Balancing at the boundaries of organisations: Knowledge co-configuration between experts in an e-Science project

Ioanna Kinti[1]
Research Fellow
ESRC Centre on Skills, Knowledge & Organisational Performance (SKOPE)
Department of Education
University of Oxford

Geoff Hayward[2]
Associate Director
ESRC Centre on Skills, Knowledge & Organisational Performance (SKOPE)
Department of Education
University of Oxford

Abstract

The research reported in this paper engages with ideas from activity theory to conceptualise more rigorously the processes of 'networked expertise'. Ethnographic methods were used to document the development of the practices of an inter-organisational research collaboration in the context of the e-Science Programme in the UK. Engaging with three types of negotiation practices - articulation work, collaborative strategising and practice alignment – enabled the actors to construct the practice platform necessary for knowledge co-configuration to occur. Identifying these three practices led to the theorisation of an emergent concept captured as 'balancing at the boundaries' between one's organisation and the new collaborative team, as an essential capacity that needs to be learned by actors to foster expert performance in this setting.

1. Introduction

The central question of this research is how to conceptualise more rigorously the processes of 'networked expertise' whereby scientists from different backgrounds are brought together to share their knowledge in order to produce innovative solutions to complex problems. To achieve this, we need to understand more about this type of collaborative activity as a form of work: the challenges and the processes involved for experts from different organisations to interact creatively together. Unpacking the complexity of experts' interactions requires us to move beyond current notions of knowledge sharing. New terminology is needed that will enable us to articulate what is involved when scientists, professionals or executives are requested to share their expertise at organisational boundaries, as a means to develop new knowledge together. This is an effort, therefore, to see through and beyond the taken-for granted perception of 'collaboration' within policy discourse in this area.

Within this wider policy discourse, an emergent paradigm for commentators on developing innovatory work systems is the importance of collaborations to share expertise (Ashton and Sung, 2002; Gibbons, 1999). Such collaborations are

[1] Dr Ioanna Kinti, 15 Norham Gardens Oxford OX2 6PY, ioanna.kinti@education.ox.ac.uk Tel: +44 01865 274259

[2] Dr Geoff Hayward, 15 Norham Gardens, Oxford OX2 6PY, geoff.hayward@education.ox.ac.uk Tel: + 44 01865 274007

increasingly perceived to be based on multi-disciplinary networks, across organisations, whose activities and goal attainment are heavily dependent on the contributions of different professions. Pettigrew *et al*. (2003) propose the term "innovative forms of organising" to illustrate the emergence of such collaborative forms of work organisation between private and public sectors, especially for the purpose of sharing expertise (Hakkarainen *et al*., 2004). In a similar vein, Barley and Kunda (2004, i) point out that firms are increasingly becoming "way stations in the flow of expertise" and argue that "what greases the skids of the new economy is networks of skilled experts" that transcend organisations and occupational communities. In this research, thus, our aim is to explore how such collaborative working between different experts is made possible in practice, especially when this transcends the boundaries of the firm. A broader conceptualisation of multi-professional working and inter-organisational collaboration is provided by Hardy *et al*., (2005, p.58) when recognising that:

> "Organisations in all sectors of society increasingly are becoming involved in a variety of collaborative arrangements such as alliances, partnerships, roundtables, networks, and consortia – in order to promote innovation, enter new markets, and deal with intractable social problems".

For example, Warmington *et al*. (2004) conceptualise the rationale of interagency working as forming partnerships to tackle social exclusion. Jirotka *et al*. (2005, p.369) articulate a similar vision for the development of the e-Science programme to promote innovation, which they characterise as involving research activity that transcends conventional disciplinary and organisational boundaries through "large scale, collaborative and multidisciplinary research…".

The avowed purpose of such working arrangements, which typically involve large teams of scientists and potential end users, is to share knowledge and expertise in order to produce new solutions to complex ill-defined problems (Starr, 1989). In order to develop our understanding, however, of the development of knowledge sharing practices in the context of collaborations, this study argues for the need to adopt a more developmental perspective on the evolution of such team practices under specific cultural and historical circumstances. Drawing on Victor and Boynton (1998), we hypothesise that knowledge sharing in such interdisciplinary teams involves an active and dialectical process of **knowledge co-configuration** during which expert actors shape and re-shape existing knowledge to produce the new knowledge needed to solve ill-defined, complex problems. The study hypothesises that an essential part of this process of knowledge co-configuration involves the negotiation and alignment of work practices between the different experts. For example, in their insightful ethnographic study of contingent employment in Silicon Valley, Barley and Kunda (2004) illuminate the challenge of creating teams where experts need to negotiate their previous understandings of work practices in order to work creatively together.

2. Conceptual clarification

In this study we are not, therefore, concerned with novice-expert interactions which are dealt with much more fully in the literature (Dreyfus and Dreyfus, 2005; Eraut, 1994). Moving beyond a conceptualisation of expertise as "amounts of knowledge acquired through experience", expertise is understood as the ability to exercise

qualified professional judgement. The term “experts” is not used, therefore, to denote superior and stable individual performance (Ericsson and Smith, p.3, 1991). Rather it is used to refer to individuals who “tackle problems that increase their expertise” (Bereiter and Scardamalia, 1993, p.78), as they interact with other actors to resolve novel situations for which they have “little or no directly applicable practice” (Engeström, 2004, p.146). The problem, here, is to examine the challenges and the processes involved in order for experts from different backgrounds to interact creatively together.

An example of how such networking works is captured in the notion of ‘high skills ecosystems’ (Finegold, 1999), such as in Silicon Valley, where the process of expanding organisational competence is typically described as involving collaborative working between trained scientists from universities, and technologists from businesses to deliver cutting edge solutions. This study highlights the need to understand more about the challenges and the affordances for sharing knowledge in such collaborations; the processes and mechanism through which knowledge and expertise is shared.

Currently, however, the mechanism through which such knowledge is shared is not well understood. Whilst there are many studies on knowledge work (Alvesson, 2004; Bechky, 2003) and the sharing of knowledge within the firm (Newell *et al*., 2003; Hansen, 1999; Tsoukas, 1996), little is known about processes of knowledge sharing and knowledge building at the boundaries of organisations, where teams of skilled experts from different institutional and organisational backgrounds collaborate for the purpose of innovation, i.e. to create new knowledge (Amin and Cohendet, 2004; Barley and Kunda, 2004).

