DEVELOPING A HIGH-PERFORMANCE WORK SYSTEM: THE ROLE OF CONFLICT IN EXPANSIVE LEARNING

Ioanna Kinti[a]
Geoff Hayward[b]

[a]Educational Studies Department,
Oxford University, England
ioanna.kinti@edstud.ox.ac.uk

[b]Educational Studies & SKOPE,
University of Oxford, England
geoff.hayward@edstud.ox.ac.uk

Session G-2

Abstract

The purpose of this research is to investigate how new forms of working develop over meso and microgenetic timescales. In this paper, we focus on the role of conflict and conflict resolution on the development of a high-performance work system (HPWS) over a period of one year. We hypothesise that this development involves a process of expansive learning. Our analysis is therefore guided by Cultural-Historical Activity Theory (CHAT) and our research question is the ways in which and the extent to which different types of conflict promote or inhibit the process of expansive learning. We use ethnographically informed case study methodology to investigate the extent to which these dynamics develop amongst a project team of IT researchers and developers designing a computerized mammography system. The contribution of the paper lies in unraveling the nature of the conflictual processes that underpin the formation of a high-performance work system overtime.

Keywords: High-Performance Work Systems, IT Project Work, Expansive Learning, Activity Theory, Workplace Conflict, Conflict Resolution Mechanisms.

Developing a high-performance work system: the role of conflict in expansive learning

Ioanna Kinti[a]
Geoff Hayward[b]

[a] Educational Studies Department
Oxford University, England
ioanna.kinti@edstud.ox.ac.uk
[b] Educational Studies & SKOPE Associate Director
University of Oxford, England
geoff.hayward@edstud.ox.ac.uk

Abstract

The purpose of this research is to investigate how new forms of working develop over meso and microgenetic timescales. In this paper, we focus on the role of conflict and conflict resolution on the development of a high-performance work system (HPWS) over a period of one year. We hypothesise that this development involves a process of expansive learning. Our analysis is therefore guided by Cultural-Historical Activity Theory (CHAT) and our research question is the ways in which and the extent to which different types of conflict promote or inhibit the process of expansive learning. We use ethnographically informed case study methodology to investigate the extent to which these dynamics develop amongst a project team of IT researchers and developers designing a computerized mammography system. The contribution of the paper lies in unraveling the nature of the conflictual processes that underpin the formation of high-performance work systems overtime.

Keywords: High-Performance Work Systems, Expansive Learning, Activity Theory, Workplace Conflict, Conflict Resolution Mechanisms

Suggested track: G Organizational learning

1 Introduction: Conceptual Clarification and the Argument of the Study

The conception of High-Performance Work Organisations or Systems (HPWS) emerged in the US new Human Resource Management (HRM) literature during the 1980s. Subsequently adopted by the high skills vision of competitiveness as articulated, by, amongst others, Robert Reich, the characteristics of such High Performance Working remain elusive. Attempts to capture its essence have ranged from lists of desired work configurations such as “team working”, “communication” and “consultancy” through statements of shared values such as trust, and descriptions of bundles of practices that facilitate these features: regular meetings, quality circles, job rotation and so on. However, the extent to which such lists of desired practices relate to

the reality of the workplace or are merely rather high blown rhetorical statements remains open to question (see Guest et. al., 2002). For example, factor analytic analysis of survey data of a range of firms by Green, Mayhew and Molloy (2003) failed to find any evidence of bundles of characteristics that could be used to define High-Performance or High-Involvement Work Systems. This research suggests that designing or developing work along the lines advocated by supporters of HPWS may be more difficult to accomplish than the HRM literature would lead us to believe. We hypothesise that the reason for this is that the development of such work systems requires a process of expansive learning amongst members of an activity system engaged in trying to develop innovative practice and products. The challenge of achieving this forms the subject matter of our paper.

