noticings from the actual settings within which the new system will be used, such as those set out within the Patten Language for Knowledge Management Systems in appendix A1. Taking such an approach goes some way towards ensuring that the system that is being formulated is one that is addressing the actual work of a setting’s members, whilst presenting the designer with the opportunity to go beyond a system that is merely usable, and towards one that is actually useful for a setting’s members by leaving room for the creation of novel solutions that extend the existing corpus of designs.

6.5. Design considerations: Operational Support System

In section 6.2. we examined the increasingly important role that notions of knowledge reuse play in modern institutions, as well as some of the problems faced by The Organisation in getting its constituent members to engage with the interventions that it puts in place to ensure that the knowledges of ephemeral individuals are available to its other agents, both now and in the future. Further, we also heard about some of the difficulties faced by the users of those interventions as they work to re-contextualise the decontextualised information that is actually held by a Knowledge Management System, and the important role that intermediaries play in supporting the negotiation that is required to make it relevant *in-just-these-circumstances*. In section 6.3. we reviewed the initial findings from a second case-study investigation which examined the work of a group of administrators and advisers within the context of their ongoing negotiations about the delivery of the schemes that dictate their daily working lives, an activity which is supported by their collective

experiences and understandings of working on those schemes for a number of years, as well as a range of systems and services put in place by The Organisation to support them in their work: not least of which was the *Operational Support System*. In particular, we began to get a sense of the subtle and often hidden nature of an array of knowledges that support their efforts as they call on a range of resources from near and far in pursuit of *just-the-required-understandings*, informed by their discussions with those whom share their daily struggles. In section 6.4. we then examined some of the properties of those Knowledge Management Systems which are said to appeal to the *hidden knowledges* of a setting's members, such as their role in establishing the identity, expertise, and the current status of knowledgeable others so that we might turn to them for assistance with our own troubles. Of particular relevance to the current investigation was the notion of a *Common Information Space* - a construct whose use dissolves the boundary between 'The System' and the wider social and conceptual milieu within which the work that it supports actually takes place - and which serves to remind the designers of those systems that users can and will do much additional work to achieve the understandings that they themselves require, including that necessary to subvert the system itself should it stand in the way of them going on with their efforts.

Whilst the existing Operational Support System is primarily seen as serving the administrators' and advisers' understandings of the technicalities of the schemes, it is clear that there is both much more to these understandings than initial conceptions or Organisational accounts would suggest, and that their achievement is not a matter of a simple interaction between isolated individuals and a passive system. Rather, their ongoing accomplishment occurs within the context of a much broader set of activities, of which interacting with the Operational Support System is only a small - if essential - component, and any effort to re-conceive of the system should therefore include consideration of how it might better engage with these wider '*meta-negotiations*' (Lutters & Ackerman 2007) as the administrators and advisers reuse their experiences and understandings of the past - and those of their colleagues - to solve their current troubles. Within the context of the maxims set out in the previous section, and guided by the noticings from both settings as incorporated into the **Pattern Language for Knowledge Management Systems** in appendix A1, how might we therefore begin to re-imagine the nature and role of the Operational Support System in order that it better serves the work that its users are actually doing to achieve the understandings that they themselves require in order to go on with their efforts?

6.5.1. It should support the exploration of geographic space

Both the administrators and the advisers call upon an array of geographically distributed institutions, actors, activities, and artefacts in support of their efforts. However, information about these comes from an equally numerous range of sources, many of which do not lend themselves to being spatially located from the available information (such as a lack of spatial coordinates that can be displayed within a Geographic Information System). In such circumstances we see their *knowledge of the lay-of-the-land* (pattern 1, page 209) come to the fore as they do their own work to metaphorically overlay *just-the-required-information* over geographies that are relevant to their own biographies in an effort to achieve a shared understanding regarding *just-what-it-is-that-they-are-actually-talking-about*. A number of devices show themselves to be a valuable substrate for such negotiations, such as coarse scale maps on the wall, or simply a desk across which spatially relevant artefacts can be strewn, and their underlying geography enacted.

Therefore, how might the affordances of these devices be supported by the system so that the geographically relevant information that it contains - such as the location of the system's other users, or the array of institutions, actors, and artefacts that get referenced within it - can be more easily spatially contextualised by *supporting the local redesign* (maxim 11, page 182) that is often required to make such information meaningful in the current circumstances. Examples include the ability to quickly produce a map embedded within the system - the Google Maps API is commonly used in other systems that staff utilise - but which can easily be 'thrown' onto a wall or 'spread' across a desk using a projector, or simply shared via a URL, transforming it into a publicly addressable artefact.

6.5.2. It should support the telling of place

The schemes are ultimately applied to a specific place, and many of the questions posed to the system are therefore sensitive to one's understanding of the immediate geographic context within which the work of the schemes is being undertaken. Significant resources are available to individuals to contextualise their *knowledge of just-this-place* (pattern 2, page 212) - such as the technical documents of the agreement, or the experiences of their colleagues who have actually visited *just-this-place* in the past - but which are largely unavailable to the system and its other users in the current circumstances.

Therefore, how might the system support the telling of *just-this-place* as it relates to the task in hand, and in particular for those who might visit that same record again in the future and

who may lack some of the *experiential understanding* (maxim 5, page 181) of its creator? Examples include the spatial referencing of the information contained within the agreement - such as digital photographs of sites on which works are planned and which are commonly taken by the advisers during site visits; pooling the existing spatially referenced information from other systems, and which may serve as a pointer to those likely to have experience of visiting the site in the past; or by simply giving staff the ability to register their interest in particular places at different geographic scales, allowing them to be alerted should a nearby question or answers be submitted.

6.5.3. It should support an understanding of the wider institutional landscape

The rules & regulations of the schemes are ultimately dictated by the wider institutional landscape within which The Organisation operates, and its staff are regularly held to account for the problems faced by customers as they struggle through what they see as the unnecessary bureaucracy of the schemes. As a result staff must constantly work to maintain their *knowledge of the institutional landscape* (pattern 4, page 218) within which they and their customers labor; through chit-chat, the telling of war-stories of other encounters, or simply sharing news of changes that will likely interest their colleagues, they have found their own ways of keeping one another up-to-date on the latest developments in their respective fields.

Therefore, how might the system support staff in maintaining their understanding of these institutions as they work to interpret the rules and regulations *in-just-these-circumstances*, serving as a *map to this aspect of their domain* (maxim 6, page 181), whilst remaining *responsive to the constant ebb and flow of political and organisational change* (maxim 10, page 182) that influences their work? Examples include maintaining a directory of partner institutions, each with their own profile against which questions & answers can be categorised, and all staff can post news and views. This would have the added benefit of enabling those responsible for maintaining these relationships at a strategic level to identify endemic problems that may not be surfaced through more formal channels, but which are causing staff on the ground real difficulties

6.5.4. It should support the negotiation of the rules & regulations

Just what the rules and regulations are, and how they relate to their work, is one of the primary difficulties faced by staff as they try to parse out just what they need to know from

the copious volumes of technical guidance available to them, and is something that absorbs significant amounts of time as they negotiate *just-the-required-understanding in-just-these-circumstances*. The breadth and depth of the corpuses of guidance mean that it is often easier to capture those elements which have proven useful within the context of one's own biography in order that it can be easily relocated again in the future. However, maintaining their ***Knowledge of the rules & regulations*** (pattern 5, page 221) in this way requires that they disconnect these individual elements from the official corpus, converting predominantly digital resources into paper, and collect them together so that they can be organised, annotated, and kept close at hand.

Therefore, how might the system assist staff in creating their own collections of guidance, and do so in a way that they can become a shared resource, one that is constantly kept up-to-date as the rules & regulations evolve, and through which they can ***negotiate a shared understanding with their colleagues*** (maxim 8, page 182), whilst keeping the elements connected to the organisationally sanctioned corpus? Examples include individual profiles within which annotated records from both the Operational Support System and the Operational Guidance Catalogue (see section 6.3.3.) can be stored alongside each other, allowing staff to quickly cross from specific queries to the wider corpus of guidance.

6.5.5. It should give all staff a voice

One of the primary drivers for the creation of locally manifest solutions to supporting the schemes is that there is no Organisationally sanctioned resource to support the ongoing and pervasive negotiations that are such a mundane feature of the work of the administrators and advisers. As a result an array of disconnected corpuses of information have emerged that represent their local ***knowledge of the rules & regulations*** (pattern 5, page 221, section 6.5.4) and ***knowledge of processes & procedures*** (pattern 12, page 242), and which might serve as a valuable resource for a range of other staff, not least because they have been designed by those actually doing the job, and have proven themselves to be valuable to them.

Therefore, how might the system ***give staff a voice amongst the Organisationally sanctioned negotiations about the schemes and their delivery*** (maxim 9, page 182) - as represented by the responses contained within the Operational Support System - and enable them to adapt it to their local needs? Examples include giving staff the facility to create collaboratively produced, publicly viewable collections, related to commonly experienced troubles with specific rules & regulations, processes & procedures, or systems & services.

Further, enabling staff to *publicly or privately negotiate their understandings* (maxim 4, page 181) of the official responses provided through the system would support the identification of misunderstandings, allow secondary issues to be observably resolved, and would give them a forum within which their voices were being heard, rather than them simply being informed of the appropriateness of solutions by faceless others, and which may - and often do - clash with their experiences of actually delivering the schemes on-the-ground.

6.5.6. It should serve as a guide to the supporting systems & services

Staff turn to the Operational Support System to diagnose errors from a range of different systems & services delivered from both The Organisation and an array of outsource providers, but lack a single location from which to draw a list of the available resources, their current status, or the identity of those most able to help in times of trouble. As a result their individual and collective *knowledge of the systems & services* (pattern 6, page 224) becomes a valuable resource that can become locally relevant at any point during the day's work, or that of their colleagues.

Therefore, how can staff be more effectively *guided to the most appropriate point of contact* (maxim 6, page 181) for the troubles they are having with a given system *in-just-these-circumstances*, whilst enabling them to more *effectively represent the specific problem they are having* (maxim 7, page 182) where the raising of a query is the appropriate action (the problems that they face often relate to specific 'screens' deep within systems, and which can be difficult for third parties to identify and access based upon the textual descriptions)? Examples include the provision of a directory of applications together with their respective owners and current statuses, and against which trending issues and workarounds can be recorded. Further, enabling the attachment of annotated screenshots of the problem screens would support better articulation of the current trouble (something which is not currently possible in the existing system), and would allow those responding to a query to literally see the offending screen, including the data entered at the time of the issue.

6.5.7. It should support their understanding of the biographies of 'the customer'

The relationship between The Organisation and its 'customers' can last a number of decades, and so there may be much information contained within its various systems and services

about the troubles that they have faced in the past, not to mention the personal experiences of the administrators and advisers themselves. However, an individual's *knowledge of the customers and clients* (pattern 7, page 227) can often exist in isolation from The Organisation's corpuses of customer information, which often lack any sense of them being anything more than a number or a series of disparate forms and agreements.

Therefore, how might this information be made available through the system so that those faced with their current troubles can get a sense of the developing biography of the customer, and in particular the *expression of the ongoing narrative* (maxim 3, page 181) of the troubles that they have faced with the schemes and those who have worked to help them in their efforts? Examples include the ability to identify the customer within the system (like the agreements, each customer has a unique identity within the context of the schemes, one that is very familiar to staff), and which would allow both the relevant queries to be surfaced as well as those who have had engagement with those customers in the past.

6.5.8. It should support access to successful solutions

Requests to the system ultimately lead to a change in the efforts of The Organisation's staff, but at present there is currently no mechanism for staff to feedback the success or otherwise of the solutions provided through the system to them, and so those discovering a record in the future have no way of assessing its potential adequacy as a solution to *just-this-problem*. As a result staff must regularly draw on their *Knowledge of 'the team'* (pattern 8, page 230) in order to identify colleagues who might possess experience of applying a given solution to similar problems in the past, so that they can support their selection of *just-which-solution* will work best in the current circumstances, and how it might actually be applied *in-just-these-circumstances*.

Therefore, how might the system serve as a *set of pointers and clues to the wider experiences* of those actually applying the proffered solutions to their work (maxim 5, page 181), providing a valuable resource for those seeking exemplar solutions to their current troubles, particularly where similar problems have been provided with different solutions over the years (a common feature in such a large corpus)? Examples include the ability to track user sentiment in terms of the response provided - such as the ability to vote responses up and down based upon their utility - or the provision of a feedback mechanism where staff can provide a narrative response of their experiences of actually implementing the solution on-the-ground, as well as any additional information that might be useful to those that follow.

6.5.9. It should support an awareness of the status of knowledgeable others

An awareness of the identity and availability of knowledgeable others supports our selection of those most able to help us with our current troubles, and whilst the existing system names those who have asked the question, and those who have administered the response, no wider sense of their identity is provided; nor is any record of the wider group of interested parties made available, such as The Organisation's experts consulted during the formulation of an answer. Further, individuals have a much richer engagement with the system than is currently explicated for its other users, not least of which is their asking and answering of previous questions, but also their searches for, and selection of, answers to their past troubles; all of which can serve as a valuable resource for developing a *knowledge of the experts* (pattern 9, page 233) on whom they might call for assistance.