Boundaries, in this context, are understood as “social objects fashioned out of spatial locations, personal identifications, patterns of interaction, and legally defined distributions of rights and obligations.” (Barley and Kunda, 2001, p.78). However, as Abbot (1995) contends, boundaries should be explored in action instead of determining them as pre-existing entities. Studied in this way, boundaries can display situated histories in action (Kerosuo, 2006). Here, where the source of innovation and expanded organisational competence is seen to reside less on the expertise of any individual actor and more in the interaction of multiple experts, the focus shifts on the negotiations that underpin the knowledge co-configuration process in boundary zones (Edwards, 2006), where the edges of different organisations’ capability domains meet (Kinti and Hayward, 2007).

One of the aims of this study is to understand the emergence and development of such negotiation processes. This is supported by recent work in diversification research, a stream within strategic management research, where Priem and Butler (2001), in particular, question the assumption that apparent relationships are really explored in practice. In that respect, Nayyar (1992) makes the distinction between *potential* and *actual relatedness*, pointing to the role of managerial action in actualising the economic value of these relationships; inter-organisational relationships have to be managed and renewed if their value is not to decay. As Tsai (2000) suggests, it takes the existence of active social networks realised by people working together, for real value to be extracted from strategic relationships. However, this points to how the activities involved in realising and renewing relationships are not to be observed from

a distance (Markides, 2002). Thus, even within the strategic management literature there are calls for studies that focus on the micro-level of interactions between experts. This then enables us to move away "from a concern with the management of experts to a concern with the management of expertise, from an emphasis on plans and strategy to an analysis of activity systems, and from a preoccupation with objective knowledge to the management of collective instability" (Blackler, 1993 p. 882). It is from this perspective that this study will make a contribution through a detailed developmental case study of an e-Science project.

3. The research setting: inter-organisational working in e-Science

The Department of Trade and Industry (DTI) defines e-Science as:

"Science increasingly performed through distributed global collaborations enabled by the Internet using very large data collections, terascale computing resources and high performance visualisations."[3]

To achieve these ends involves the use of a new type of computer technology, grid computing, developed and applied within the context of a range of e-Science pilot projects. The long-term objective of the e-Science Programme in the UK is to draw lessons from these pilot projects in order to build the electronic platform that will enable the desired large-scale scientific collaborations using the Internet. Through this emergent e-Science Grid, collaboration amongst scientists and other actors from across universities, research and development labs of manufacturing corporations, hospitals, research institutes, government agencies etc will result in a combination of their expertise to help tackle the big scientific questions hitherto unexplorable (David, 2004).

The potential implications of the restructuring of work practices inherent in the e-Science initiative is explored using the lens of Activity Theory (AT) and a case study of one pilot e-Science project: the e-Demon project. This was a two-year collaborative research project aiming to prove the benefits of grid computing in the domain of *eHealth*, in particular for Breast Imaging in the UK. The need for this project derived from the professional recognition that the stresses upon the national Breast Screening Programme and for Breast Imaging in general were increasing, putting an already stretched service under more pressure (Department of Health, Social Service and Public Safety, 2002)[4]. Specifically, the project was set up to design a large distributed database of mammograms which, using grid computing power, could be accessed from many different hospitals and research centres nationwide. By enabling clinicians to retrieve and examine mammograms on their computer screen through the grid instead of using the film, as in their current practice, the e-Demon prototype was intended as the first step towards developing a potential tool to assists radiologists in the UK in earlier and better diagnosis of breast cancer.

The focus of this paper is on the work of the core R&D team, the e-Demon Solution team, comprised by university researchers from a Computing Laboratory (Com Lab)

[3] http://e-science.ox.ac.uk accessed February 2005.
[4] Comprehensive Review of the Radiography Workforce, Department of Health, Social Service and Public Safety, April 2002, http://www.dhsspsni.gov.uk/publications/ahp-docs/radiography_workforce.pdf accessed August 2005

and private company IT systems developers from two manufacturers, M1 and M2. Other actors participated in an ad-hoc basis in this team, specifically clinical researchers specialising in medical computing and radiologists.

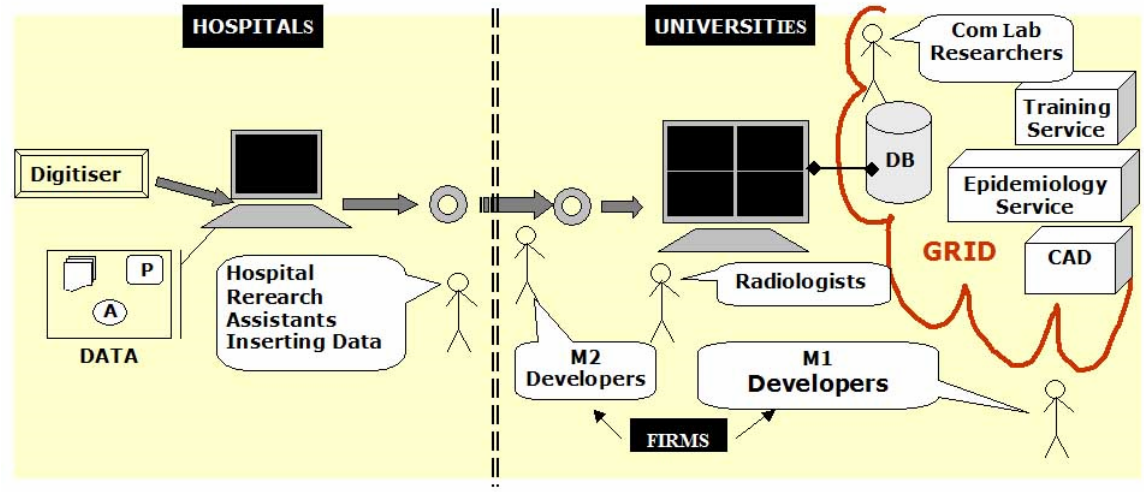

Figure 1: The nature of multidisciplinary work in the Solution Team

While bringing all these experts to work together, each one of the parties involved in the Solution Team was charged with delivering a different component of the final prototype as illustrated in Figure 1: "Com Lab" was responsible for designing the distributed database of the new system; M1, a large international hardware manufacturer, was responsible for designing the architecture and developing the grid infrastructure of the distributed database. The grid services, screening, training and epidemiology, were developed with the assistance of clinical researchers. The developers from M2 - a university spin-off company who had managed to evolve as an international champion in digital imaging technologies- had to work closely with the clinical side of the project comprising clinical research assistants and radiologists in order to develop the software for the radiologists' workstation. It is in this sense that the e-Demon team needed to develop a capability for co-configuration, to enable the different specialists to interact and learn from each other's expertise in order to design the new computer system.