2 Theoretical Perspective: Using CHAT to study the Development of IT Project Work

In our analysis we draw upon the theoretical tradition of Cultural Historical Activity Theory (CHAT) (Vygotsky, 1978). We follow James Wertsch in adopting a cultural historical research approach because we are concerned to understand how mental action is situated in cultural, historical and institutional settings (Wertsch, 1991) with particular focus on a university-industry research collaboration in medical computing. Within that context, we adopt the idea of learning as being rooted in the practice(s) of an activity system and see learning as change in the joint activity of the system. An attentive look at the literature reveals that organisational learning is commonly regarded as relatively separate from substantive organisational transformations of work and production (Barley and Kunda, 2001). This prompts us to focus on how teamwork gets done over time and to explore how learning occurs through team working. Such a developmental approach could enable us to understand how a putative high-performance work system emerges microgenetically, i.e. at an extremely small level.

We begin this exploration by considering work development to occur through a process of “expansive learning”. The theory of expansive learning (Engeström, 1987), which stems from the general framework of cultural historical activity theory, analyses organizational transformations themselves as processes of learning. We see this kind of theoretical perspective as a particularly useful lens through which to explain how a collaborative work system constructed among different institutions comes into being. Expansive learning is learning what is not yet there: constructing new patterns of collective activity (Engeström, 2004). We are specifically interested therefore in the

ways in which and the extent to which, practices around the development of innovative products involve expansive learning processes, which we envisage as being crucial to the development of HPWS. Within complex work practices experts are not only engaged in simultaneous tasks. They also "operate in and move beyond parallel activity contexts, which may demand and afford conflicting cognitive tools, rules, and patterns of social interaction (Engeström et al, 1995). The essence of expansive learning within the activity theory system becomes therefore the notion of conflict. This conception is however not new. The notion of "managed conflict" as a resource for learning traces back to John Dewey's analysis of an act of thinking beginning with a "forked road situation" (Dewey, 1910). Following the same logic, an activity theory system evolves because of a dialectical process of conflict resolution within that system. This means that the inner- contradictions of such a system can emerge as a key site for analyzing innovation, change and development of the system, including its individual participants (Engeström, 1993). Such contradictions prompt participants within activity systems to invent new "instruments" for their resolution, through experimentation, borrowing and conquering. And, as Leander notes, this process of using "given new" resources to form "created new" instruments and finally new activity, is identified as "expansion" or learning by expanding (2002, 214). Thus, in order to explain how a HPWS develops overtime, we follow Engeström's (1999, 384) analysis of innovative learning in work teams: "The process of expansive learning should be understood as construction and resolution of successively evolving tensions or contradictions in a complex system that includes the object or objects, the mediating artifacts, and the perspectives of the participants".

In this paper we focus on the development of an evolving object (Foot, 2003), the construction of which we see, following Fenwick (2003, 98), as "…the means by which the actors make sense, name and enact foci for activities". These objects have histories and trajectories: they can provoke desire and resistance, and can generate identity or new forms of identity". More precisely, our focus is on analysing how the object of the activity system expands or contracts through a dialectical process of conflict resolution within the activity system. The focus of this paper is then the role of conflict and conflict resolution in the development of work practices.

2.1 Research Focus

The ways in which, and the extent to which, these dynamics develop is investigated amongst a team of IT university researchers and private company system developers designing and developing a computerized mammography system. This team is

situated within a national research project in the UK, which is especially concerned with changing the work practices of radiologists through introducing new technology. In this context, the Solution Team is designing the prototype for a distributed database of mammograms applying a new type of computing power, grid computing. Developing grid technology for diagnostic use in healthcare is innovative. It implies the Solution Team's capability to draw upon and to coordinate different streams of expertise from delivering ethnographic analyses of clinicians' workflows, converting those to requirements' specifications, architecting and designing the system, writing code to fix the system's interfaces and applications etc, and testing system's performance with end-users, a sample of radiologists in UK. Thus, the work of such a team should match closely the static descriptions of the configuration of HPWS given earlier.