Therefore, how might the system become more '*socially translucent*' (maxim 2, page 181) and serve as a device for representing this richer sense of identity, whilst supporting the establishment of the current status and whereabouts of trusted others, including those not Organisationally sanctioned to serve as The Expert? Examples range from a simple status icon embedded within the system where identity relevant information is being displayed, and which provides those seeking help with a subtle pointer to the likely availability of knowledgeable others, through to a full trace of user activity - such as their asking of questions, starring of records, or voting them up and down - and which can provide a deeper sense of the interests of colleagues. By exposing this information the system can begin serving as the basis for an extended social network, one that is accessible to all staff, including those just beginning their careers.

6.5.10. It should serve as a map to the conceptual structure of the schemes as experience by staff

Staff approach the system from quite different standpoints depending on whether they speak the technical language of the administrators, or the output focused language of the advisers. In spite of this, the existing system makes no distinction between the differing understandings of its diverse user-base, channelling all users through a single entry point which was designed by distant others at a time when little was known about the scheme or how it would be delivered. As a result staff must apply their own *knowledge of the corpus* (pattern 11, page 239) to their navigation of the system so that they might find an appropriate solution to their current troubles, and in particular their understanding of the

complex and interconnected sets of rules & regulations and processes & procedures that define the schemes and their delivery.

Therefore, how might the system serve both groups so that they can more easily achieve a sense of *the conceptual topography within which their troubles are located* (maxim 6, page 181), enabling them to more quickly gain an understanding of the likely location of an appropriate solution, including those situated beyond the bounds of the system itself? Examples include abandoning a unified entry point for all staff, and instead offering each group an overview of their own domain - tailorable to their differing technical languages - whilst providing an overview of the wider role of the system to remind them that it is here to help in a range of different circumstances.

6.5.11. It should support the telling of the proper procedure

A common trouble faced by staff is the appropriate execution of any one of the vast array of processes and procedures that they must undertake when administering applications and agreements. Due to their often complex nature staff have developed a number of locally manifest solutions to assist them with their *knowledge of the processes & procedures* (pattern 12, page 242, section 6.5.5), such as various re-interpretations and re-presentations of the Organisationally sanctioned guidance, including a number of official and unofficial workarounds to known problems.

Therefore, how might the system assist in the creation and maintenance of this local understanding, whilst giving those responsible for the design and execution of individual processes & procedures oversight of common troubles that are occurring, and the local workarounds that are being instituted, so that they and their supporting *guidance can re-negotiated* (maxim 9, page 182) with those who have the deepest understanding of their application? Examples include the use of Internet-based 'office' suites which allow for a more portable product than the image files that are currently used as the official representation of processes maps, ones that can just as easily be embedded within the individual pages of guidance but which increasingly support direct annotation by users. Further, uniquely identifying processes & procedures to staff would allow these to be tied to individual queries within the Operational Support System, enabling owners to monitor trending issues with them, and adjust their guidance accordingly.

6.5.12. It should support their understanding of just-this-agreement

All requests to the system ultimately occur within the context of the application or

agreement upon which staff are currently working. However, each request relating to that agreement might be separated by several years and be submitted by someone from a different physical or organisational location, making it difficult for individual staff members to maintain their overall *knowledge of the plan* (pattern 14, page 248) as it relates *to-just-this-agreement*. The locally manifest solution to keeping track of this disparate set of questions and answers is to print them off, and then scan them into the agreement's documentation held within Origin's Electronic Document Management System.

Therefore, how might the system better *support this locally manifest solution* (maxim 11, page 182), whilst also serving as a resource for gaining an overview of the troubles faced over the lifetime of the agreement as-a-whole? Examples include the ability to export a PDF version of the query specifically formatted to meet the needs of those discovering it within the documentation at a later date, such as hyperlinks back to the original question and answer so that it can be monitored for changes. Further, each agreement has a unique identity number that is one of the primary currencies used by staff during discussions with their colleagues (the other being the customer's identity), and which could be recorded within the system, allowing existing queries to be pooled and displayed when a new one was being submitted.

6.5.13. Summary

As we saw in section 6.3. and the noticings set out in appendix A1, the most significant source of support available to the administrators and advisers is their immediate 'workscape' (Whalen et al 2004), and which contains a number of resources to aid them in their work, not least of which is the Operational Support System itself. However, like so many *Knowledge Management Systems*, it is only available through the singular form factor of the desktop monitor, and yet their understanding about the information that it contains is predominantly developed out in this wider workscape as it is negotiated with colleagues who have faced similar troubles in the past, drawing on a range of physical and conceptual artefacts from near and far to inform their discussions. These considerations are therefore a response to investigations into how the re-conceived system might better support these ongoing and pervasive negotiations by engaging with the very procedures they themselves are calling upon to make their knowledges manifest, such as their understandings of the rules and regulations that guide their work, the process and procedures through which it is to be delivered, and the systems and services that The Organisation provides to aid them in their efforts. In particular they have sought to improve the system's ability to 'bleed out' into

this wider context so that a richer set of pointers and clues are available to be called upon during these negotiations, as well as broadening the range of services offered by - or available through - the system, so that the troubles that its individual queries represent can be more effectively placed into their wider context, both for those asking questions and answering their colleagues' calls for help, but also those re-contextualising those responses at some as-yet-unknown point in the future.

Whilst the constraint of delivering the service through the singular form factor of the desktop monitor remains in place, this is increasingly a product of those Organisational circumstances, rather than limitations of the available technologies, which are becoming more and more capable of supporting such work: Larger format screens allow information to be displayed publicly in a more fluid manner, including the ability to receive broadcasts from a range of other devices, or to serve as a touchable interface in their own right; Cheap tablet computers have come to express many of the affordances of paper, such as their mobility across a range of spatial scales - from being passed amongst a huddled group, through to being taken out into the field - as well as providing a more natural substrate through which annotations can be made using both stylus and touch; and 'smarter' phones now make it possible for staff to be called upon in a broader range of circumstances, and via an array of communications channels, whilst enabling more contextual information to be gathered when recording data, such as the automatic geolocation of photographs as they are taken with the device's camera. All of these technologies are available now in commercial products, and in other circumstances could be integrated with the Operational Support System, adapting its services to be delivered through these different form factors, as well as enhancing those services based on the affordances those devices offer.

During the life of this study the practicality and applicability of these recommendations have been negotiated with the various stakeholders invested in the success Operational Support System - not least of whom are its actual users - using the patterns of *a-knowledge-of-just-this-thing* as a basis for these continuing discussions. These negotiations have also occurred within the context of other business Functions planning to use the system's services, and how these considerations might impact on its utility for their work areas; something which has increased the requirement for the system to be locally adaptable at a range of different organisational scales: from the maintenance of the base system, for those responsible for administering a given Function, to those actually using the system to support their work. Further, the considerations identified here take into account the constraints that limit the

range of technological solutions available within this particular setting, the most significant of which is that many of the systems used by staff - from their laptops through to the Origin system - are outsourced to third party suppliers. As a result, even minor re-configurations can be prohibitively expensive, and so any solutions - like the ad hoc arrangements that staff are able to institute for themselves - must fit within the tight conceptual space of what is practicable using the available in-house services: namely the server-based infrastructure upon which the Operational Support System is itself built, and the increasing array of 'cloud' services that are available to it through their Application Programming Interfaces.

Within the context of this investigation, the approach set out in the previous chapters has shown itself to be capable of identifying a broad set of specific design considerations that take account of the array of knowledges that were identified as playing an essential part in the work of The Administrators and The Advisers, but which are largely absent from official conceptions of the system and its users, or the design of the-system-as-it-currently-stands. This is an approach which has sought to acknowledge the requirements gathering processes as one that involves the combining of two disparate sets of knowledges - those of the investigator and those of a setting's members - as we teach them about the capabilities and limitations of the technology, and learn about the setting and their practices from them (Suchman, Trigg & Blomberg 2002). The result is a set of considerations for future developments of the Operational Support System that are both technically feasible, but which directly appeal to the ways in which the member's of these particular settings actually work on a day-to-day basis, and which have been negotiated as such. These design considerations must now be transformed into actual system functionality if their potential value it to be realised, something that is ongoing, and which is open to its own set of negotiations.

7. Discussion

In chapter one we heard about the important part that evolving notions of a *Knowledge Society* have played in guiding the role of The Organisation and its constituent members in the ongoing transition to the new globalised *Knowledge Economy*. The privileged status of so-called *Knowledge Workers* within this context was then highlighted, and in particular the special efforts that *The Organisation* - as well as the Knowledge Society as-a-whole - has gone to in order to support the work that they do: namely the creation of a new discipline, called *Knowledge Management*. The central role that technological interventions play as part of these efforts - in the form of *Knowledge Management Systems* - was then noted, and specifically the work that they are perceived to do in supporting the reuse of existing knowledge in the name of maintaining Organisational efficiency and competitive advantage. Finally, some of the difficulties faced by Knowledge Management's agents in their efforts to design, develop and deploy effective and appropriate systems and services suitable for everyday work settings were outlined, and in particular the difficulties caused by the hidden nature of certain species of knowledge: most often characterised as *a tacit knowledge*.

Within this wider context, the aim of the work set out in the preceding chapters has been to formulate an approach to understanding the requirements for new Knowledge Management Systems; one that pays special attention to those knowledges which might ordinarily be hidden from the undirected view of The Organisation and its analysts. This was achieved by first advancing the trope '*hidden knowledges*' to stand in for the array of knowledges that can go unnoticed during the design, development, and deployment of new technological interventions, including - but not limited to - a tacit knowledge. We then examined the proven utility of *ethnomethodologically informed ethnography* as a mechanism for noticing those aspects of a setting's members' practices that might otherwise be hidden from an undirected view, and in particular those moments when they can be seen to be meaning more than they can say *in-just-so-many-words*. Following the application of just such an approach to uncovering some of the hidden knowledges found within an international architectural practice, *Pattern Languages* were advanced as a device particularly suited to sharing the findings from such investigations with all of the stakeholders invested in the success of a new system, not least of whom are its eventual users. Finally, within the context of a second case-study investigation - which evaluated the application of this approach to the evolution of an existing Knowledge Management System - we saw its utility for guiding us towards the design of appropriate technological solutions to the actual problems faced by a setting's

members as they negotiate an answer to the immortal question: ‘*how do we go on?*’

7.1. Hidden knowledges

In chapter two we examined a number of sometimes conflicting accounts of a tacit knowledge that appear across a range of disciplines, and in particular those that have a special interest in the role that such hidden phenomena are playing in our everyday lives: as a philosophical account of the part played by our intellectual passions; as an account of the cognitive mechanisms through which we implicitly learn new skills; as a sociological account of the shared conceptual objects that are called upon to account for the persistence of socio-cultural phenomena, such as traditional practices; and as a praxeological account of methodic procedures through which a common understanding is established and maintained by a setting’s members. We then examined concerns that certain commentators have expressed regarding the appropriateness of many of these conceptions of a tacit knowledge: namely that they often achieve little more than a re-description of the phenomenon of interest in a philosophical, theoretical or technical language. In response to similar concerns regarding inappropriate conceptions of workplace knowing in other areas, we heard how some investigators have turned to the *situated paradigm*: an approach which acknowledges the partial, local and multiple nature of members’ *knowledges*. Based upon this analysis the notion of hidden knowledges was advanced as a gloss for all those knowledges which might ordinarily be hidden from the undirected view of both The Organisation and its analysts - including a tacit knowledge - and it was suggested that this re-specification may help to reduce some of the tensions and misconceptions that have built up with the inappropriate application of the term by avoiding making any unwarranted claims about a given phenomenon’s cognitive status.

In chapter three we examined a range of approaches to uncovering the part played by such hidden knowledges in everyday work settings, and it was argued that those taking a more formal stance were in danger of inappropriately reifying the situated knowledges of a setting’s members, or treating them in the abstract, and therefore risked their analyses becoming little more than desktop exercises in philosophical puzzle solving. Others have argued that the creation of theoretical or conceptual constructs as an account of situated activity, even if they are based on direct engagement with a setting’s members - such as through the application of Grounded Theory - can result in the constitution of a different social world, one that can lose any connection with what that work was, and from which an accurate understanding of it can never be recovered (Rawls 2008a). This is a criticism that

can also be levelled at some of the constructs created by those offering accounts of knowing in the workplace - such as can be found in some of the literatures of Knowledge Management - who have often become enchanted by the allure of including references to a tacit knowledge within their depictions, without offering an adequate description of how they actually manifest themselves in just-these-circumstances. Those turning to more formal approaches to the production of such accounts may therefore be claiming too much with regard to their ability to offer an effective representation of the actual work of a setting's members - particularly with respect to their hidden knowledges - and that those who design, develop and deploy technological interventions in the workplace might benefit from techniques that make the investigator's original understandings of such phenomena available to all of a project's stakeholders in a more meaningful form.