An insight into the challenges experienced by the e-Demon project team is provided by the project manager in the following excerpt[5]. As Sienna indicates these challenges or "complexities" revolved around: a) the experts' individual drivers; b) their employment contracts; and c) the multi-institutional composition of the team.

A challenge in delivering this prototype was in the individual partner drivers. Clearly, a commercial partner would want to push for their technology to be adopted

[5] This excerpt is drawn from a more developed account of the project manager's views, in Kinti, I., Lloyd, S., Simpson, A., and Hayward, G. (2005) "*Managing Collaborative Expertise: Issues and Challenges*" in Proceedings of the 6th European Conference on Organisational Knowledge, Learning and Capabilities (OKLC), Boston, 18-19 March.

as part of the solution as any potential exploitation would result in higher sales for their organisation. The project had a technical architecture team straggling several entities and had a technical architect working for the main commercial organisation. This resulted in difficulty in making technical decisions on the architecture, as the committee argued extensively over decisions. A better solution would have had the decision making process independent of any commercial vendor.

A further complexity resulted in the nature of research funding which required the universities to employ research assistants on these projects. These research assistants are expected to publish papers but are often tasked with fast track development to ensure delivery of these prototypes. The University research staff not only had to manage the design of data management systems but also the systems administration of a complex and novel grid architecture.

This aspect of the project could be aligned to the management of normal projects but proved to be difficult in that: there was no real customer, but several competing users, it had research staff performing development, and experienced conflicts with cross-organisational decision making. While the project team followed the process of gathering requirements, designing an architecture and planning multiple phases of deliverables, this process was more like product management than project management due to the need to align the development with known constraints and potential markets.

Whilst Government policy, for example, extols the innovatory potential of such new ways of working, there is little insight into the challenges of how such teams might be constructed and how the negotiation and alignment of work practices might be fostered.

4. Knowledge work at organisational boundaries

To help develop a theoretical framework to enable exploration of these questions we turn to two aspects of the organisational literature to assess their value in helping us unpack the complexity of this form of working between different experts. The first is concerned with the idea of knowledge creation and sharing, the second with boundaries as sites of creativity and innovation where the edges of different organisations' capability domains meet.

4.1 Knowledge sharing

Production of new knowledge is conceptualised in this literature as 'knowledge creation' (Nonaka and Takeuchi, 1995; Hakkarainen *et al*., 2004; Paavola *et al*., 2004; Newell *et al*., 2006). Implicated in the various models of knowledge creation is a process of 'knowledge sharing' (Nonaka and Takeuchi, 1995; Hansen, 1999; Hakkarainen *et al*., 2004; Tsoukas, 2005; Newell *et al*., 2006;). For example, Nonaka and Takeuchi identify the sharing of tacit knowledge, through a process of socialisation, as the first step in organisational knowledge creation (Tsoukas, 2005). However, whereas the notion of knowledge creation is rather too abstract to focus on how different experts interact to build new knowledge, the notion of knowledge

sharing is quite limiting in capturing the dynamics of experts' interactions for two reasons.

First, the term 'knowledge sharing' is limiting in its semantic meaning as an interaction between individuals at the interpersonal level, because within this understanding the influence of contextual factors on how individuals express and share experiences between themselves is missed. Second, the notion of knowledge sharing, as employed in the current knowledge economy discourse and the knowledge management literature (Swart and Kinnie, 2003), is limiting in an additional way. Within this literature, knowledge sharing is invoked as an almost invariably consensual process of transferring knowledge from one individual to another, understanding knowledge as a substance acquired during learning and later moved to another situation. This approach neglects that using knowledge is a reflective and reflexive process in relation to one's identity and sense of self, as well as leaving unaccounted the complex socio-political nature of such interactions.

4.2 Knowledge co-configuration

The term "knowledge co-configuration" emerges out of a critical engagement with Victor and Boynton's (1998) notion of "co-configuration" focusing on the co-configuration of artefacts. To co-configure means to arrange something in a particular way, especially computer equipment, to make such equipment work according to the needs of its end-users. Victor and Boynton understand co-configuration as the capability of the firm to develop a product network through a commitment to learning from the expertise of various groups of specialists and users. This product network learns how to adapt its performance to the individual's customer needs:

> Doing mass customisation requires designing a product at least once for each customer. This design process requires the company to sense and to respond to the individual customer's needs. But co-configuration takes this relationship up one level – it brings the value of an intelligent and adaptive product. The work of co-configuration involves building and sustaining a fully integrated system that responds and adapts to the individual experience of the customer. (Victor and Boynton, 1998, p.195).

Co-configuration, as defined by Victor and Boynton, resonates with the work of the e-Science team as it involves creating partnerships for experts to *learn* from their end-users, and vice versa. Thus, the issue is how to organise such **learning partnerships** in practice, to enable specialists from different epistemic cultures (Knorr-Cetina, 1999) to learn from each other. Consequently, co-configuration work involves building and sustaining a fully integrated system that responds and adapts to the individual experience of the customer. This means that organisational development of the co-configuration network needs to take place. However, this shifts the emphasis on the **work practices** that need to be developed in order to sustain this form of work, especially because Victor and Boynton note:

> With co-configuration, there are no final products; no service is ultimately delivered. Instead, the boundaries between learning and work, customer and product, customer and company **disappear** [emphasis added]. What replaces those boundaries are tightly coupled linkages,

> which feature constantly shared information, ideas, and experiences around the product of service experience. (1998, p. 207).

The issue, in this case, however, is: do the boundaries really disappear? How is it made possible for these experts to work together? Victor and Boynton emphasise co-configuration as part of a firm's product development strategy, they do not problematise it as a learning process. The concept of knowledge co-configuration is introduced, therefore, as a response to this need, seeking to theorise the challenges and the processes involved when different specialists interact to learn from the expertise of each other in order to design a new product or service. Here, the notion of knowledge co-configuration is proposed as a more adequate term, to capture the struggle for meaning making among actors who come into the collaboration from within different thought worlds (Dougherty, 1992) but still need to work creatively together. Knowledge co-configuration involves, it is argued, the **constant shaping and reshaping of knowledge where the experts involved have to adapt and re-adapt their stance to the collectively negotiated requirements of a complex task.**

This section has argued so far that notions of knowledge sharing and knowledge creation (Hakkarainen *et al*., 2004) are helpful in describing networking processes schematically but limiting in enabling us to generate an understanding of the nature of experts' interactions during, in particular, processes of networking at the boundaries of organisations. Similarly, the concepts of knotworking' (Engeström *et al.*, 1999) and 'netWORKing' (Nardi *et al*., 2002) are useful to describe the activity of particular networks but may fail to capture the socio-political dimensions of the orchestrating of interactions necessary to produce a new 'knowledge object' (Knorr - Cetina, 1997) between actors from different organisations. The study uses the concept of knowledge co-configuration in the attempt to characterise and theorise such processes where the actors struggle to combine their different fields and funds of knowledge together. An important feature of this type of work is that the actors involved repeatedly cross boundaries and have to balance between competing demands and pressures to interact creatively together. This is a complex process and we deemed it useful to employ ethnographic methods to explore it in practice.