Ultimately, we seek to understand how individuals with different personal drivers, who represent diverse institutional interests, negotiate in order to construct a new domain of reality, a way of moving forward with their common work. To achieve this, it is insufficient to simply observe IT specialists in action and generate thick descriptions of observed practices. We need to observe from within a conceptual framework. The prevailing framework of individual agency focused on the stand-alone expert proves inadequate in this research because IT development for healthcare purposes is a cognitive task, which can be learnt only through teamwork. Hence the decision to use Cultural Historical Activity Theory (CHAT), as a means to help us untangle how learning occurs through team work, especially because this theory underscores how the team's context is an integral component, not just a container for intelligent activity (Spillane, Halverson and Diamond, 2000).

3 Research Methodology

The research problem of what are the ways in which and the extent to which different types of conflict promote or inhibit expansive learning is considered through three research questions: a) how is work accomplished in the team; b) does this involve a process of expansive learning and how does this occur; c) how, if at all, does high-performance working emerge through expansive learning. Our research proceeded in three phases to address the research problem: a) sampling of case; b) data collection and c) data analysis. We selected to investigate high performance working at the level of the team because we consider high performance working to occur through collaborative problem solving while work gets done (Eraut, 1994; Orlikowski, 2002). Importantly, fieldwork evidence derived at the first stage of our research during a two-

month pilot study in a telecommunications firm indicated that the team was the minimal social context in which complex work activities got accomplished. In that pilot study, we found that work was normally organised within different sorts of project teams (cross-functional, task-oriented etc), where more than one individuals worked together to reconstruct and rediscover how to achieve some end, which no one of them (individuals) actually had the knowledge, the time or the overall responsibility to achieve independently. This prompted us to proceed to examine a high-performance project team.

Previous studies on HPWS have largely looked at organisational work systems, which are to some extent in existence and, on that basis, they tend to identify HPWS as mere products of specific bundles of managerial practices. But, admittedly, no work system can be a high-performance one all the time. Thus, alternatively, the methodological challenge of this research is how to capture an organisational work system and study it developmentally, that is to say, in its full movement. We are therefore looking for a putative high-performance work system. And we seek to find it at the cutting edge of technology because the sort of theorization of HPWS indicates this is where we should be finding these particular work arrangements. We therefore sample a very prominent university- industry research project on medical computing, where experts and top specialists are coming together from many different disciplines and streams of expertise and interact with each other in many sorts of ways. These interactions occur in the context of a collective, which is formed to deliver a particular project outcome and once this is achieved it is dissolved. We regard this particular sort of sampling useful in terms of maximising our chances of observing the emergence of a putative high-performance work system in practice.

For this purpose, we adopted a developmental case study research design to follow the Solution's Activity as this team works its way through collective zones of proximal development over the project's lifetime. Case study methodology (Yin, 1994; Stake, 1995; Punch, 1998) is particularly well suited to unravelling the development of what is a poorly understood phenomenon, the emergence of High-Performance Working in project teams. To acquire this understanding, ethnographic data sources were used which included: a) direct observations to generate thick descriptions (Geertz, 1973) of how the team accomplishes work; b) tape-recording of face to-face as well as video-mediated meetings, which provided a view of how expertise is practically, collaboratively and discursively constructed; c) ongoing explorative conversations to understand the nature of IT work; d) semi-structured interviews for the purposes of

triangulating data collected in fieldnotes. To date, the Solution Team as well as the surrounding project organization, have been observed for a total of twelve months including approximately sixty five face-to-face meetings, lasting from one hour to eight hours each, with research participants.