7.2. Noticing hidden knowledges

We then heard how, partially as a reaction to the inability of more formal approaches to offer an effective account of certain aspects of the situated work of a setting's members, some have turned to Ethnomethodologically informed techniques in order to gain a deeper understanding of the work undertaken in the settings under investigation. Those taking such a stance argue that, rather than try to make our conceptions of such work fit scientific or rational ideals, we should examine its practical, unruly, ad hoc, and endlessly detailed nature if we are to fully appreciate how we might more effectively support its conduct in the future. However, despite the potential offered by the ethnomethodological turn, we heard that Ethnomethodology has itself succumbed to some of the same criticisms regarding its approach to understanding the situated practices of a setting's members as those levelled against other disciplines: namely that Ethnomethodology's often implicit reliance on the knowledgeable and reflexive actor can be seen as yet another example of a theoretical abstraction, in many ways equivalent to those upon which more formal approaches - such as those we heard about in section 3.2 - often rely (Pleasant 1999). Notwithstanding his criticisms of Ethnomethodology, Pleasant maintains that the ideal to which the approach aspires - that the ethnomethodologist should not attempt to offer their own theoretical constructs to replace those of a setting's members, including the members of other disciplines - is a worthy one, and one that he tries to pursue in his own work. Indeed, he notes that the genuinely reflexive, indexical and accountable nature of ethnomethodological accounts should mean that investigators attempt to say no more about what they see before them *than they can know*.

To achieve this end, we examined how Ethnomethodology focuses our attention on the conceptual space between abstract social structures, and the machinations of the individual mind: the space between action as a product of institutional constraints, and action as the product of individual motivations. Within this view, the individual actor is seen as the locus of an endless array of methodic procedures - rather than a container of motivations or discrete knowledge - and it is through a detailed analysis of their enactment that we can come to notice the normally hidden facets of their efforts. From such a position notions such as trust, identity, or even a tacit knowledge stem not from personal characteristics, but rather the very practices through which they are made manifest: *that the 'individual' is constituted in and through these practices, that things can only be 'thingified' through them, and who or what they are beyond these circumstances is largely irrelevant, unless practical work is done to specifically make it so* (Rawls 2008b). Within this context, the work of Garfinkel and Sacks was not intended as the basis of a theory, but rather was meant to serve as the foundation for an apprenticeship system (Lynch 1999), with their breaching experiments and tutorial exercises aimed at developing the knowledges of their students, transforming them into *connoisseurs* of noticing the subtleties of members' practices. Such a conception highlights the practical nature of undertaking ethnomethodological investigations, reminding us that it is not just the study of practice, but that it is a practice, and that by design it has no unifying frame, just an ever growing corpus of studies; Or, in a typically recursive characterisation: *'Ethnomethodology is applied ethnomethodology'* (Garfinkel 2002, p. 114).

As we heard in section 3.4, those wishing to take an ethnomethodological stance towards understanding knowing in the workplace have typically turned to ethnographically informed approaches to generate their primary data. Whilst the original purpose of creating ethnographic accounts was to sate academic interest in unfamiliar cultures - through the creation of an empirically informed description of the ethnographer's direct experiences of that culture - we heard how this purpose has since been extended by those working to design and deploy new technological systems within everyday work settings. The utility of ethnographically informed accounts of work is now well established within fields such as Workplace Studies, Requirements Engineering and Computer Supported Cooperative Work (CSCW), with such descriptions standing in for both the investigator and the setting's members when they are not able to present the requirements for a new system for themselves. In particular we heard how such studies can serve as a useful counterpoint to the tendency of some approaches to produce abstract accounts of reified phenomena, reminding designers that the systems that they are working hard to create will eventually be used by

real people doing real work, an understanding that will assist them in designing a system that can be woven into the conduct of that work, rather than disrupt it. Such a sophisticated understanding of the workplace becomes ever more important as technology is increasingly integrated into our daily working lives - with the tabs, pads and boards predicted so long ago (Weiser 1991) finally becoming an everyday reality - enabling those involved in the creation of such systems and their increasingly disparate supporting infrastructure to fully appreciate the artful relationship that we have with them, and the ways in which they increasingly influence the very nature of work and our conduct of it.

7.3. Hidden knowledges in action

To illustrate the utility of taking such an approach the findings of an initial case-study investigation were presented in chapter four, one which examined the role of an array of hidden knowledges within the context of an architectural practice's design philosophy, and the part that they play in informing the production of 'good design'. This work set out to assess the feasibility for a new Knowledge Management System to support the reuse of existing design knowledge - in the form of a design reuse system - and in particular what impact those knowledges which might ordinarily go unnoticed might have on the success of such a system. Any group seeking professional status must distinguish themselves from the rest of society through the exclusivity of their knowledges, and whilst there is much that can be explicated about the work of the likes of architects, there is more that remains hidden - such as the architect's enduring passion for experiencing 'good architecture' first hand, or their sense of the 'quality' of a designed space or artefact - factors which go beyond their being merely professionally qualified, and towards the artful displays of competence so revered by the likes of Polanyi. Within this context the procedures through which four such knowledges were being made manifest were examined - knowledges that might not have been considered worthy of support by those taking more formal approaches - but which were shown to be playing an essential role in the formulation of a new design: the architects' knowledge of the outputs of the profession as-a-whole; their knowledge of their own practice's corpus of existing works; their knowledge of the current status of 'the plan'; and their knowledge of the particular artefact upon which they are currently focused, and its place in the building-as-it-will-become.

These activities are in many ways the epitome of hidden knowledges in action, where those with highly developed skill-sets are unable to articulate *just-what-it-is-that-they-mean* other than through the artful performance of the practice itself: a performance that in-turn enables

them to mean more than they can say *in-just-so-many-words*. Further, we also saw how these knowledges supported the development of their understanding of the practice's underlying design philosophy - advanced as an example of a tacit knowledge in action - and which is only available through a series of disparate tellings - in the form of an endless array of metaphors, analogies, maxims and exemplars - and which are only ever told for *just-these-circumstances* and *in-just-the-required-ways*.

Continuing reliance on such hidden knowledges points towards much of the learning and practice of the design disciplines as being experiential in nature - rather than the abstract and idealised modes of thought preferred by some researchers and educators (Abel 1981) - our ongoing inability to articulate a formal basis for these processes signalling why the apprenticeship system that was so evident in the day-to-day work of the architects continues to play such a central role in their ongoing personal development. It was therefore suggested that it was here that any technological intervention to support the reuse of design knowledge should focus, one which acknowledged the highly situated and often contested nature of the array of knowledges that they call upon during the mundane work of 'doing design', and the practical procedures through which they are being made manifest *in-just-these-circumstances* and *in-just-the-required-ways*: their juxtaposing of the-design-as-it-currently-stands with exemplars from the practice's corpus or those of the-profession-as-a-whole; their subtle drawing-in of distal pointers and clues to motivate just-the-required-understanding of 'the plan' as laid out before them; the listing of the properties that their designs should or should not have as pattern or warning for their current efforts; or their use of their own bodies to represent spatially or temporally distant objects; all of which supports an ongoing and pervasive negotiation regarding how best to go on with their current efforts.

7.4. Describing Hidden Knowledges

In order to share the findings from explorations such as those presented in chapter four, we then examined a number of devices for re-presenting the investigator's original understandings to the other stakeholders invested in the success of new technological interventions. Specifically *pattern languages* were advanced as a descriptive device that provides many of the benefits of long-form narrative accounts - whose use can help guard against the creation of abstract accounts of reified phenomena - whilst offering an easily digestible and portable format that can directly appeal to a range of different readers, and in particular those responsible for making a Knowledge Management System manifest. As we heard in section 5.5, a number of alternative approaches to structuring the information

contained within a language's individual patterns have been proposed by those utilising them as an account of situated phenomena, with some using an array of sub-categories, or the presentation of a detailed analysis of individual vignettes - such as those presented throughout chapter four - to motivate an understanding of the pattern's nature. However, in the work presented here the aim was to utilise Alexander's original formulation - because of its focus on motivating an understanding of the '*quality without a name*' as a prototypical example of a hidden knowledge in action - and so the findings from the fieldwork were presented as a series of noticings, a descriptive turn which appeals directly to our own experiences of everyday life, and draws our attention to the procedures that the members of these particular settings were calling upon to go on with their own efforts. As such, these noticings were not intended to carry the same academic currency as the detailed findings presented in chapter four, but instead sought to motivate a personal understanding of the problems faced by the members of these particular settings, and the solutions they themselves were calling upon; an approach which could serve as a basis for all of those involved in the design process to reach for a common understanding of the work that the intended system was to support, and how they might go about achieving this end. In both investigations, grouping these noticings around the '*knowledge-of-just-this-thing*' construct proved particularly fruitful in terms of being able to draw out the methodic procedures through which it was made manifest - and in particular those circumstances where its telling went beyond the use of words alone - whilst at the same time guarding against the desire to say more than we could know about the contents of such knowledges, or indeed their cognitive status.

When discussing the individual patterns with the administrators and advisers involved in the second case-study it was quickly apparent that the most fruitful conversations occurred when the findings were couched in everyday language - avoiding terms such as 'a tacit knowledge' - something which they could then engage with directly, and extend on their own terms. The narrative structure of the pattern language showed itself to be capable of bridging this gulf, providing all involved with a shared language upon which to formulate a common understanding of the work done and the feasibility of any support proposed. Further, because they often see themselves as being knowledgeable about their particular areas of work, framing these discussions within the context of their knowledge-of-just-this-thing showed itself to be a particularly empowering basis for a conversation about the detail of the work that they were doing to achieve that understanding, and how that work might be better supported in the future.

Despite the perceived differences in these settings and the nature of the final outputs of those working within them - tangible buildings versus diffuse environmental goods - when examining the conduct of their members' work from the perspective of the patterned approach being advanced here, there was shown to be a high degree of similarity in the procedures used to co-ordinate their efforts across a range of conceptual scales: from their knowledge of the artefacts which stand in for the final material outputs of their work - 'the plan'/'the agreement' - outputs which in many cases will never be experienced first hand; through to the procedures used to mean more than they could say in-just-so-many-words - such as the simple gestures that are used to subtly draw attention to resources from both near and far. Further, the open and flexible structure of the language also showed itself capable of representing the subtle differences in each case, and therefore helped guard against slipping into the use of abstractions which had lost their connection with the real work of any setting's members.

7.5. Designing for Hidden knowledges

Within the context of this thesis we are specifically working to address the design of Knowledge Management Systems in order that they might more appropriately support the array of hidden knowledges that a setting's members call upon during the mundane conduct of their everyday work. To this end we have examined whether taking a step back from some of the tensions and misconceptions that have become established within the literatures of Knowledge Management surrounding these topics - and most notably those relating to conceptions of a tacit knowledge - might provide the basis for the design of systems that go beyond the dominant model for such technologies. Of particular utility to making such a move is the notion of a *Common Information Space* (section 6.4.1.), because - rather than focusing on performing a transformation and acquisition of knowledge based upon some abstracted or reified conception of the work that a setting's members do - such an approach seeks to acknowledge the ongoing manifestation of an array of knowledges in-and-through the course of the very work that they help to define. To support this move we have examined the wider social and conceptual milieu within which the work that Knowledge Management Systems are designed to support actually takes place, and in particular the procedures through which a setting's members solve their everyday troubles for themselves.

To assess the utility of the outlined approach it was evaluated within the context of a second case-study investigation: a project to re-develop an existing Knowledge Management System to better support the array of knowledges that surround the management and

delivery of an ‘agri-environment’ scheme within a small Government agency in the United Kingdom. Whilst it was not possible to utilise audio or video recording in this new setting - something that did effect the depth of analysis possible - taking an ethnomethodologically informed stance towards understanding the procedures through which the administrators and advisers managed their work still produced valuable evidence regarding an array of knowledges that are essential to their efforts, but which are largely absent from the Organisation’s - or indeed their own - accounts of their work. Further, it uncovered the pervasive and ongoing negotiation that is such a feature of their daily working lives as they constantly reach for an adequate understanding of the schemes - *in-just-these-circumstances* and *in-just-the-required-ways* - so that they might go on with their efforts.

It has been noted elsewhere that a setting’s members must work hard to make the problems that they face articulate-able within the context of third parties, such as those sponsoring their activities (Fujimura 1987), and others have argued that the role of the investigator should be to assist users in representing themselves in circumstances that they may not be familiar with, and therefore lack the technical languages through which to articulate the work that they do (Hughes, Randall & Shapiro 1993). Some authors have even suggested that we should consider leaving behind the literary description of such work altogether, and instead utilise the prototype to directly embody the-design-as-it-currently-stands, using it to surface the un-articulated and un-articulable needs of a setting’s members through their direct engagement with it (Blomberg, Suchman & Trigg 1996, Suchman, Trigg & Blomberg 2002). Such an approach appeals to the notion that anything short of pointing at the activity itself is necessarily an abstraction of some sort, and that by calling upon the prototype, and the user’s interactions with it, we can formulate both a developing description and a provisional proposal in parallel.

However, here we have seen the role that descriptions of work can play in seeding such prototypes, an approach which provides a basis for the designer and the setting’s members to think beyond their immediate circumstances, and re-imagine what role such systems might play in their future efforts. As we heard in chapter five, pattern languages have been applied within a number of disciplines, and there are now an array of languages that focus on

software development, such as those tailored to the design of user interfaces¹. Whilst some have questioned the utility of taking a patterned approach to system design, in terms of the quality of the designs produced (Wania & Atwood 2009), they do acknowledge that their use leads to the inclusion of more variation, which in-turn leads to a system that is ultimately more useful, and therefore stands a greater chance of being successful. Here we have begun to get a sense how system designers might achieve this end, guided by a series of maxims that provide advice as to how they might go about creating technologies that integrate themselves with the actual work of a setting's members as they call upon their knowledges of geographies, institutions, actors, activities and artefacts; during their negotiations about how best to go on with their current efforts, and which has produced a range of design considerations whose practicability has been negotiated with those who will eventually use them to support their work.