5. Research approach

To meet the challenge of shifting towards the micro while avoiding ethnographic positivism, the collaboration between the different experts was studied developmentally (Vygotsky, 1978; 1981), that is, as a "dynamic process full of upheavals, sudden changes and reversals" (Kozulin, 1986, p. 266), as the different experts interacted to create new knowledge. In the literature, there are two main theoretical traditions that enable us to study knowledge work[6] as a developmental

[6] All work involves knowledge. Therefore, the recent government policy rhetoric does not refer to all work, but rather focuses on a certain subset of work. The question that emerges, therefore, is what exactly is this type of work called "knowledge work", given that all work involves the use of knowledge? According to Alvesson (2004) it is the type of work which revolves around the use of intellectual and analytical tasks, and is typically seen as requiring an extensive theoretical education and experience to be carried out successfully. Knowledge work includes the exercise of professional judgment in the effort to solve complex, often unique problems. The individual knowledge worker (or team) is often in the situation of having the best general insights into the problem area as well as being the person (or team) with most familiarity with the specifics of the actual problem (2004, p.23).

process: Actor Network Theory (ANT) and Cultural Historical Activity Theory (CHAT). ANT has been criticised for eliminating history and culture (Kallinikos, 2005), and, similarly, the dedication to details of constructivist approaches to understanding work practices (Heath *et al*., 2000; Orlikowski, 2002) is seen as a failure of theoretical imagination (Kallinikos, 2005). Furthermore, such studies focus more on practices in well-defined contexts, such as science laboratories (Latour and Woolgar, 1986), and less in collaborations at organisational boundaries.

With an indirect yet clear focus on motivation, CHAT was deemed to offer a more adequate analytical framework to capture the dynamics of the research problem in this setting. ANT has been extensively used to explain social network development, particularly in contexts of technological work and scientific collaboration (Law and Hassard, 1999). However, it does not seem to provide the conceptual tools that would enable us to understand the problem of sharing knowledge in collaborations. ANT does not account for what ultimately *motivates* the development of such a network; what enables the actors to move the work forward. The problem in doing so is that Latour's principle of generalised symmetry turns all the actors (or actants, as he prefers to call them) into black boxes without identifiable internal systemic properties and contradictions (Engeström, 2001). It is important to frame this study in a way that takes into account the mediation of history and culture, because these determine how actors enact their knowledge and how they develop and use practices to share knowledge. CHAT was seen as a more adequate lens because it provides a theoretical framework that enables a focus to be maintained on both the micro and the macro levels of analysis.

6. Research methods

A developmental case study research design was used to follow the Solution Team during the evolution of its work. Informed by socio-cultural activity theory, the essence of such a design was to capture the development of practice in motion. To acquire this understanding, the Solution Team was studied developmentally from the first day of its formation and during the twenty month period of its work, until the team was dissolved.

Specifically, ethnographic data collection methods were used including: a) direct observations of work meetings to generate thick descriptions of how the team accomplished work; b) tape-recording of meetings (n= 40) that provided a view of how expertise was practically, collaboratively and discursively constructed; c) three types of interviews (n=70) including: i) "interviews about instances", after meetings to understand the flow of events from practitioners' own perspectives and capture gaps in inter-subjective understandings; ii) explorative conversations to understand the nature of IT work; iii) semi-structured interviews to triangulate the data; and d) respondents validation with key participants. Data analysis involved both inductive and deductive processes through a recurrent process of analysing both the data and the literature. First the work of the team was divided into four phases based upon a

qualitative measure that emerged from the analysis of the data: a significant turning point in the organisation of the team's work (Table 1).

***Table 1*: Periodisation of work according to qualitative shifts in practice development**

Work Phase	Intended technical development	Socio-political Problems encountered	Qualitative shifts in practice enabling the team to move to next phase
Phase 1	Establish project specification – specify users requirements	Stasis – Difficulty to move the work forward due to high levels of ambiguity	The decision to do "Phase Zero" and its adoption in the group's practice.
Phase 2	Design the system's infrastructure	Conflict – Difficulty to coordinate parallel work activity	Reorganization of the technical activities to provide more structure for coordination
Phase 3	Develop the system's infrastructure	Delays – Difficulty to maintain M2 commitment / change of M2 engagement strategy	Re-definition of the main deliverables towards a feasible outcome.
Phase 4	Development of grid services aligned with clinical team and radiologists	Difficulty to sustain creative effort and coordination across multiple contexts.	Demonstration of the prototype at the e-Science Conference – end of work.

After the periodisation of the team's work was completed, an iterative process of within and across phase analysis was adopted to produce a rich descriptive account of how the team's work was developing in different phases of the collaborative project. This descriptive account was then used as a basis for identifying how collaborative practices emerged and developed. Such identification led to a return to the raw data to examine in more detail the nature of change (breakdowns, external interventions, innovations) in the team's practice, especially during the first three qualitative turning points (Table 1). At that stage of the analytic process the focus shifted on the team's negotiations and developing negotiating practices and how these enabled the actors to move the work forward.

7. Arriving at the interaction: collaborative working at organisational boundaries

In the Solution Team, we have experts from a wide variety of backgrounds moving across geographical, institutional and occupational boundaries as they work on a shared work problem, how to design and develop the e-Demon computer prototype. These experts differed in their organisational and individual drivers for participating in the collaboration. For example, the researchers were driven by the need to publish innovative papers in academic journals whereas the developers were driven by the demand to produce tangible results fast enough to meet competition in foreign markets. Activity Theory (AT) has a characteristic emphasis on motivation expressed in the key concepts of object of activity and object orientated activity (Edwards, 2006; Engeström and Blackler, 2005) and, therefore, provides a lens to explain the challenge

for actors to engage in practice development in this new work system. Objects in AT terms are not the same as goals. Goals are primarily conscious, relatively short lived and finite aims of individual actions (Engeström *et al*., 2005). The object in AT terms is a heterogeneous and internally contradictory, yet enduring, constantly reproduced *purpose of collective activity that motivates and defines the horizon of possible actions* (Engeström, 1995; Leont'ev, 1981).[7]

What became evident during actors' interactions was that the work of the inter-organisational team was underpinned by a fundamental systemic contradiction: cutting edge research versus commercialisation reflecting, at times, a fractured object of activity. It was exactly the emergence of this type of contradiction, however, that triggered and gave rise to the negotiations necessary in order to re-assess the course of the work and to change the practice of the team. Contradictions, in AT terms, are historically accumulated tensions that constitute a social system's source of change and development (Engeström, 1987). The actors in this inter-organisational work system, however, are together for such a short period of time that their interactions lack the historicity of interrelated practice needed to develop contradictions in the sense that Enegström (1987; 2001) uses the term. Rather, the term contradiction is used in this study to refer to the emergence of oppositional behaviours and discourse as the actors pull the object of activity in different directions. How the externalisation of accumulated tension, in the form of such contradictions, enabled the team to change the course of the work was made particularly evident during qualitative turning points in the group's practice (see Table 1).