4 Data Analysis

4.1 Thick Description of the Solution Team's Activity over time

The project organization we study can be rather characterized as adhocracy (Mintzberg, 1985) in terms of its organisational origin, form, structure and vision to innovate. IT researchers from four universities, software developers from two pioneering manufacturers and clinical personnel from four hospitals participate simultaneously in multiple face-to-face as well as ICTs mediated work contexts as part of their effort to co-configure a new digital mammography system. We focus on following *in situ* the activity of the Solution project team, which is responsible for delivering this new system. The Solution Team, is formed by specialists from three distinct organizations: two IT researchers, a project manager and a systems administrator - both under research status, and a computer science lecturer from a University Computing Laboratory; a lead architect and three developers from the large international hardware and middleware manufacturer, and a team leader and three developers from a university spin off software manufacturer specialising in digital imaging. Each one of the three parties is charged with delivering a different component of the new system and the challenge is how they learn to combine their efforts to achieve the anticipated outcome. As a view of what is happening in this team, one of their most recent collaborative tasks has been to set up a one-day educational workshop to train the clinical research assistants in hospitals about how to use the grid services and how to query the distributed database. In principle, the clinical side of the project is charged with collecting, analyzing and providing "user requirements" for the Solution Team to architect and develop the new system and then conjointly testing its performance with radiologists and radiographers. In practice, we observed researchers, developers, clinicians, team leaders, project managers and also principle investigators engaged in struggles over defining what this project is to ultimately deliver given their distinct and often conflictual interests. Although crossing organisational boundaries gradually became a daily exercise, as we actively observed project meetings and interviewed group members over a period of twelve months, it became evident that these different specialists and experts found it hard to see through the politics of their

own organizations and “wear the project’s hat”. What permeated their work was a dichotomy stemming out of diverse project drivers: cutting edge research versus delivering a fast and solid technical solution. Our first round of ethnographic interviews revealed this was due to people being measured in different ways by their parent organizations for their performance on the project.

At the beginning the Solution Team’s work was very analytical. The developers were not eager to get involved in document production, an essential part of research work, instead they wanted to “start building things”. On the other hand, the researchers wanted to ensure more time and space for innovating than it was predicted in the initial proposal because “a good academic needs to have four publications per year”. As they were going through a proof of concept exercise for the system’s architecture, which lasted four months, work in the Solution Team was becoming more like collaborative guess-working. This caused many iterations of work problematization to occur, which accentuated internal contradictions between university researchers, commercially minded developers and clinical specialists, who remained essentially remote to the project and were not actively involved - with the exception of four people- even after the proof of concept exercise for the technology was completed. During a “Lessons Learned” exercise at the end of the initial phase of the project it was decided to reorganise the project into parallel contexts for work activity, such as a newly integrated requirements team and a cross functional series of workshops to engage radiologists and clinical researchers more actively in the designing activity. Thus, development of existing activity systems was set up for experts and specialists to interact in order to progress with the prototyping activity. Each of the three key organisations constitutes itself a multiple activity system, which fosters different interests, work practices and patterns of behaviour to emerge between members of the Solution Team as experts cross their parent activity system to enter the newly created one (Figure 1).

Some specific examples of how the newly emerging Solution activity system interacts with the activity systems of the three parent institutions are the following: a team of ethnographers and requirements specialists formed at the computing laboratory is assigned to capture user requirements. This indicates how a newly formed team liaises with Solution researchers and developers and participates in the prototyping activity. However, the interaction between the requirements team and Solution specialists is not coordinated effectively and this causes the prototyping activity to stagger. Another example is the lack of organisational commitment from the software university spin off

just after this was taken over by an American digital mammography pioneer. Developments towards intensive commercialisation inside this organisation resulted in Management not dedicating much effort towards research, especially in terms of the human resources engaged on the project, who were re-directed to work for a competing project. This resulted in developers at the software company failing to meet deadlines that proved crucial for the Solution Team's progress overtime.