In the face of pressure to make the findings from such studies reusable across different settings, we must be cautious that any descriptive device used does not get in the way of our ability to come to new understandings of what we see before us, and therefore to formulate novel solutions to the problems that the members *of-just-this-setting* face. Rather, disparities in our understanding of how such work is thought to be done and how it is actually achieved *in-just-these-circumstances* are inevitable and, rather than attempting to create eternal representations of what are only ever ephemeral configurations, we should utilise this tension when creating accounts that will go on to inform the design of new systems. Within this context the contents of the pattern language come to serve as a set of pointers and clues - *an aid to a sluggish imagination* - that guide the investigator towards their own noticings of the settings they have before them, rather than attempting to serve as a repository for 'captured' design knowledge. As such, the pattern language as-a-whole begins to function as a designer's notebook, something which is under constant revision as each-next-setting is investigated, and new understandings of how work is conducted *in-just-these-circumstances* are achieved.

¹ Yahoo! Design Pattern Library [<http://developer.yahoo.com/ypatterns/>], Designing Mobile Interfaces [<http://4ourth.com/wiki/Index>], User Interface Design Patterns [<http://ui-patterns.com/>], Quince User Experience Patterns [<http://quince.infragistics.com/html/AllPatterns.aspx>], Designing Social Interfaces [http://designingsocialinterfaces.com/patterns/Main_Page], Common Ground: A Pattern Language for Human-Computer Interface Design [http://www.mit.edu/~jtidwell/common_ground.html]

7.6. Conclusion

Despite the ongoing and understandable appeal of being able to ‘capture’ the knowledge of a setting’s members within a Knowledge Management System, we must remember that - rather than treating it as an end in itself - capturing information based upon or about an individual’s knowledge is just one of the roles that such systems can play within everyday work settings, and that it is only through the re-contextualisation of that information by a knowledgeable human actor - *in-just-these-circumstances* and *in-just-the-required-ways* - that its value can be realised. Whilst such nuances may appear to be only of academic interest, if we are to fully engage with the fundamentally situated nature of knowing then more stable characterisations of phenomena such as ‘a tacit knowledge’ are required for researchers and practitioners alike, ones where knowing’s local, partial and multiple nature is treated quite differently than the reified constructs that are viewed as capable of being captured on some substrate, and which will ultimately lead to systems that better serve a setting’s members in the work that they actually do.

Clearly the stance set out in the preceding pages is not one that will appeal to all of the researchers and practitioners of Knowledge Management, and in particular its attempt to eschew formal approaches to conceiving of the knowledges of a setting’s members - acknowledging that one must develop one’s own skills in order to make such noticings - goes against the grain of much of the established literatures on the topics addressed here. However, the subtle and hidden nature of many of the knowledges that support the work done in the settings investigated here show that achieving an adequate understanding of their nature requires more than the application of a standardised methodology, but instead demands a personal investment on behalf of the investigator as they engage with a system’s potential users, immersed in the context within which their work actually takes place, and that they commit to developing their own sense of what that work is so that they might engage in a more meaningful negotiation about how it can most appropriately be supported in the future.

To achieve this end the trope ‘hidden knowledges’ has been given a central position in the approach taken, each example of which serves as a marker around which our observations of the members’ procedures through which they are made manifest can be investigated using ethnomethodologically informed techniques, described using their patterned nature as a basis, and discussed with those who possess the greatest understanding of the work that they do: *the members of the settings themselves*. Taking such a stance offers us the opportunity to

reconsider the part that technology might play in the mundane and ongoing negotiation of understanding that pervades our daily working lives - and which it might be argued is the defining feature of *Knowledge Work* - and begins with the acceptance that the system no longer needs to be viewed as a definitive store of 'knowledge', but rather as a *centre of coordination* (Suchman 1997) for the disparate set of pointers and clues which motivate our endlessly developing array of knowledges of an ever evolving workscape; many of which are largely hidden from an undirected view.

7.7. Further work

The findings presented in the preceding pages offer a number of avenues for further work, including:

- Whilst the approach set out here has shown itself to be useful for a singular investigator/designer, can it be applied effectively as a tool where these roles are being fulfilled by different individuals, or where there are a number of designers and developers working in the same setting and so must negotiate a shared understanding amongst themselves? Further, we have seen here the approach applied to two settings and which combined produced a total of 15 patterns. Does the language scale effectively in terms of additional settings, multiple authors, as well as the granularity of patterns; all of which could lead to a rapid expansion of the language?
- The existing corpus of ethnomethodologically informed studies contains accounts of a vast array of members' procedures, many of which could easily be integrated into the patterned approach set out here e.g. the procedures through which we deal with interruptions to our work (Rouncefield *et al* 1994), through which we maintain the flow of work (Bowers, Button & Sharrock 1995, Hartswood *et al* 2003), through which arguments are made (de la Flor *et al* 2010), as well as the array of patterns already identified in other studies (Martin & Sommerville 2004). Do these existing descriptions lend themselves to being re-articulated within the knowledge-of-just-this-thing construct being advanced here? Further, the Pattern Language for Architecture also contains a number of patterns that could potentially be incorporated into this language: Self governing workshops and offices (80), Small services without red tape (81), Office connections (82), and Master and Apprentices (83) (Alexander, Ishikawa & Silverstein 1977).
- One of the most appealing aspects of A Pattern Language for Architecture was that it might allow us to design and construct a new building without the involvement of a

formally qualified architect. To what extent does the Pattern Language for Knowledge Management Systems - when paired with the maxims set out in section 6.4.1. - begin to offer a setting's members the opportunity to better specify and articulate their own requirements to those who will make the system manifest on their behalf?

Appendices

A1. A Pattern Language for Knowledge Management Systems

We each possess an array of knowledges that are applied to the successful completion of our work. Each of those knowledges are both a personal and collective achievement as we constantly reach for *just-the-required-understanding* in *just-these-circumstances*. The methodic procedures through which this never-ending pursuit is achieved are available to all of a setting's members in and through the work that they do, and are the very basis of a *knowledge-of-just-this-thing* as our understandings coalesce in pursuit of a solution to the perpetual puzzle: '*how do we go on?*'

Our Knowledges of Geographies

Our knowledges of different geographies - including our understanding of the lay-of-the-land, specific places, or the current location of distant others - supports our contextualisation of spatially relevant institutions, actors, activities and artefacts, and play an essential role in coordinating work that might be distributed across a range of spatial scales - from our immediate circumstances to those that are taking place many thousands of miles away:

1. Knowledge of the lay-of-the-land



Contextualising institutions, actors, activities and artefacts at geographic scales is an important part of framing our understanding of our current efforts, as well as the labours of those with whom we work.

Whether it be the location of the outputs of others, or the whereabouts of a project's stakeholders, all work can be spatially located at geographical scales, ranging from our immediate setting through to different continents. In an increasingly networked and globalised world maintaining an understanding of the geographic lay-of-the-land becomes an essential part of cultivating an awareness of the status of our own work, as well as that of our colleagues, no matter where they might be located. To achieve this end a setting's

members call upon a range of resources to support them in the formulation of their knowledge of the lay-of-the-land, and accountably display this understanding to those around them:

- Despite being provided with a spreadsheet containing information about the geographic territories covered by a group of field advisers, when it comes to actually matching this information with the identity of the individual responsible for overseeing a specific location, and the customers that it contains, a group of administrators find it lacking. To assist them in their task they turn to a coarse scale Ordnance Survey map of their own territory pinned to the office wall and - calling upon their knowledges of various geographies - proceed to negotiate the identity of the appropriate adviser by cross-referencing the known location of the customer with places familiar to their own biographies, the location of The Organisation's offices, and the information contained within the spreadsheet, as they metaphorically overlay the map with an array of different 'layers' of information in their efforts to estimate the territories covered by the relevant advisers.
- Two clients are visiting their London-based architects from their native India in order to discuss the design of a new building, which is still in its early stages of development, and therefore limited to a small number of two dimensional paper representations laid out on the desk before them. Also present in the meeting are the senior architect responsible for the project, and a consultant engineer brought in to advise on the structural elements of the design. The discussion quickly shifts to the location of the design within the wider landscape in which it must sit, supported by the metaphorical transformation of the two dimensional representation laid out on the desk before them into a three dimensional rendering of the-building-as-it-will-become, and the animation of that landscape over the surface of the desk - as they work to fit the suddenly very mobile design into the available space. Unknown to the architect, the engineer has worked in the region before, and is therefore able to contribute valuable knowledge regarding the nature of the underlying rock, something which radically transforms their discussions in terms of the amount of work that can practicably be done in order to modify the local landscape to accommodate the-design-as-it-currently-stands.
- Despite an organisation's attempts to disband its official Cartography units, and move their staff onto other duties, they manage to keep hold of their specialist equipment and quickly become locally known as a resource for creating high quality representations of

work at geographic scales, giving their peers access to the detailed, custom made maps that they have always required to spatially contextualise their work in their discussions with colleagues and customers.

Therefore:

- A simple coarse scale paper map pinned to a wall, or spread across a desk, can provide a valuable focal point for our discussions with co-workers as we negotiate our understanding of the lay-of-the-land;
- Support the juxtaposition of different geographies by providing access to materials and resources that enable us to visualise the spatial layout of different territories so that we might locate our place, or that of our work, within them;
- The metaphorical performance of geography - not just its representation through information constructs - enables us to enact our knowledge of the geographies that are relevant to our own biographies, metaphorically placing ourselves and our work within them;



Our understanding of the geographic layout of the world around us informs our KNOWLEDGE OF THE PLACES (2) within which work occurs, as well as our KNOWLEDGE OF THE LOCATION (3) of distant institutions, actors, activities and artefacts...

2. Knowledge of place



... our KNOWLEDGE OF THE LAY-OF-THE-LAND (1) informs our understanding of the specific places within which the products of our efforts will be located.



Our contributions to the projects on which we work often occur at some distance from the final location of their outputs, which themselves are situated within a local context that may be quite different from our own circumstances, and which we may never experience first-hand.

The work that we are undertaking in our current location often relates to projects whose final outputs may be located in a place that is some distance from our own contributions, and which we may never have the privilege of visiting ourselves. However, our understanding of the nature of these distant places may influence our ability to formulate adequate solutions to the problems with which we are faced, and therefore the success of the project as-a-whole. Such understanding may be formulated following our direct experience of visiting these places, but more often it is achieved through talk - supported by physically or metaphorically pointing at maps and photographs on a screen, desk or wall - as we negotiate our knowledge of place with those around us so that we might share a common understanding of just where the products of our work is located, and the implications the nature of just-this-place might have for our current efforts:

- As a junior architect works to complete a report for a client he must spatially locate himself within a scene that is very far away from the office within which he currently sits, and which he has never experienced first hand. He begins by ‘flicking’ through a set of digital photographs taken from a vantage point overlooking the site of the new building,

stored in a shared project folder, and displayed on the PC monitor before him. However, he struggles to achieve the necessary understanding, and so turns to the senior architect responsible for capturing the images - sat at the adjacent desk - and who has visited the place many times. Together they proceed to negotiate a common understanding of a range of phenomena related to both the images, the place that they represent, and the work he most do, including its aspect, the location of key features, as well as 'their' distance from the nearby waterfront.

- A customer phones one of the administrators responsible for managing their contract with the organisation in order to discuss a particular aspects of their agreement, and which relates to a specific piece of land that they own. However, unlike some of her colleagues - or the customer themselves - the administrator has never experienced this site first-hand, and so must do additional work in order to establish her understanding of just-what-it-is-that-the-customer-is-actually-talking-about. To assist her in this task she has a number of resources at her disposal, not least of which is the contract itself: an artefact that is written in a technical language with which she is deeply familiar, and can therefore readily navigate. However, the customer does not share this technical understanding, and so the administrator turns to a freely available, online satellite imagery service in order to bridge the conceptual gulf between them. Using the textual information contained within the contract as a guide, she describes what she sees on her screen before her in the fields that it identifies - such as sheep grazing, or particular types of crops - which allows them to quickly align their understanding of the place, and its relevance to their current conversation.
- A troublesome administrative system generates so many errors and warnings that they are habitually overridden by a group of field advisers, leaving the administrators to clean up the problems that they have left behind. However, in this case an adviser has led themselves down a blind alley by seemingly correctly un-checking some boxes that did not match their knowledge of the place to which they relate, and which has caused the system to 'lock-down' the case on which they are working. To resolve their troubles they turn to an administrator for help, who - whilst they lack any knowledge of the place itself - possesses a deep understanding of the system and its quirks, and who knows that the boxes must always be marked as checked, no matter the status of the land to which they relate. The adviser must therefore discard their knowledge of this particular place if they are to proceed with their efforts.