The collective purpose was interpreted differently by each organisational group, to enable a different horizon of possible actions to be realised within the shared problem space. For example, the object of activity worked upon in 'Com Lab' was to undertake cutting edge research. This defined the Solution Team's researchers' horizon of possible action in terms of work that leads to academic publications, research grants and solving real scientific problems. For M1, on the other hand, the object of activity was fast commercialisation in European marketplaces which defined M1 developers' horizon of possible actions in the collaborative project as doing things extremely pragmatically, for example, pushing for a simple and generic solution that could be designed fast. The object of activity worked upon in M2 was customisation of digital imaging products and services. This defined the horizon of possible actions of M2 designers in terms of a focus on potential customers, such as the NHS.

The e-Demon experts schematised their experience in the collaborative project according to how the horizon of possible actions was being shaped by the norms, policies and strategies of their parent organisational activity systems. As a result, the boundaries between these particular activity systems did not fade over time, as suggested by Victor and Boynton's (1998) conception of co-configuration between producers and suppliers; they remained, and were, at times, intensified. For example, when Ryan, the M2 team leader, left the project at the beginning of Phase 3, the boundaries between the e-Demon team and M2 intensified with M2 actors failing to

[7] Objects are not, in this view, simply raw material for the formation of logical operations but cultural entities; they are not 'things' out there in the environment to be acted upon, such a 'thing' only becomes an object of activity when it is invested with meaning and motivating power for the subject (Edwards, 2007 p.7).

come to project meetings, despite the attempts of Sienna, the project manager, to engage the new M2 CEO to support the inter-organisational team.

To explore these questions, the study uses the notion of 'boundary zone' conceptualised as a space for collaboration, a space for interaction, where the edges of different capability domains meet, and where actors from different organisational activity systems liaise to solve a complex problem that necessitates more than the expertise of a single specialist group.

7.1 From uncreative interaction to creative interaction: knowledge co-configuration in the Solution Team

The process of knowledge co-configuration is only energised with the development of object orientated activity in the Solution Team. This process involves negotiations in the form of: a) articulation work which enables the actors to chase the object of activity leading to the surfacing of contradictions; b) collaborative strategising which enables the different experts to *work with* their contradictions and to expand the object of activity in the collaborative team through developing a collective task performance strategy; and c) practice alignment, negotiations focused on how to coordinate experts' different ways of completing work tasks as a means to actualise the project outcome.

However, the activity of the team does not stabilise at the state of creative interaction. The 'practice platform' can collapse due to the emergence of 'latent coordination' problems and unresolved tension. As the team tries to maintain coordinated action the object 'kicks back', due to the high levels of complexity and commitment needed to maintain the coordinated interactions underpinning knowledge co-configuration. These are easily undermined through 'latent coordination problems' – for example when M2 changes its product development strategy and M2 actors reduce their commitment to the inter-organisational team. This leads the team to reverting back to the state of uncreative interaction.

This process of degeneration could take the form of a reversal of the step like building of the practice platform. This could lead the system to degenerate completely to level 1, the state of uncreative interaction. Alternatively, this degeneration could occur in one move, a more catastrophic event. In reality this complete degeneration never occurred until the team was dissolved. Rather they tended to fall back to an earlier stage and then rebuild the practice platform as soon as they were more able to reassume object orientated activity. Therefore, it is important to recognise that the shift in the boundary zone from the condition of uncreative interaction to the stage of creative interaction does not imply that the team's work became boundary free: fundamental boundaries remained between the team members, for example, in the form of continuing disagreements about the analysis of user requirements, an essential part of co-configuration work. What does, however, change is the way in which the team *negotiated* and conducted its ongoing activity over those organisational boundaries. Engaging with these three types of negotiating practices enabled the actors to balance their performance and contribution of expertise between the collaborative team and their own organisation.

7.2 Learning to balance at the boundaries: engaging in three negotiating practices

Articulation work

In contexts of innovation work, where the problem is ill-defined, the specialists involved in the collaborative activity need to negotiate in between themselves how to move the work forward. Innovation, at this stage, takes the form of an interpretive process that requires negotiation of different *systems of meaning* (Dougherty, 1992) - different conceptualisations, judgements, values and beliefs- about how to shape the collective task. The first of the negotiation processes that enables such surfacing of differential understandings between the experts involved in the collaboration is termed articulation work (AW).

Articulation work enables the surfacing of actors' differential motivations and engagement strategies in the collaborative activity. The actors begin to negotiate the following questions: 'what exactly are we working on here'; 'why are we doing this'? These 'why' questions could be construed as a questioning of the existing practice - what they have been doing until that stage, i.e. a process potentially analogous to the questioning processes hypothesised by Engeström (2001, 2004) to initiate an expansive learning cycle. Such questions, in this case, trigger a search for articulation (Mark *et al*., 2003): discursively this is both a search for clarity "what do we mean by research" and a search for fit, how can we best work together. Through asking such questions, AW surfaces how actors deem it useful to execute the task depending on their previous practices and future aspirations - their desired ways of working - the outcomes they wish to bring about and how. This process involves identity negotiation: actors become reflective often feeling their professional identity is being challenged. For example, Dennis uses a value statement to influence his peers about the direction forward and how this should enable the researchers to produce more academic papers. Jonathan, however, is struggling to balance at the boundary between M1 and the new team .He is still attached to his M1 role and identity as a 'doer', he does not attempt to expand his understanding of his role in the Solution Team.

> In a progress review meeting, Dennis, the 'Com Lab' researcher, says*: "We need papers out of this project, a good academic needs at least four publications per year"*.
>
> But, at the end of that meeting, Jonathan, the M1 developer, says: *"I don't like writing documents or doing project management stuff…You know…**I am a doer*** [emphasis in the original]. *I like building things like the operational model we're doing over the summer"*.