A third example stems from a stalemate in signing a Collaboration Agreement between project parties because the manufacturers' lawyers could not agree over property rights issues. Delaying the Collaboration Agreement, which commits financially all parties to the project, caused the Project Manager to be unable to enforce project demands on the small manufacturer, who somehow begun free-riding over the project once taken over by the big American firm. These three examples indicate the significance of considering critical developments within the interacting activity systems in order to explain how the Solution Team's work changes and develops overtime.

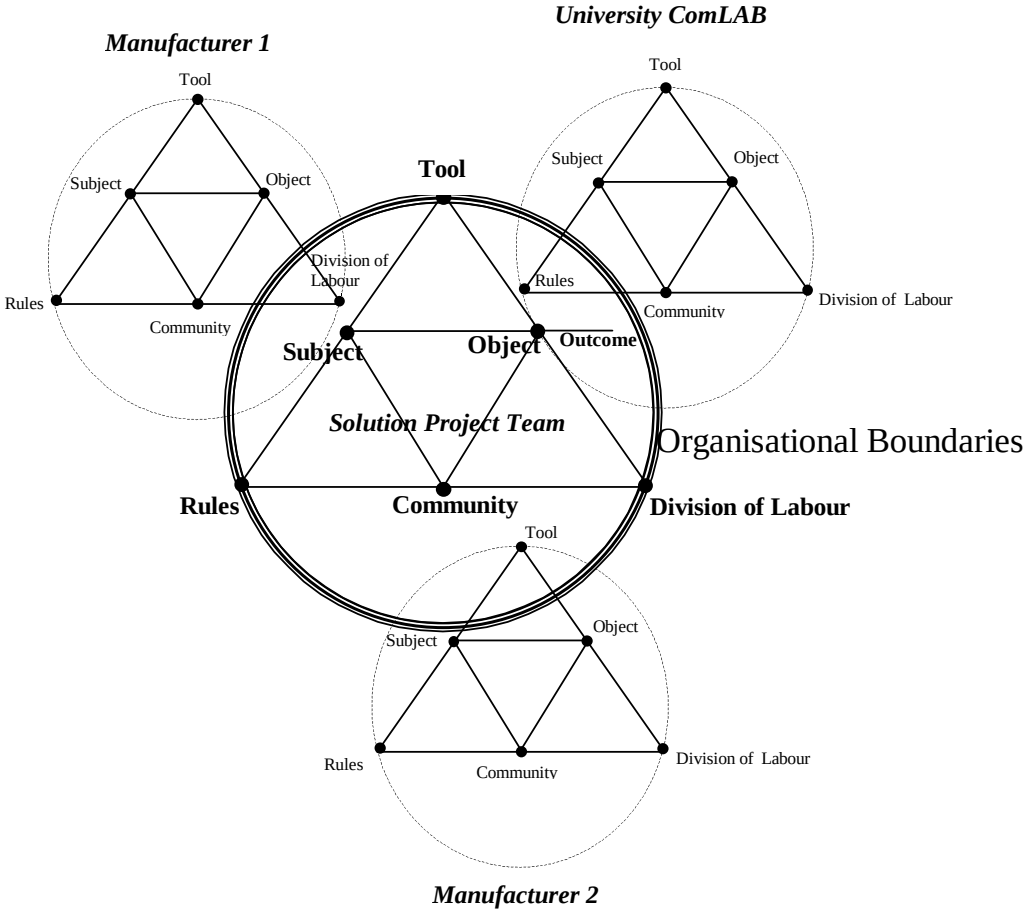