Therefore:

- Provide the capability to capture images of the places we have first hand experience of, and a mechanism for sharing those images with those whom we must negotiate an understanding of those places with;
- Facilitate the telling of specific places by those most familiar with them, whether it be within the context of a shared knowledge of the lay-of-the-land, or juxtaposing just-this-place with others from our shared biographies;
- Providing access to freely available satellite imagery enables distant interlocutors to literally see the nature of places all over the globe from the comfort of their own desktop;
- Support the representation of our knowledge of place where it might conflict with the systems & services that we use to complete our work;



Our understanding of the places within which work occurs informs our KNOWLEDGE OF THE LOCATION (3) of a range institutions, actors, activities and artefacts...

3. *Knowledge of location*



... our KNOWLEDGE OF THE LAY-OF-THE-LAND (1) informs our understanding of the current location of a range of institutions, actors, activities and artefacts at different geographic scales, whilst our KNOWLEDGE OF PLACE (2) informs our understanding of their likely location in relation to their current status, or that of their work.



Maintaining an awareness of the current location of institutions, actors, activities or artefacts is an important part of working in collaboration with others.

Be they in the next office or on another continent, knowing the current location of an array of institutions, actors, activities and artefacts is an essential part of going on with our own work. In particular, knowing the current location and status of those with whom we must work to deliver our outputs enables us to stay in touch with them through the most appropriate channels, or simply defer communication until their availability returns. Referring to people's calendars, their online status in chat applications, asking colleagues, or simply standing to peer across an open-plan office; a setting's members do their best to maintain an ongoing awareness of the current whereabouts of those with and for whom they work in order that they can competently display that knowledge should it become relevant in the current circumstances:

- As others have noted (Martin & Sommerville 2004), individuals located at physical

gateways - such as receptionists - come to play a central role in establishing an understanding of the current location and status of those who pass by their station. However, this role also extends to those located at less tangible gateways, such as points through which information much pass as it flows around organisations, e.g. project administrators. Be it a responsibility for checking a physical or digital inbox, the maintenance of work trackers, or simply the management of a diary, such individuals come to gain a deep sense of the temporal and spatial flow of activities, and therefore the likely current location and status of a range of actors and artefacts.

- The availability of staff changes across many temporal scales - from being away from their desk, to having left the organisation altogether - influencing our own ability to call upon them for help with our current efforts. Whilst primarily implemented to provide a direct messaging service for staff, desktop chat clients serve an ancillary purpose of indicating the current availability of distant others, particularly when combined with our wider knowledge of their movements. As such services become embedded within a growing array of applications - such as Microsoft's Communicator product - and which shows current status of individuals across a range of views, they become an everyday part of establishing the current location of colleagues - in many ways equivalent to standing up and peering across an open-plan office - some of whom may be many hundreds of miles from our current location. Further, because these views are available to anyone with access to such systems, so their current status becomes a topic of conversation as a group of staff with access to the same information representation on their own desktops negotiate their selection of an appropriate other upon whom they might call for assistance.
- A pair of administrators are working to understand the current status of a technical document, but recent organisational restructuring means that its current physical and organisational location, or that of its creator, are unknown. Working from their own desks - but concurrently accessing the same resources - they scan tracking spreadsheets, an Electronic Document Management System, as well as lists on pieces of paper as they attempt to develop their understanding of the possible location of the assistance that they require.
- A whiteboard on the wall of a office was set-up to track the whereabouts of field staff, but with dates of the last entries now long since passed it has clearly stopped being used, despite being situated within a busy room, with staff constantly coming and going.

Therefore:

- Facilitate access to those located at physical or virtual gateways so that we can benefit from their deep understandings of the whereabouts and status of a range of actors, activities and artefacts;
- A simple icon showing the online status of colleagues can be locally co-opted to support our knowledge of the current location of distant others;
- Support our ability to call upon a range of seemingly disparate sources of information to cross-reference the likely location and availability of those with whom we work;
- Ensure that systems for sharing our whereabouts fit into the flow of our work if they are to be used for their intended purpose;



Our awareness of the current location of an array of institutions, actors, activities and artefacts informs our KNOWLEDGE OF CUSTOMERS & CLIENTS (7) on whose behalf we work, our KNOWLEDGE OF THE TEAM (8) with whom we work, and our KNOWLEDGE OF THE WORKSCAPES (13) within which we work...

Our Knowledges of Institutions

Our knowledges of the institutional landscapes within which our work is situated - including those who dictate our work, whose rules and regulations guide our current efforts, or whose systems and services we call upon to assist us with our work - allows us to contextualise actors, activities and artefacts within the wider institutional structures that are part of our everyday lives:

4. Knowledge of the institutional landscape



...our KNOWLEDGE OF THE LAY-OF-THE-LAND (1) informs our understanding of the spatial location of the institutions who influence our work.



The institutions with and for whom we work exist within a wider political and legal landscape which can impact on their - and consequently our - work, both now and in the future.

The policies of other institutions - from small service providers through to whole Governments - can have a significant impact on the work that we do, both now and in the future. Maintaining an ongoing awareness of the machinations of these other entities enables us to understand how the demands on our time may change, even though we may be

powerless to influence their outcome. Such machinations may also be occurring at some distance from our current circumstances - geographically, temporally and organisationally - and interpreting the meaning of them can come to be a specialism in its own right. Through debate with colleagues, instigated by flows of information from a range of disparate sources, a setting's members frequently negotiate an appreciation of the wider institution landscape within the context of which their current efforts are located:

- An architect from another practice visits a group his professional colleagues to discuss a project that they are collaborating on, and which is located in his home country, very far from this practice's London office: spatially, politically, and economically. However, a conversation that began as a discussion between a small group about the project on which they are working quickly expands into a discussion about the economic climate at a global scale, and which draws in a number of other architects not directly involved in the current project, as the different perspective introduced by the visiting architect allows them to update one-another on the factors that are influencing the future of their profession.
- To keep work flowing into their practice, a group of senior architects hold regular meetings to discuss the shifting institutional landscape at national and international scales, and the likely sources of potential jobs that this might generate. Once possible sources of work are identified, they share what they know about the project's various stakeholders, and discuss which one of them might know an 'in': someone who can introduce them to the relevant parties, and through which they might make their services known to them.
- An article from a newspaper pinned to a wall in their office's kitchen area prompts a discussion between a group of administrative staff regarding the status of their Governmental organisation within the wider political landscape: National elections are on the horizon and they are concerned that their own institution might not survive the subsequent and inevitable re-organisations. Whilst the information content of the article is limited, the discussion about its subject matter spreads throughout the wider group as they negotiate their understanding of its implications for their work in the years to come. Whilst seemingly inconsequential to their current efforts - and not something that managers would consider to be relevant to their roles - these same staff are regularly engaged by stakeholders about the long-term viability of the the services that they offer, and must show themselves to be competent in the face of such questions, even if they don't have all the answers.

Therefore:

- Inter organisational projects are also an opportunity for us to chit-chat about the differing perspectives that those working in other circumstances might have on the factors that influence our own work;
- Maintain our awareness of partner organisations by facilitating access to information about their current status, identifying our individual relationships with their members, and tracking our ongoing communications with them;
- Announcing news items about partner organisation, and the discussions that these generate, enables us to stay up-to-date on changes that may effect our work in the future;



Our understanding of the wider institutional landscape informs our KNOWLEDGE OF THE RULES & REGULATIONS (5) that guide our work. However, we may have to call upon our KNOWLEDGE OF THE EXPERTS (9) in order that they can inform our understanding of its implications for the work that we do...

5. Knowledge of the rules & regulations



...our KNOWLEDGE OF THE INSTITUTIONAL LANDSCAPE (4) informs our understanding of the interconnected web of rules & regulations within which our work is conducted.



Modern organisations are often large, complex entities, and our work for them can be governed by a vast array of rules and regulations, including those defined by other institutions.

Understanding the rules & regulations that guide our work is an important part of delivering an effective service and presenting ourselves as a competent member of the social collectives within which work is conducted, whilst providing the boundaries beyond which certain activities must not stray. However, there can often exist a tension between the formal rules, as represented in ‘The Guidance’, and the locally manifest knowledges of how the rules are actually to be understood and applied in just-these-circumstances. Further, the work of others on whom we rely - whether from our own organisation or farther afield - may be bound by their own sets of rules & regulations, of which we may have little direct knowledge. Turning to an array of locally manifest resources staff constantly negotiate just-the-required-understanding to go on with their current course of action, including locally produced guidance, personal collections, and most predominantly the advice of the

colleagues with whom they share their troubles on a daily basis:

- In an effort to understand the rules relating to the construction of some new hospital accommodation close to a site of high environmental value, a field adviser phones round the various stakeholders invested in the application in order to assess what their opinion might be, whilst also keeping them ‘in the loop’. During the ensuing conversations ‘The Rules’ or ‘The Regulations’ are frequently referred to, but never spelled out explicitly. Instead there is a constant negotiation amongst those in the office and on the phone regarding just-which-rules are applicable in just-these-circumstances. The outcome of his discussions rest on an interpretation of the ‘degree of occupancy’, something that only those making the application can clarify, and so, based on his new understanding, the request is returned to them.
- A group of administrators have become the reference point for their field adviser colleagues as they struggle to maintain their understanding of a complex set of rules & regulations regarding the delivery of ‘the scheme’. Rather than look up the guidance for themselves they frequently come to see the administrators, or call them over the phone, to negotiate the applicability and application of the rules in just-these-circumstances. However, the administrators complain that they don’t listen, and so must come back and disturb them again in the future to resolve similar issues as they arise.
- The ever-changing set of rules that define a long-running scheme mean that those who administer it must keep its paper handbooks within easy reach. As a result of the number of schemes they each administer, and the frequency with which their rules change, their office comes to be littered with boxes packed with the supporting documents that they find most useful. Managed individually or as a group, these boxes become highly valued artefacts, and colleagues can be publicly rebuked for not returning a document to its rightful location.
- An adviser takes a call from a stakeholder regarding a change they would like to make to a legal document. The adviser knows that the document is not enforceable by them, and so informs the caller that they would not take issue with the proposed change. However, the office ‘guru’ overhears the call, and as he hangs up the phone informs him that, whilst not enforceable by them, other partner organisations are legally obliged to enforce the agreement, and that he should have advised them accordingly.
- Not all rules are formally expressed, but may only be available as a series of maxims,

metaphor, exemplars, and indexical gesture and talk that are only made manifest during the mundane flow of the very work that they help to define, and which serve as a guide to acceptable conduct for novice and experienced workers alike. A group of architects' perpetually developing knowledge of their practice's underlying design philosophy serves to maintain consistency in the designs of The Organisation's corpus of works - across decades of work and hundreds of individuals, and is something which those currently working on the practice's behalf are held accountable to as they toil to make their own contributions to it. However, these are by no means 'strict rules' for being a 'good architect' or producing 'good architecture' in general, but rather they serve as specific pointers and clues to the bounds of acceptable behaviour within this particular practice in-just-these-circumstances, or as accounts of the adequacy of its work from the past. By juxtaposing their current efforts against those from the practice's past, in design review meetings or huddled around a screen, design's from its existing corpus of works are held up as warning or inspiration so that those working to make their own contribution can do so without being 'told off' by their colleagues.

Therefore:

- Moderate the flow of requests to those who, whilst they may possess valuable knowledge of the rules & the regulations, also have other work to complete, such as giving them a voice in the design of the formal systems and services designed to support staff;
- Facilitate the creation of locally manifest solutions to keeping the rules & regulations close at hand in a form that can be easily accessed and shared more widely;
- Enable the negotiation of an understanding of the rules & regulations between a disparate set of stakeholders, including those from other institutions;
- Support the repair of misunderstandings of the rules & regulations so that we can learn from more experienced others;
- Providing exemplars of work from the past can help share an understanding of the factors that guide our work that are not explicated in the formal rules & regulations;



Our understanding of the rules & regulations that guide our work informs our KNOWLEDGE OF THE PROCESSES AND PROCEDURES (12) through which it must be delivered on The Organisation's behalf...

6. Knowledge of the systems & services



... our KNOWLEDGE OF THE INSTITUTIONAL LANDSCAPE (4) informs our understanding of the systems and services available to us as a resource, and our KNOWLEDGE OF THE CUSTOMERS & CLIENTS (7) informs our understanding of those which we ourselves must provide.



Modern organisations provide and consume a complex array of systems and services which both support and are a product of the work of their constituent members.