The evidence from the work of the Solution Team, however, suggests that AW has four key characteristics: a) it enables the surfacing of actors differential motivations and engagement strategies in the collaborative activity; b) it involves a preoccupation with 'why' questions, i.e. 'why are we doing this? c) it involves definitional work; and d) it leads to differentiation of actors' roles and functions. In AT terms, AW is about chasing the object of activity (Foot, 2004), a process which enables the actors to communicate their object motives, individual and institutional, to other actors. In the Solution Team, this surfacing of differential motivations became more apparent at the

end of Phase 1, a period of increased ambiguity as the actors were struggling to define the project requirements in practice.

An outcome of AW is that knowledge about actors' differential motivations and engagement strategies has been communicated around the team and has been mutually understood. In order for the actors to 'combine' their knowledge to deliver work together, they first need to feel included in the task. However, this does not happen automatically; the negotiation reveals how actors come into the collaboration with different drivers, related to their professional identity developed through years of experience as, for example, software engineers in different organisations. This professional identity may be challenged as actors interact at organisational boundaries and have to balance their performance and contribution of expertise between the different directions that are proposed in the inter-organisational team. These balancing acts reveal how professional identity consists not only of technical and propositional knowledge but also of encultured, process, personal and tacit knowledge that relates to, for example, visions of how to undertake tasks. AW enables the voicing and communication of these different visions.

Collaborative strategising

Whereas accomplishments of AW include the surfacing of different engagement strategies and the differentiation of work roles, the accomplishment of collaborative strategising negotiations is the formation of a task performance strategy for the team. CS is about taking into account actors' different object motives - their use values and engagement strategies surfaced through AW - to formulate a task performance strategy. It is the ability of the actors to accommodate, in the shaping of the collaborative solution, these different 'use values' emanating from their different epistemic cultures - their different practices of creating and warranting knowledge in different domains (Knorr - Cetina, 1999, p. 246).

Before being assigned M1 team leader in the e-Demon team, Jonathan noted: "*We are not interested in what is clinically useful all we want is to be technically sellable*". And, Anthony, the 'Com Lab' team leader, said at the end of a meeting in the middle of Phase 3: "*Every time we come into these meetings it is revealed that M1 wants to do something that just works whereas we want to solve some real problems and we are not given the space and time to learn*". This indicates the struggle that actors experience in knowledge co-configuration as they have to negotiate the taken for granted elements of their professional practice, i.e. their professional identity. Ultimately, through becoming more reflective, they learn to balance the different commitments in the negotiation of the solution. They learn to engage not only as individual actors, but as actors representing different organisational and institutional strategies.

While engaged in CS negotiations, the actors are expanding in practice the object of activity through developing a collective task performance strategy. For example, at the end of Phase1, the e-Demon experts came up with a clear double version of what they would be doing - Prototype and Blueprint - on the basis of which they decided to do a proof of concept exercise for the 'All Hands' Conference. To realise this new task performance strategy, the Solution Team constructed a new phase of work named "Phase Zero" in a way that combined experimentation (the blueprint component),

favoured by the researchers, with delivering work to strict deadlines (the prototype component), favoured by M1 and M2 developers. The construction of 'Phase Zero' is an example of how the team at this stage is able to develop *instrumentalities*: new collective mental models about how to move the work forward. The characteristic feature of such mental models is that they enable the team to work *with/through* the contradictions, in this case, between cutting edge research and fast commercialisation, an indication that the actors are more able to balance at the boundaries between their organisation and the new collaborative team.

Practice alignment

Practice alignment (PA) negotiations are focused on developing coordinated interactions between actors involved in different tasks working with different practices. Practice alignment is enabled by the development of collective instrumentalities, mental models about how to move the work of the group forward incorporating elements from different actors' thought worlds. Generated out of AW and CS negotiations, 'Phase Zero' and the '5 Buckets tool' were models about how to develop parallel work activity between the different expert groups. Thus, whereas AW negotiations enable the actors to clarify ambiguities and CS negotiations aim at pulling the actors together to ensure their commitment in collective performance, PA negotiations are about coordinating parallel work activity using the model that emerged through CS.

The outcome of practice alignment -through which actors' understandings of the task are being shaped and reshaped- is knowledge co-configuration. This is not a simple sharing of knowledge, it is a reciprocal shaping and reshaping of the way that an actor takes account of the needs of other actors in actually thinking through what is that s/he has to do as an expert. For Solution Team actors, developing such a capacity appears to be more innovatory in Phase 2 than it is in Phase 4. An accomplishment of PA negotiations is that the actors are constructing and validating work process knowledge, with their end users. Knowledge of how to do things is being communicated and new practices are being formulated. Actors are allowing themselves to be shaped and reshaped though coordinated interactions with the members of the other teams.

What changes is the ability of the actors to negotiate the way forward in the inter-organisational team as they improve their performance in balancing at the boundaries between their parent work systems and the new team. For example, during a tension between M1 and the 'Com Lab', Alex, the M1 lead architect, stepped out of his own reference group to oppose the objections raised by both his manager and the project manager, and to insist on resolving the problem, so that the team could move on. However, Alex also ensured that the proposed practice was in alignment with M1 demands. This was the first time that an e-Demon actor crossed out of his own reference group and offered a solution that became accepted by the others leading to the creation of new work process knowledge. The rest of the team then engaged in this balancing act to ensure that the work process knowledge generated from this particular interaction would count as valid within the different organisational activity systems.

The collaborative team **becomes a slightly autonomous work system as more actors engage in boundary balancing;** certain actors feel able to go beyond the remit given by their parent organisations and this proves to be necessary for constructing new knowledge in the team This indicates that a capacity to 'balance at the boundaries' between the parent and the collaborative organisation is necessary to foster expert performance in this setting of inter-organisational work.
This process is construed as learning to *balance* at the boundaries of organisations rather than boundary crossing since, as a metaphor, it implies a more delicate and dynamic process with personal and contextual factors tipping the actor towards and away from active participation in the building of the infrastructure, the practice platform, needed to support knowledge co-configuration.

What emerges progressively is a pattern of working that enabled the actors to actualise the project outcome by providing possibilities to expand certain elements of their previous practices. This enabled the actors to maintain the boundaries between their organisations while learning to work at the boundaries by constructing new chronotopes of collaborative working (adapted from Lemke, 2004). Co-configuring of work process knowledge emerges through appreciation of the need to accommodate elements from others' practice. This results in a coordinated effort to actualise the project outcome.

8. Conclusion

The research reported in this paper was an attempt to conceptualise more rigorously the processes of 'networked expertise' whereby scientists from different backgrounds are brought together to share their knowledge, in order to design innovative solutions to complex problems. The evidence provided was based on a longitudinal case study where ethnographic methods were used to document at a micro-genetic level the development of the practices of a research collaboration comprising experts from different organisations in the context of the e-Science Programme in the UK.

Drawing on Sociocultural Activity Theory, the main contribution lies in characterising this form of collaborative working as a process of knowledge co-configuration between experts. The term is coined to capture the struggle and identity negotiations involved in knowledge sharing interactions between experts from different institutional backgrounds. This involved a process of practice development that enabled the collaborative team of experts to make the transition from uncreative to creative interaction. Engaging with three types of negotiation practices - articulation work, collaborative strategising and practice alignment - enabled the actors to construct a *practice platform* necessary for knowledge co-configuration to occur. Identifying these three practices led to the theorisation of an emergent concept captured as 'balancing at the boundaries' between one's organisation and the new collaborative team, as an essential capacity that needs to be learned by actors to foster expert performance in this setting.

9. Bibliography

Abbot, A. (1988) The system of professions: an essay on the division of expert labour. (Chicago: University of Chicago Press)

Abbot, A. (1995a) Boundaries as social work or social work of boundaries? Social Service Review 69, pp. 545-562

Amin, A. and Wilkinson, F. (1999) 'Learning, proximity and industrial performance' Cambridge Journal of Economics, 23 2, pp. 121-125

Amin, A. and Cohendet, P. (2004) 'Architectures of Knowledge'. (Oxford: Oxford University Press)

Alvesson, M. (2004) 'Knowledge Intensive Work and Knowledge Intensive Firms'. (Oxford, Oxford University Press).

Ancona, D. And Caldwell, D.F. (1992) Bridging the Boundary: External Activity and Performance in Organizational Teams. Administrative Science Quarterly, 37, pp.634-665

Ashton D. and Sung, J.,(2002). Supporting Workplace Learning for High Performance Working, International Labour Office (ILO), Geneva: ILO

Barley, S. and Kunda, G. (2001) 'Bringing Work Back In'. Organization Science, 12 1, pp. 76-95

Barley, R.S. and Kunda, G. (2004) 'Gurus, Hired Guns, and Warm Bodies: Itinerant Experts in a Knowledge Economy'. (Princeton, Princeton University Press)

Bechky, B.A. (2003) 'Sharing meaning across occupational communities: The transformation of knowledge on a production floor'. Organization Science, 14 pp. 312-330

Bedny, G., Segun M., and Meister, D. (2000) 'Activity Theory: History, Research and Application'. Theoretical Issues in Ergonomics Science 1 2, pp. 168-206

Bereiter, C. and Scardamalia, M. (1993) Surpassing Ourselves: An Inquiry into the Nature and Implications of Expertise, (Chicago, Open Court)

Blackler, F. (1993), 'Knowledge and the theory of organisations: organizations as activity systems and the reframing of management', Journal of Management Studies, 30 6, pp.863–84

Blackler, F., (1995) 'Knowledge, knowledge work and organizations: An Overview and Interpretation'. Organization Studies, 16 6, pp. 1021-1046

Boreham, N., Samurcay, R. and Fischer, M. (2002) 'Work Process Knowledge'. (London, Routledge)

Carlile, R.P. (2002) 'A Pragmatic View of Knowledge and Boundaries'. Organization Science, 13 4, pp. 442-455

Chi, M. T. H., R. Glaser, and M. J. Farr, eds., (1988) The nature of expertise. (Hillsdale, NJ : Erlbaum).

David, P. 2004. 'Towards a cyberinfrastructure for enhanced scientific collaboration: Providing its soft foundations may be the hardest part'. Research Report No. 4, Oxford Internet Institute

DEPARTMENT OF HEALTH, SOCIAL SERVICE AND PUBLIC SAFETY (2002) Comprehensive Review of the Radiography Workforce [online]. Available from: http://www.dhsspsni.gov.uk/publications/ahp-docs/radiography_workforce.pdf [Last Accessed 21st August 2005]

Dougherty, D. (1992) 'Interpretive barriers to successful product innovation in large firms'. Organization Science 3 2 pp.179-202

Dougherty, D. (1996) Organising for Innovation. In S.R. Clegg, C. Hardy & W.R. Nord, Eds. Handbook of organisation studies. (Thousand Oaks, Sage), pp.424-439

Dreyfus, H. L., & Dreyfus, S. E. (1986). 'Mind over machine: The power of human intuition and expertise in the era of the computer'. (New York, Free Press)

Dreyfus, H. and Dreyfus, S. (2005) 'Expertise in real world contexts', Organization Studies, 26 5, pp. 779-792

Edwards, A., (2005) ' Relational agency: learning to be a resourceful practitioner', International Journal of Educational Research 43 3, pp.168-182

Edwards, A. (2006) Moving Knowledge upstream from practice to strategy; the lessons from one national intervention. Paper Presented at the British Educational Research Association, 6-9 September, Warwick

Edwards, A. (2007) 'Enhancing Expertise through Interagency Working'. Paper presented at the American Educational Research Conference, Chicago, 9-13 April.

Engeström, Y., Engeström, R. and Karkkainen, M. (1995) Polycontextuality and boundary crossing in expert cognition: learning and problem solving in complex work activities. Learning and Instruction, **5** 4, pp. 319-336

Engeström Engeström, R. and Vahaaho, T. (1999) 'When the centre does not hold: the importance of knotworking'. In S.Chaiklin, M. Hadegaard and U. Jensen (eds) 'Activity theory and Social Practice: Cultural Historical Approaches', (Aarchus, Denmark, Aarchus University Press)

Engeström, Y., (2000) From individual action to collective activity and back: developmental work research as an interventionist methodology in P. Luff, J. Hindmarsh and C. Heath (eds)

Workplace Studies: Recovering Work Practice and Informing System Design, (Cambridge, Cambridge University Press), pp.150-166

Engeström, Y. (2004) The new generation of expertise: Seven theses, in H. Rainbird, A. Fuller, and A. Murno, (eds.) 'Workplace Learning in Context' (London, Routledge) pp. 145-165

Eraut, M. (1994) 'Developing Professional Knowledge and Competence'. (London, The Falmer Press)

Ericsson, K.A. and Smith, J., (1991) Prospects and Limits of the Empirical Study of Expertise: An Introduction, in K.A. Ericsson and J. Smith, 'Toward a General Theory of Expertise: Prospects and Limits'. (Cambridge, Cambridge University Press)