Most organisations are now supported by an array of Information Technologies that help to manage their flows of information - some of which can be highly complex - and new systems & services are constantly being added, or old ones removed, from The Organisation's suite of tools. Maintaining an awareness of the systems & services available to us informs our understanding of what contributions we can expect them to make to our own work, in terms of their ability to deliver the quantity, quality or timeliness of our requirements. However, organisations now outsource many of the activities not considered to be their core work to third parties, and so we can become just one part of an extended ecosystem of individuals and organisations who must work together to deliver the work in-hand. Using these systems effectively and appropriately is a skill-set that all staff must

develop if they are to operate as competent members of The Organisation, something that they most often learn informally from those with whom they work. Calling to one's colleagues across the office, over the phone, or via instant messenger and email, errors in both the system and our conception of it can be repaired by those who have experienced similar troubles in the past:

- A pair of field advisers are having difficulties entering a record in a newly developed and deployed casework tracking system, which is demanding that they enter an as-yet-unknown date into the record before it can be saved. Coming to the aid of their troubled colleagues, the whole office engages in a problem solving exercise to discover just how they might subvert the new system in order that they can go on with their actual work. The solution selected is one that they have used before in other systems: to enter a 'dummy' date and hope that they will be able - and remember - to update it at some as-yet-unknown point in the future.
- A pair of administrators are presented with an error message by a cantankerous system that is refusing to allow them to go on with their efforts. They search an online database of errors and warnings to see if they can discover an appropriate resolution, but the problem description for this particular error does not match their conception of what has led to their current troubles. The office 'guru' overhears the discussion and suggests a workaround to the problem, but it is one that will add significantly to the amount of time that it takes for them to get to the next stage in the process.
- A large administrative system is under constant development as the processes and procedures that it supports evolve. A senior administrator - and the office 'guru' - attends a daily conference call with her peers spread throughout the country so that changes and fixes can be cascaded to them. Once the call is over she begins her rounds of the office, sharing what she has just learnt with her staff, 'walking' them through any new or amended 'screens' on the system, guided by the paper notes that she made during the call.
- The local office 'guru' takes a phone call from an adviser from another office as they struggle to make sense of some screens on an administrative system, due to a quirk with this particular customer. To help her conceive of the correct solution, and explain it to the adviser, she opens another record on the system - for two different users cannot be logged on to the same record at the same time. She then 'walks' the adviser through the task that they must complete as she narrates the solution based on what she sees before her.

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- In those circumstances where systems & services are outsourced to third parties, seemingly simple problems can come to span organisational boundaries, making it difficult for staff to locate the appropriate owner of the problem, and therefore its resolution. Experiencing a problem with a printer driver - and its effect on the width of the lines on a printed version of a digital plan - a pair of architects break off from their work to discuss its likely cause, and the organisational location of a solution. However, they are unable to identify the locus of a resolution to either problem and so, as others overhear their troubles, the problem quickly spreads to the whole team as they collaboratively work to find a solution to this seemingly minor problem, based upon similar difficulties that they have faced in the past.

Therefore:

- Allowing us to safely leave markers in the system means that we can be reminded to return to unfinished work at a later date;
- Provide a simple mechanism for us to share issues that we may be having on a day-to-day basis, as well as potential improvements and workarounds that we have identified through actually using the system to deliver our work;
- Support the walking through of a system's screens so that disparate users can 'see' the same thing when we are diagnosing one-another's difficulties;
- Facilitate appropriate oversight of our work so that problems can be diagnosed by supportive others, but also hidden from view when their help is not required;
- Provide a single point of entry to the organisation's systems & services - in the form of a visual map - that makes a clear link between each service, a named owner and their contact details, the guidance that supports them, as well as their current status.



Our understanding of the systems and services informs our KNOWLEDGE OF THE PROCESSES & PROCEDURES (12) that they are used to undertake, as well as our KNOWLEDGE OF THE WORKSCAPES (13) within which that work occurs...

Our Knowledges of Actors

Our knowledges of the social collectives through which work is coordinated - including our understanding of the standards to which they aspire, to which we will be held accountable, their internal machinations, and their individual capacities and capabilities - allows us to situate our own efforts within context of those around us:

7. Knowledge of the customers and clients



... our KNOWLEDGE OF THE INSTITUTIONAL LANDSCAPE (4) informs our understanding of those on whose behalf we work, and our KNOWLEDGE OF THE LAY-OF-THE-LAND (1) informs our understanding of their spatial location.



Understanding the requirements, expectations, and capabilities of our customers & clients - including those within the organisations for whom we work - is an essential part of delivering effective services.

The work that we do on behalf of The Organisation is typically done to meet the needs of a range of customers & clients - either from elsewhere within the organisation, or further afield - and maintaining an appropriate understanding of their requirements is an essential part of providing a successful service to them. However, the work that we do may be far

removed from those whom we serve - spatially, temporally, organisationally and conceptually - and so we may have to do additional work to formulate the necessary understandings of their needs. Through the telling of stories of our engagement with particular individuals from our own biographies, our own experiences with similar services in the past, or by imagining how we might consume such services in the future, our understanding of the expectations that others might have of our outputs is constantly re-negotiated with our colleagues:

- A group of architects must manage the interests and expectations of a range of stakeholders, some of whom may not be in such a privileged position as they themselves are, in order to ensure that the project on which they are currently working meets the needs of all those invested in its success. Discovering what their clients want from their work, and translating this into a design that both they, and those who are paying for their services, will be happy with is one of the many skills required of a 'good architect', and which can only be learnt on-the-job. Through the telling of stories about past and present client expectations and demands - and juxtaposing these against their current efforts - the architects are able to envision the future uses of their designs, whilst reminding all concerned that clients - on occasion - change their mind.
- The abstract notion of 'the customers' that has become so prevalent in modern organisations - and which is often spoken with inflected quotes - belies the personal relationships that a group of administrators actually have with those on whose behalf they work. These are people whom they may have worked with for many years, and so have come to know personally, or at the very least are known to them as characters as they share anecdotes and 'war stories' with their colleagues of the dealings they have had with them in the past. The stories are most manifest after extended periods on the phone, conversations that are partially overheard by one's colleagues, and which quickly become a topic of talk as the full picture of the other's tails of woe are retold for all concerned: 'he's a proper old boy'; 'he's a real scoundrel'; 'he's a widower'; 'he's in his 80's'. This seemingly incidental information transforms 'the customer' from a faceless other - available to them through the technical properties of systems that they use to manage the work that they do on their behalf - into real people in whom they themselves come to have a personal investment.
- A trainee architect is struggling to find adequate technical guidance on the appropriate number of toilets that should be located within the limited space available for such

amenities as he works to make his own contribution to the design of a new building. Unperturbed, he drafts up his imagining of how such a space might work and, presenting his design to a senior architect, asks for an assessment of his work, and advice on how he might best go on. Clearly unsatisfied with his efforts, the senior architect asks his apprentice a series of questions that appear designed to motivate his colleague to think back on his own experiences of using such facilities in the past, and to consider how his sense of these spaces might inform the pending re-drafting of his work.

Therefore:

- Encourage the direct engagement of staff of all levels with The Organisation's customers & clients in order to promote their transformation into real people, rather than faceless administrative constructs;
- Support the sharing of stories about our engagement with customers & clients from the past, and their juxtaposition with our current efforts, so we might envision their current and future requirements;
- Facilitate the telling of the experiences of those consuming the services that we provide - and in particular our own or those of our colleagues - so that we might be reminded what it is like to be a user of those services, not just a provider;



Our understanding of the customers & clients invested in our work informs our KNOWLEDGE OF THE SYSTEMS & SERVICES (6) that we are required to provide...

8. Knowledge of 'the team'



... our KNOWLEDGE OF THE INSTITUTIONAL LANDSCAPE (4) informs our understanding of the disparate group of people with whom we directly work, and our KNOWLEDGE OF LOCATION (3) informs our understanding of their likely whereabouts and status.



Our contributions to the institutions for whom we work can be influenced by a wide range of disparate individuals upon whose time or skills we might have to call in order to solve our own troubles.

Organisations group individuals into teams in order that they can take on tasks which are too large or complex to be completed alone. However, colleagues come and go, the layout and location of whole teams can be re-configured for no apparent reason, individuals can have bad days, some have personal interests in particular aspects of the work of the team, whilst others have specific working patterns; all of which must be taken into account during the daily struggle to get the job done. Keeping track of friends and colleagues within this social milieu - through chit-chat with those around you, trips to the desks of others, or simply observing the eb-and-flow of the office - assists us in maintaining an understanding of the likely availability and whereabouts of support when it is needed most:

- The daily working lives of a group of administrators is punctuated by 'chit-chat' about their status, and that of their colleagues. Whilst seemingly 'not-work', this ongoing thread

of discussion forms an essential part of their sense of being part of ‘the team’. Whether it be a senior administrator telling her staff that their boss is in a bad mood today - because he has been off helping his daughter with some DIY, and has likely returned to a very full inbox - or the simple acknowledgement of the absence of a helpful colleague - and therefore the requirement to go elsewhere for assistance - casual talk with colleagues provides a valuable set of pointers and clues to the current status of those with whom we work.

- Offices spread across different floors or buildings can come to seem like an archipelago of distinct worlds whose activities are largely unknown to one-another. However, keeping track of the work undertaken by one’s immediate team, or that of others, is an essential part of maintaining an awareness of the current state-of-play of a wide range of activities. Regularly walking around her team, or the office as a whole, a senior administrator chats with her staff as she stays up-to-date with their current efforts, offering support where needed, and assistance where previously unknown troubles are discovered.
- An architect’s practice has a high turnover of its junior staff as they go back and forth between periods of institutional education and work experience. To prevent colleagues from losing a sense of belonging to a wider team, each ‘new starter’ is walked around the practice’s offices and introduced to everyone individually. Whilst time consuming, and vulnerable to the vagaries of people’s movements, it at least gives staff a chance to become familiar with those who they may only ever come to know in-passing during their inevitably short time with the organisation.
- In order to better understand the work of their field adviser colleagues, a group of office based administrators are regularly sent out into the field to shadow them as they meet the customers and visit the sites that are the final manifestation of their collective efforts. However, the selection of which advisers to go on a visit with is no accident, for the senior administrator knows what personal interests her staff have, and so tries to ensure that the field visits that they get sent on are matched accordingly. Further, over-and-above the technical understanding that they glean from such visits, an administrator notes that simply overhearing the advisers talk amongst themselves about the work that they are doing provides a significant boost to his own understanding of the part that they themselves play in the wider machinations of The Organisation.

Therefore:

- Support a sense of community amongst those of us who share the same offices by introducing newcomers and celebrating the highs and lows of office life;
- Providing a simple list of those who share the same office building - combined with their current status - reminds us that the help of others is close at hand;
- Give staff a reason to go to the desks of others, so that they might catch up on the latest news of other teams;
- Support the telling of the part that we each play within the teams that we work, so that others appreciate the work that we do, and the skills that we have;



Our understanding of those with whom we directly work informs our KNOWLEDGE OF THE EXPERTS (9), as well as our KNOWLEDGE OF THE CORPUS (11) of works that we collectively produce...

9. Knowledge of the experts



... our KNOWLEDGE OF THE TEAM (8) informs our understanding of the expertise of those with whom we work, and our KNOWLEDGE OF THE PROFESSION (10) informs our understanding of the competencies we might appropriately expect them to possess.



Understanding the capabilities and capacities of those with whom we directly work provides an important resource on which we can call in times of trouble.

One of the advantages of working within large organisations is that they facilitate the development and availability of particular specialisms. These include the technical experts specifically employed by The Organisation in order to address problems which require high degrees of understanding, but also the unofficial experts who have developed particular specialisms by way of previous careers, personal interests, or simply ‘being in’ for an extended period of time. However, in order to gain access to The Organisation’s experts staff must be aware of both their existence as well as their likely availability if they are to help with their current troubles. Searching official and unofficial corpuses of information, asking one’s immediate colleagues, accessing our wider social networks, or simply turning to those who have helped us in the past, we search out those most willing and able to assist us in going on with our current efforts:

- Whilst the organisation maintains lists of official experts to which staff can turn for

assistance, in large spatially distributed organisations their immediate availability can often be unknown, and their capacity to offer support when it is required limited. As a result a group of administrative staff have developed their own locally manifest solutions to this problem, such as spreadsheets of those whom they know to be willing and able to support them with their troubles in an accessible and timely manner. Made known through introductions to new staff - where the local experts they share their offices with are announced as such, paired with their particular specialism - or offered as a solution to announced or overheard troubles, staff in need of support are guided by their colleagues to those most likely to be able to offer them assistance, in just-these-circumstances and in just-the-required-ways, in order that they might go on with their work.

- Large complex projects - such as the design of a new building - require a wide range of expertise from an array of sources, both from within The Organisation, but also further afield. Whether it be an architect sitting at his office in London struggling to interpret a data-sheet for a paint product that he would like to use to cover a steel structure, and who calls a friend at home in Germany for advice on how best to proceed; or calling a previously used specialist contractor to advise on how a distant city centre development might be tailored to appeal to the local council's interest in educational access; drawing on the informal advice of third-party specialists is an essential part of deciding how best to go on.
- A group of administrators share an office with some of The Organisation's national experts, and so both groups have become a resource that is called upon on a regular basis by the other. Through their regular discussions, the administrators have developed a keen sense of what is expected of applications made to The Organisation by their 'customers', an understanding which extends beyond the mere administrative knowledge that they would be expected to have, and includes quite abstract notions - such as its 'value for money' - that they believe the expert will call upon when assessing the merits of just-this-application. Through conversation with peers they negotiate their understanding of the expectations of their specialist colleagues, applying their collective experiences of their discussions with them to the problem at hand: namely, should just-this-case be escalated, or is it enough for the Expert to be present by proxy.

Therefore:

- Maintain a register of the expertise of all staff - not just the Organisationally sanctioned Experts - so that we can turn to the most appropriate other in times of need;

- Support engagement with our extended social networks built up from our time in education, other organisations, or previous roles, so that their expertise can be applied on The Organisation's behalf;
- Promote our direct engagement with experts wherever practical so that we can learn from them, but also so that they can be reminded of the needs of those at the 'coal face';

Our Knowledges of Activities

Our knowledges of activities - including our understanding of the outputs of our immediate colleagues or those of the profession as-a-whole, as well as the appropriate conduct of the processes & procedures through which they are created - helps guide us in our search for the most appropriate solution to our current troubles:

10. Knowledge of the profession



...our KNOWLEDGE OF THE INSTITUTIONAL LANDSCAPE (4) informs our understanding of the wider professional groupings within which we operate.