Foot, K.A. (2002) 'Pursuing an evolving object'. Mind, Culture and Activity 9 2, pp. 132-149

Finegold, D. (1999) Creating Self-Sustaining, High-Skill Ecosystems. Oxford Review of Economic Policy, 15 1 pp. 60-81

Gibbons, M. (1999) 'Science's new social contract with society.' Nature 402, C81

Hakkarainen, K., Palonen, T., Paavola, S. And Lehtinen, E. (2004) Communities of Networked Expertise: Professional and Educational Perspectives. (Oxford, Elsevier)

Hardy, S. Lawrence, D. and Grant, S. (2005) 'Discourse and Collaboration: The role of conversations and collective identity'. Academy of Management Review 30 1 pp. 58 - 77

Jirotka, M. et al. (2005) 'Collaboration and Trust in Healthcare Innovation: The eDiaMoND case study'. Computer Supported Cooperative Work 14, pp. 369-398

Johnson, G., Melin, L., & Whittington, R., (2003) 'Micro-Strategy and Strategising', Journal of Management Studies, 40 1, pp. 3-22.

Kallinikos, J. (2005) 'The Order of Technology: Complexity and Control in a Connected World', Information and Organization, 15 3, pp. 185-202

Kerosuo, H. (2006) Boundaries in Action. Department of Education, University of Helsinki

Kinti, I. and Hayward, G. (2007) 'On the making of networked expertise: developing webs of signification across organizational boundaries' Paper presented at the American Educational Research Association, Chicago, 9-13 April.

Konkola (2001) Developmental process of internship at polytechnic and boundary zone activity as new model for activity in Finland. Tuomi-Gröhn and Y. Engeström (eds.) Between School and Work: New Perspectives on Transfer and Boundary-Crossing. (Oxford, Pergamon Press).

Knorr-Cetina, K. (1997) 'Sociality with objects: social relations in post-social knowledge societies' Theory Culture Society, 14 1, pp. 1-30

Knorr-Cetina, K. (1999) 'Epistemic Cultures: how the sciences make knowledge.' (Cambridge, Harvard University Press)

Kozulin, A. (1986) The concept of activity in Soviet Psychology American Psychologist 41 pp. 264-274

Latour, B. and Woolgar, S. (1986) Laboratory Life: the Construction of Scientific Facts, (Princeton, Princeton University Press)

Lemke, L. J. (2004) 'Learning Across Multiple Places and their Chronotopes'. Paper presented at the Symposium: Spaces and Boundaries of Learning, American Educational Research Association Annual Meeting, San Diego

Leont'ev A.N. (1978) Activity, Consciousness, Personality (Englewood Cliffs NJ C Prentice Hall)

Leont'ev A.N. (1981) Problems of the Development of the Mind, (Moscow, Progress)

Mark, G., Abrams, S., and Nassif, N. (2003).Group-to-Group Distance Collaboration: Examining the Space in Between. Proceedings of the 8th European Conference of Computer-supported Cooperative Work (ECSCW'03, Helsinki, Finland, pp. 99-118.

Markidis, C.C. (2002) 'Corporate Strategy: the role of the centre' in A. Pettigrew, T. Howard, and R. Whittington (eds) Handbook of Strategy and Management. (London, Sage)

Miettinen, R.(1999) 'The Riddle of Things: Activity Theory and Actor Network Theory as Approaches to Studying Innovations'. Mind, Culture and Activity, 6 3, pp.170-195

Nardi, B., Whittaker, S. and Schwarz, H. (2002) 'Networkers and their activity in intentional networks' in Computer Supported Cooperative Work 11, pp.205-242

Nayyar, P.R. (1992) 'On the measurement of corporate diversification strategy'. Strategic Management Journal 13 3, pp. 219-236

Newell, S., Bresnen, M., Edelman, L., Scarborough, H. and Swan, J. (2006) 'Sharing knowledge Across Projects: Limits to ICT led-led Project Review Practices'. Management Learning 37 2, pp.167-186

Nonaka, I and Takeouchi,H. (1995) 'The knowledge creating company'. (Oxford, Oxford University Press).

Orlikowski, W. 2002. 'Knowing in Practice: Enacting a Collective Capability in Distributed Organizing'. Organization Science. 13 3, pp. 249-273

Paavola, S., Lipponen, L. and Hakkarainen, K. (2004) 'Models of innovative knowledge communities and three metaphors of learning', Review of Educational Research 74 4 557-576

Pettigrew A.M., Whittingon R., Melin L., Sanchez-Runde C., Van den Bosch F., Ruigrok W., Numagami T. (Eds.). 2003. Innovative Forms of Organizing: International Perspectives**.** London: Sage

Prahalad, C.K. and Hamel, G. (1990) 'The Core Competence of the Corporation' Harvard Business Review 68 3 pp. 79-91

Priem, R and Butler, J.E. (2001) Is the resource based 'view' a useful perspective for strategic management research? Academy of Management Review, 26 1, pp. 22-40

Scarbrough H., and Swan J.A. (2005) 'The politics of networked innovation' Human Relations, 58**,** pp. 913-934

Starr, S. L. (1989) 'The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving' In M. Hughins and L. Gasser (Eds) 'Readings in Distributed Artificial Intelligence', Menlo Park: Morgan Kaufman pp. 37-54

Starr, S.L. and Griesemer J.R. (1989) 'Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39'. Social Studies of Science 19, pp. 387- 420

Swart, J. and Kinnie, N. (2003) 'Sharing knowledge in knowledge intensive firms.' Human Resource Management Journal, 13 (2), pp. 60-75

Tsai, W. (2000) ' Social Capital, strategic relatedness and the formation of interorganizational linkages'. Strategic Management Journal 21 9, pp. 925-40

Tsoukas, H. (1996) 'The firm as a distributed knowledge system: A constructionist approach'. Strategic Management Journal, 17, pp.11-25

Tsoukas, H. (2005) Complex Knowledge. (Oxford, Oxford University Press)

Victor, B. and Boynton, A.C. (1998) Invented Here: Maximizing Your Organization's Internal Growth and Profitability. (Harvard, HBS Press)

Vygotsky, L.S. (1978) Mind in Society: the development of higher psychological processes. (Cambridge, Harvard University Press)

Warmington, P. Daniels, H., Edwards, A., Leadbetter, J., Martin, D., Brown, S., Middleton, D. (2004). 'Conceptualising Professional Learning for Multi-Agency Working and User Engagement' Paper presented to the British Education Research Association Annual Conference, UMIST, Manchester, 15-18th September

Weick, K. (1995) Sensemaking in Organizations. (Thousand Oaks: Sage)