Membership of a professional collective allows us to place our work within the context of a disparate group of others who have sought to solve similar problems in the past, providing warning, juxtaposition and pattern for possible solutions to our current troubles.

Whilst the work that we do is most immediately accountable to those with and for whom we directly work, we are often also a member of a wider collective of disparate individuals undertaking similar work in other circumstances, sometimes formalised as professional associations. Maintaining an understanding of the expectations of these wider communities-

of-practice is an essential part of being able to adhere to their norms, and therefore present oneself as a competent member of their ranks. Through talk and gesture, we both literally and metaphorically point at exemplars from the profession's corpus of works, making them relevant in-just-these-circumstances and in-just-the-required-ways. By juxtaposing them with the work in-hand we are able to establish a wider context, one that goes far beyond the immediate circumstances:

- In the absence of the-building-as-it-will-become a group of architects must make use of the resources at hand in order to gain an appreciation of the scale and proportions of the buildings that they are working to design. Whilst plastic and wooden models can assist in this process they are inevitably limited in their ability to provide a proper sense of the human scale of either the various representations of a design, or the architects' imaginings of the-buildings-they-will-become. Through conversational references to distant spaces that they themselves have experienced first-hand, they place their current efforts into the wider context of designs formulated by other members of their profession in the past, and so begin to get a sense of how the designs that they are currently working on might 'feel' when they are finally made manifest.
- A senior architect's interest in how the spaces designed by other architects 'feel' is deep enough for him to take measurements of their dimensions whilst on a private visit to another country, in order that he might someday use this information as a pattern for formulating his own designs; designs that might themselves engender the same high regard from his professional colleagues in the future. During moments when he and his colleagues are attempting to design such spaces for themselves, these personal recollections are made available through talk, juxtaposing them with their current efforts, enabling them to imagine some of the experiences that will be engendered by the buildings they are currently envisioning.
- A physical model of the current state of his colleague's work provides an impromptu medium for an architect's telling of the work of others, and how they might transform what they see before them based upon the successes of their professional colleagues in the past. Using a series of demonstrative lists to establish a common-sense understanding that large buildings are never experienced in the whole - as they themselves are experiencing the model now - but rather as a series of 'ends and beginnings', the architects metaphorically draw an array of distant exemplars from their own profession which they themselves are experiencing first hand into the current circumstances. Further, the

production of each item in this list of examples is shared by three different members of the group, indicating that the point being made is one that is both commonly understood and accepted.

- A group of architects litter their desks with books and magazines containing the outputs of their professional colleagues, and which steadily become filled with Post-it notes marking the exemplars that they turn to when seeking inspiration for their own designs. Discussing the latest issue of an architectural magazine - the cover of which shows a recently completed building by a globally renowned British colleague - a pair of senior architects conclude that the architect in question has ‘lost the plot’: that whilst they had considered him as someone who pushed the boundaries - as they themselves seek to do - his designs had now become too extreme for their tastes. However, like the building’s ordinary users, they speak about it as though the design was his alone, but surely it was the product of the distributed negotiations that they themselves take part in every day of their working lives.

Therefore:

- Making the work of our professional colleagues available in a readily accessible form allows us to maintain an awareness of the innovations being formulated by distant others;
- Support access to exemplars from the output of the profession as-a-whole in such a way that they can be juxtaposed with our current efforts;
- Providing support for the telling of our past experiences of the work of our professional colleagues allows us to present it as example, juxtaposition and warning for our current efforts;
- Knowing who has had direct experience of the work of our professional colleagues is a valuable resource that could be put to work on The Organisation’s behalf;



Our understanding of the professional groupings of which we are a member informs our KNOWLEDGE OF THE EXPERTS (9) with whom we work, as well as our KNOWLEDGE OF THE CORPUS (11) of works and its contribution to the outputs of the profession as-a-whole...

11. Knowledge of the corpus



... our KNOWLEDGE OF THE TEAM (8) within which we work informs our understanding of their corpus of outputs, both now and in the past.



Our understanding of the past and present outputs of our colleagues offers us valuable guidance on how we might go on with our current efforts.

The products of our current work rarely stand alone, but rather will join the outputs of others from within the same organisation who have had to solve similar problems in the past, and whose experiences might serve as a valuable source of clues as to how we might go on with our own efforts, preventing us from having to reinvent the wheel with each-next-problem - saving the organisation valuable resources - whilst also ensuring consistency in its outputs over time. However, maintaining an awareness of the work completed by others is no easy matter: documents are filed away in archives, or simply disappear into piles on the desks of colleagues; those involved in past projects move on to other organisations; or the sheer volume of work done in the past obscures just-those-outputs which might be of use in the solving our current troubles. Through conversation and demonstration the past outputs of others are drawn into the current circumstances so that they might inform our own efforts:

- Whilst each-next-building is designed from scratch, and to the requirements of their clients and other stakeholders, the work of a group of architects ultimately occurs within

the context of the practice's corpus of ongoing and completed works, and which stand in for the capacities and capabilities of The Organisation as-a-whole. In a discussion about how best to go on with their current efforts, a senior architect lists three of the practice's most well known buildings, together with the secondary factor that was involved in making the designs what they became: worthy additions to the practice's corpus. Through this list of completed designs, and their most important attributes, the building-as-it-currently-stands is placed into the context of those which have gone before, in order that they too might - through advancement, pattern or juxtaposition - use them to make their own contribution to the practice's burgeoning corpus.

- A group of administrators are supported by a large corpus of technical guidance provided by The Organisation to support them in their work. However, they often find it lacking in terms of completeness, availability, and relevance, and so a number of locally manifest solutions to managing their own corpuses of guidance have arisen. These include storing shared insights within personal email folders, ring-binders filled with selected and annotated guidance collected from a disparate range of sources, or post-it notes stuck to the walls, desks and monitors containing notes of key facts that they frequently need to recall as they go about their work.
- When looking for information in a large corpus of guidance, an administrator's first-port-of-call is not to search the system, but rather to call out a question to those she knows and trusts as competent colleagues, asking whether they know of any 'good' guidance, and where it is located.
- An erroneous barcode causes a form to be titled incorrectly as it is scanned in to a document management system - giving it the same title as another common form - and ultimately to be officially discontinued. However, the form is locally known to a group of administrators to contain valuable information in a particularly accessible form, and so they are guided by their colleagues to actively seek the form out in certain circumstances, even though its erroneous title makes it difficult to locate amongst the hundreds of other documents present on the system.
- An administrator is adding some documents to a shared corpus of technical information on behalf of a colleague who authored them. However, he struggles to find their proper location in terms of the appropriate categories that will be used to classify them, as so turns to his colleague for advice. His colleague offers him some general advice on why documents belong in certain categories, and then quickly places two of the documents in

their rightful location. However, the third document's appropriate placement is less clear, and so the two set about negotiating its likely location within the wider corpus of documents within which it must sit, a debate that results in the creation of a new category that will join those that already define the corpus' structure.

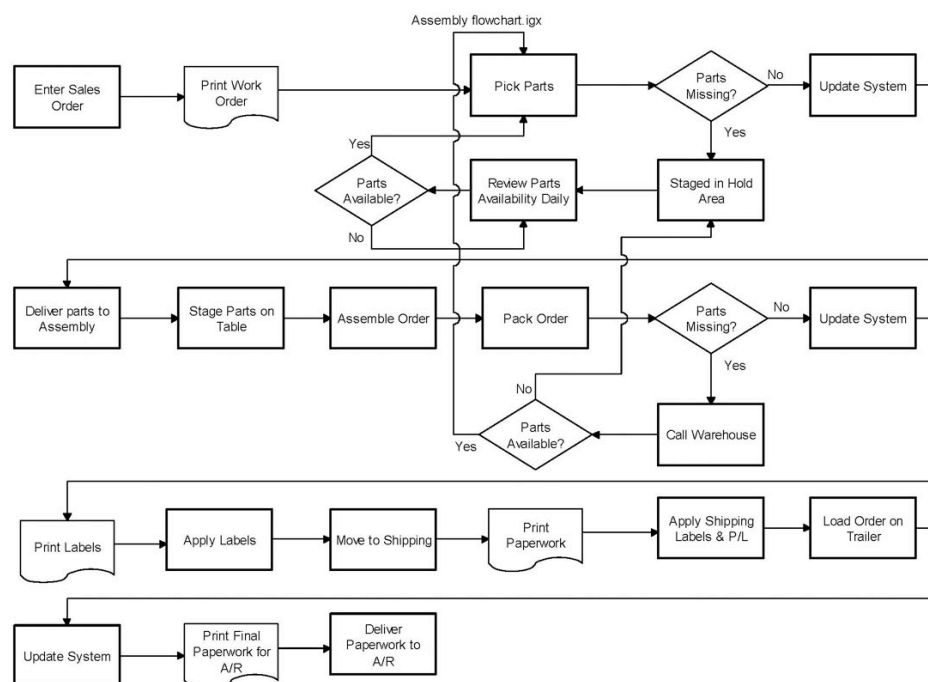
Therefore:

- Enable easy access to The Organisation's corpus of works so those of us beginning each-next-task can look back on how similar problems have been solved in the past;
- Providing direct access to those who were involved in the creation of each member of the corpus of works enables us to establish a shared understanding of the work that went into its production;
- Facilitate the making of our own collections from the corpus' ranks so that we can select items that are most relevant to the work that we do;
- Provide a mechanism for tracking updates to the corpus, so that we can monitor it for new additions that may be of value to our work;
- Enable 'zooming' of the corpus so that we might find the proper location of our own additions to its ranks;
- By their nature corpuses of works are under constant revision, and so those contributing to them must be able to adapt them to accept their work;



Our understanding of the corpus of outputs of ourselves and others informs our KNOWLEDGE OF 'THE PLAN' (14) and KNOWLEDGE OF THE ARTEFACT (15) on which our current efforts are focused...

12. Knowledge of processes & procedures



... our KNOWLEDGE OF THE RULES & REGULATIONS (5) of the institutions for and with whom we work informs our understanding of the processes & procedures we are expected to complete on their behalf.



Bureaucratic processes and procedures are a major feature of most organisations, and being able to negotiate an understanding of how to complete them correctly is an important part of presenting oneself as a competent member of its staff.

Much of the efficiency of modern institutions is achieved via the processes & procedures through which they expect their constituent members to deliver their work. However, not only must we understand the workings of those processes & procedures for ourselves, we must also be able to identify when others are failing to complete them correctly and teach them the error of their ways. Turning to those closest to us for help, we are taught how to adequately apply both the official and unofficial (e.g. workarounds) processes & procedures that guide our daily working lives:

- A senior adviser admits to overriding the system warnings that are the likely cause of a

junior administrator's current troubles, and so the two of them sit while the administrator explains the error of her colleague's ways. However, this is not a simple telling off, but a deep technical explanation of the nature of the procedures she should have followed, why the warning was in place, and the repercussions of her overriding it. This is a common task for the administrators, one that they know they will have to do again in the future, and which causes them much consternation - and more than a little amusement - as they note their colleagues seeming inability to follow what they see as simple procedures.

- A field adviser is unsure how best to proceed with the processing of a customer's application, and so requests clarification from the office's 'guru' on how best to go on. After discussing the nature of the application with his colleague, the expert provides her with a brief overview of the issues she should be conscious of, and even suggests a preliminary conclusion. However, the discussion prompts him to offer up a 'war-story' from when he first joined The Organisation - told to all of those present in the room - and which centred on his discovery of a whole new street of housing that had been wrongly built in a conservation area, and which had occurred because of a failure to follow the proper procedures of the time.
- A group of administrators struggle with the ever-changing nature of the complex processes & procedures that are at the centre of their daily work. To aid them in their efforts they have taken to locally creating their own process diagrams in a word processing application, and then sharing laminated copies of them amongst their immediate colleagues so that they can be stored close at hand on their desks.
- A group of architects hunt for a report that they need to inform their discussion about the design on which they are currently focused, but cannot find it. The project's administrator has filed the document within the projects files, but an unofficial - and therefore undocumented - procedure is in place that dictates that she should have circulated it amongst the architects first. The senior architect calls her over and reminds her of the 'proper' procedure for the future, even though she is just temporarily filling in for an absent colleague.

Therefore:

- Support access to those most familiar with undertaking particular processes & procedures so that they might teach us their appropriate application;
- Enable those responsible for ensuring the proper execution of processes & procedures to

maintain oversight of their conduct so that they can rescue those that go astray before they do too much damage;

- Support the creation of local solutions to understanding complex processes & procedures in a way that ensures that they can be shared more widely;
- Sharing the detailed consequences of not following the correct processes & procedures can encourage their adherence if we understand the negative effects that we are having on our colleagues;

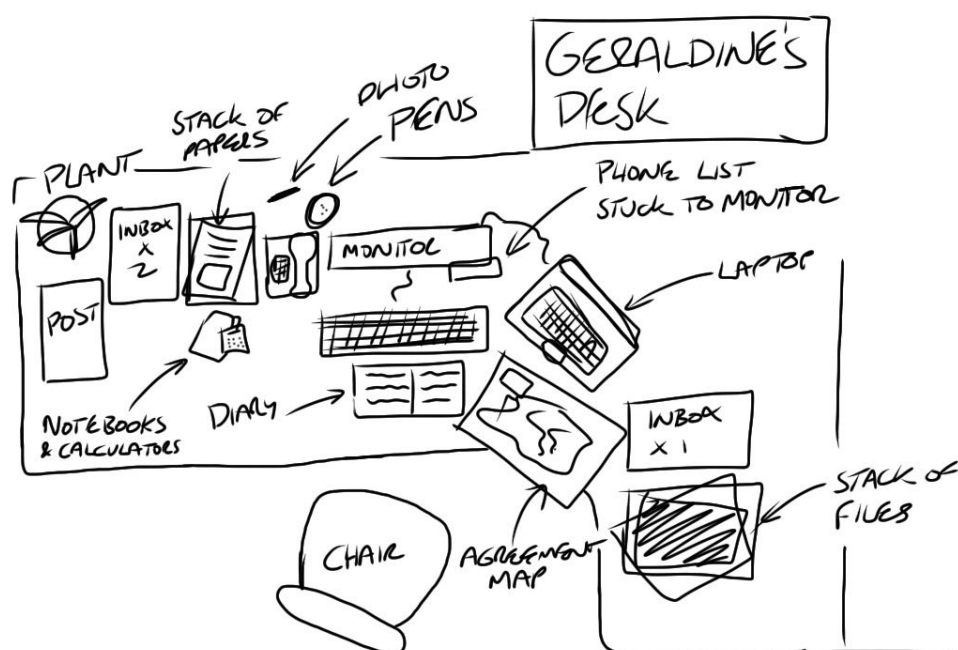


Our understanding of the adequate application of the processes and procedures informs our KNOWLEDGE OF THE SYSTEMS & SERVICES (6) that are used to complete them...

Our Knowledges of Artefacts

Our knowledges of artefacts - including our understanding of their affordances, their current status, or their nature as just-this-artefact - supports our efforts in making them relevant in the current circumstances:

13. Knowledge of the workspace



... our KNOWLEDGE OF THE SYSTEMS & SERVICES (6) informs our understanding of the workspaces that are provided by The Organisation in order that we might work more effectively with our colleagues.



One of the primary efficiencies brought about by our membership of The Organisation is the availability of a range of different resources that could not be achieved when working alone.

Organisations provide their constituent members with an array of resources to support them in their work, including the expertise of specialist colleagues, expensive systems & service, the ability to import resources from partner organisations, as well as the immediate ‘workspaces’ within which our work is conducted (Whalen *et al* 2004). Applying these resources to the resolution of each-next-problem is part of our everyday working lives, and

maintaining an awareness of what resources are available, their current status, and in which context they can be applied, is an important part of being an effective member of the group. Piles of papers remind us what work is yet to be completed, and in what order it is to be done (Schmidt & Wagner 2004); the simple layout of the workspace informs us of the structure of processes and procedures and the order in which they should be completed (Whalen *et al* 2004); and posters-on-the-wall inform us of the location or status of works, or remind us of work undertaken in the past:

- A group of architects are working to understand the future requirements of their clients, and in particular how they might go about cleaning the inside of a large glass atrium in the building-as-it-will-become. Searching the Internet for different types of ‘cherry-pickers’ - mechanical cradles that will lift the cleaners to the high glass ceiling - they animate the design-as-it-currently-stands in order to motivate their own understanding of just how this work might be completed in the future. To assist them in their efforts they turn to the glass wall of the building within which they are currently working - which itself is several meters high, and which they note is very much in need of a clean - and collectively imagine how they might go about cleaning what they see before them based on the findings from their research.
- Representatives from firms that supply building materials regularly visit individual architects or the practice’s librarian in order to promote their wares, depositing samples in the hope that the architects will use their products in a current or future design. As a result, boxes of building materials of all shapes and sizes from past and current projects have come to litter the practice’s offices, and are regularly rooted through in order that their samples can be touched and felt, and colours compared. Further, because they are close at hand, and the individual architects have enjoyed using them in the past, specific materials can bleed from one project to the next, such as their liking of a particular blue covering material that worked well in similar circumstances in a previous project.
- A group of architects have learnt from experience that materials can look completely different in the searing sun of the Middle East than they do in the cooling shade of their office, or the catalogues of materials provided by suppliers. As they negotiate just-which-material they are going to use to cover the design on which they are currently working, they carry the numerous heavy slabs of marble they have been sent as samples to the street outside their office and line them up in the sun. They then spend time debating their different merits as they examine each of them from a range of different angles, attempting

to envision how they might appear when in their final location high up on the building-as-it-will-become.

- In order to reduce its operating costs an Organisation issues a mandate that limits each staff member to one square meter of floor or shelf space for the storage of the materials that support their work. However, the large boxes of paper handbooks that administrative staff collect and rely upon to deliver on The Organisation's objectives do not figure in this equation, and cause much troubled discussion as staff worry about how they will work effectively under this new regime.

Therefore:

- Consider how the layout of the workscape directly assists us with the work that we do, such as our ability to juxtapose different elements of our work against one-another;
- In an increasingly digital world how do we support the affordances of physical materials, and the role that our ability to feel and see them plays in our decision making processes;
- Record a short interview with those visiting the organisation selling their wares so that we can gain a deeper understanding of their value long after their visit has occurred;
- Ensure that we are in a position to influence the nature of our own workspaces so that they can be tailored to our actual needs, not those conceived by managers;



Our understanding of the workspaces within which we spend our days immersed informs our ongoing KNOWLEDGE OF 'THE PLAN' (14)...

14. Knowledge of 'the plan'



... our KNOWLEDGE OF 'THE TEAM' (8) informs our understanding of the current status of their work, and our KNOWLEDGE OF THE CORPUS (11) of works from the past informs our understanding of what is expected of our current efforts.



Whether we work alone or in groups, we can be held accountable for the current state-of-play of our efforts or those of our colleagues, and must therefore maintain an ongoing awareness of them.

Ensuring that our work is coordinated with those around us requires that we develop and maintain a common understanding of its current status, and what more needs to be done in order to complete any outstanding tasks. Being able to demonstrate an understanding of the-plan-as-it-currently-stands is therefore an important part of presenting oneself as a competent member of the social collectives within which work is conducted. Through our own involvement, the indirect observation of others, or conversation with colleagues, we maintain our awareness of the current status of our efforts and display this understanding to others:

- An architect is having difficulty conceptualising the positioning of a canopy that will be used to protect the area from the searing sun, and in particular its location on the two dimensional drawing of the design-as-it-currently-stands that is laid out on the desk before him. Through talk and pointing with their hands, his colleagues make an array of artefacts from the plan that currently surround them relevant in just-the-required-ways: two and

three dimensional paper renderings laid out on the desk before them; a three dimensional model of the design made of plastic and wood, perched on the edge of the desk; and large-format posters of the building-as-it-will-become pinned to the wall at the back of the office - all of which appear to be target at motivating just-the-required-understanding so that they might go on with their discussion.

- In response to the ongoing critique of his designs, a senior architect attempts to explicate the approach that he has taken to formulating these particular buildings: in effect a partial account of his interpretation of the practice's design philosophy. His understanding of this aspect of the plan goes beyond an account of its technical properties, and includes the more abstract notions that have informed his underlying approach to the creation of the design-as-it-currently-stands. Through talk, supported by the mobilisation of his own body and the artefacts at hand, he appears to try and get across more than he is able to say in just-so-many-words: the imaginary three dimensional building he places on the desk in front of them to remind them of the influence of the sun on different aspects of the design; the small, scale model of the building's substructure that he delicately draws into the conversation to support his claims of simplicity; or the large model of the master-plan laid out in front of them which he appeals to when reminding those present that these buildings are part of a greater whole.
- A blank wall behind a row of architects' desks becomes a useful location for pinning ad hoc information about the projects on which they are currently working, and in particular the latest renderings of the designs of which they are rightly proud. This display of their work quickly becomes a shared resource for their colleagues as they visit the team's desks, admiring what they see before them, and discussing the rationale behind how they came to just-this-design. In particular it becomes a resource for the senior architect who leads the team as he makes a flying visit to the office, using the display to gain a rapid overview of the current state of the project, physically zooming in and out of the collection as his focus is drawn to specific items by the gestures and talk of his staff.
- In an effort to go 'paper-free' an organisation scans all paper documents as they arrive in the post, making their digital versions available to staff through its Electronic Document Management System. However, such an effort discounts the many affordances that paper offers its users - such as their ability to annotate it, spread it out on the desk before them, to leave post-it notes to remind others of actions that they must perform, to track a line with a ruler, or simply to be able to read in comfort - and so a group of administrators go

to great lengths to get their hands on the paper copies before they are shredded, something that requires that they put in place their own locally manifest solutions for maintaining an understanding of their current whereabouts so that they can be called upon by those who need them for their work.

Therefore:

- Being able to spread the artefacts of the plan-as-it-currently-stands out before us provides a basis upon which to negotiate a shared understanding of its current status with our colleagues;
- Facilitate the telling of the plan's properties not readily available in the information that it contains, such as the personal interests that informed certain decisions, or our imaginings about the final uses of its products;
- Support the ability to zoom in and out of a plan's component parts so that we can gain the overview of its status that we require;
- In the rush to go paper-free, remember that paper has many affordances not currently adequately supported by digital devices, and which may provide real efficiencies for the work that we do on The Organisation's behalf;



Our understanding of the plan on which we are currently working informs our KNOWLEDGE OF THE ARTEFACTS (15) on and through which we work...

15. Knowledge of the artefact



... our KNOWLEDGE OF LOCATION (3) informs our understanding of the current whereabouts and status of the artefacts that are a resource for, and product of our own efforts.



We spend our working lives using both physical and virtual artefacts created in the past to support our current efforts, and creating those that will be used to do other work in the future.

We each utilise and create an array of artefacts - both physical and virtual - in and through our daily work, and whose nature and availability influences our ability to go on with our efforts. Developing and maintaining a common understanding with one's colleagues regarding an artefact's properties and its current status ensures that we appreciate the affordances that it has for the work that we do. Through talk, supported by pointing with our hands or the enactment of our bodies, we make just-the-required-properties of the artefact relevant in just-these-circumstances:

- At its finest scales the work of an architect involves the specification of a vast array of individual artefacts that must be skilfully imagined, carefully drawn, their technical properties specified in three dimensions, materials for their construction selected, and then they must be placed into their proper location within the plan as-a-whole. In the absence

of a physical artefact to serve as the focus of their discussions, a senior architect and his junior colleague turn to talk and gesture to animate the artefact they ‘see’ before them, it being difficult to tell whether their rotating hands are holding the artefact, or they become the actual artefact itself. Further, the nature of their conversation suggests that these representations do not stand in for the artefact in abstract, but rather the architects attempt to instantiate some of its specific technical properties, such as the actual placement of yet-to-be-manufactured components in a yet-to-be-created three dimensional space.

- Following a site visit, two senior architects sit in front of a desktop display and discuss a series of digital photographs of an artefact that they designed, and which has been manufactured by a third party contractor. Their discussion reflects their ongoing concern for the finest details of their design, even those aspects which may never be seen by the eventual users of the-building-as-it-will-become: *‘I mean its the sort of detail you may not see anyway’*. In particular we see how the aesthetic qualities that they wish this artefact to engender, as well as the reconfigurations that must take place in order to achieve them, need hardly be said out loud when in the company of other competent members of the practice; needing nothing more than an extended series of finger sketches over a digital image on a computer screen, or the curling action of a hand in order to establish a shared understanding of how they might go on.
- A group of field advisers and administrators, whilst working on the same information artefacts, delivered through the same processes & procedures, have very different starting points for their understandings of them. The advisers, who see the environmental outcomes of their work, begin their discussions from the physical effects that it will have on-the-ground; whilst the administrators approach it from lists of its administrative properties, and the processes & procedures associated with them. As a result, the technical languages they use are quite different, and so they must regularly do subtle additional work to repair one-another’s understand of just-what-it-is-that-the-other-is-actually-talking-about in just-these-circumstances.
- Work on a given project is often temporally, spatially and organisationally distributed amongst a wide range of actors who may only be distally known by those undertaking the current task, but who require access to the same physical or digital artefacts in order to complete their work. However, those distant others can possess valuable information not manifest in the artefact itself, and so a group of administrators maintain spreadsheets containing lists of others who have interacted with them on a project, paired with their

responsibilities, and which have come to serve as a map of the organisational location of both their colleagues and the current location of the paper files that they share responsibility for.

Therefore:

- Being able to enact an artefact across a range of physical and conceptual scales plays a valuable part in our understanding of its nature;
- Support the annotation of digital representations of physical artefacts so that we might share our understanding of them with our colleagues;
- Provide support for the subtle differences in the technical languages that different users of the same artefact might possess;
- Not all information is attached to the artefacts that we use, and so sometimes we simply need to talk to its other users to help us with our current efforts;



Our understanding of just-this-artefact informs our KNOWLEDGE OF 'THE PLAN' (14) as-a-whole as well as our KNOWLEDGE OF THE CORPUS (11) of outputs *in toto*...

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