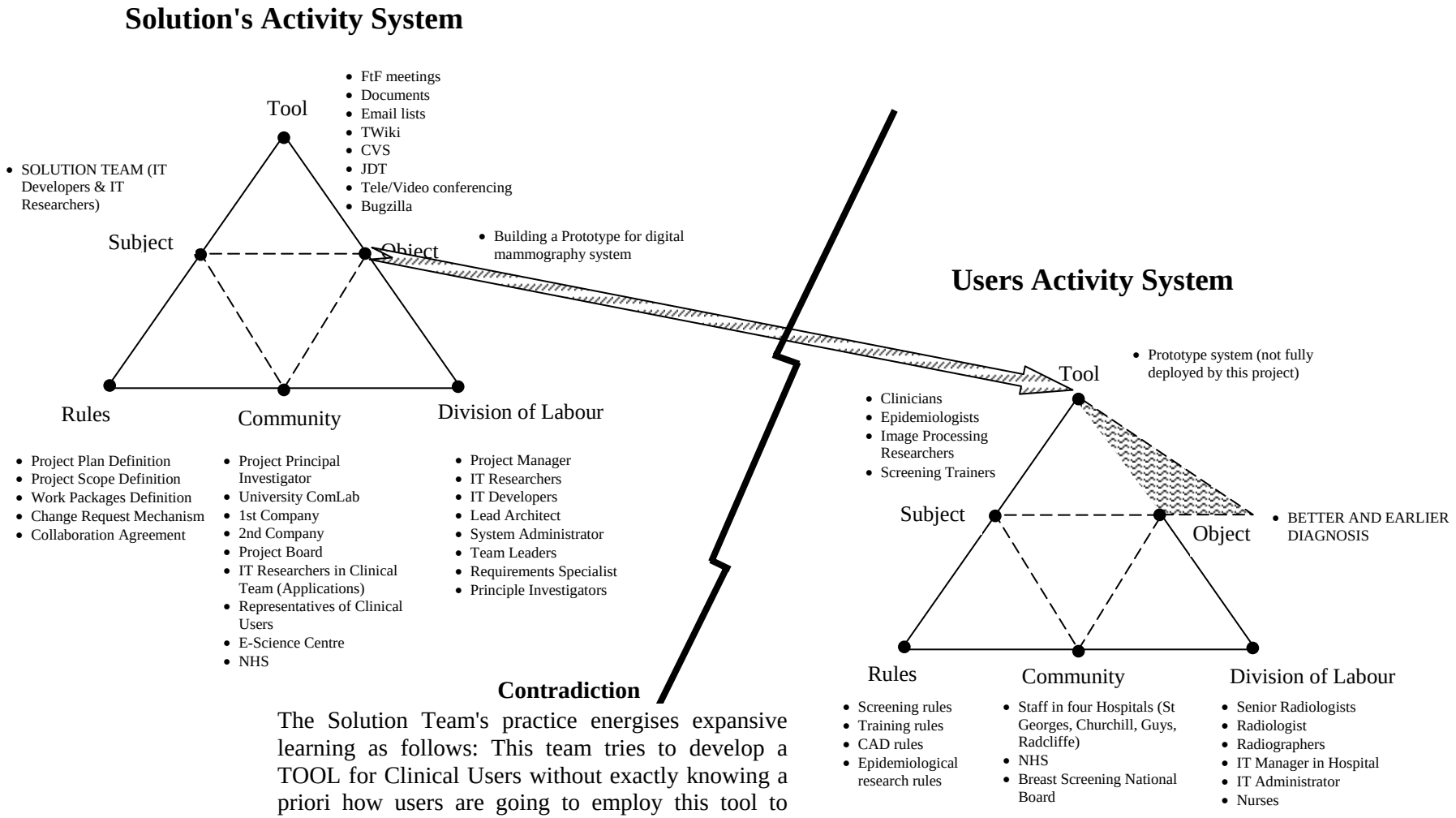


Fig. 1 Expansion of IT Project Work through Multiple Activity Systems

4.2 Understanding how expansive learning is energised in the Solution's activity system

Project work interaction also takes place between the Solution activity system and the User activity system, which is mostly comprised of clinical researchers as well as a limited number of end users, radiologists and radiographers. This interaction illustrates the contradiction permeating the project's work as an innovative activity: the Solution and User's systems interact through a dialectical process of attempting to resolve controversies and tensions. Expansive learning occurs in the context of this interaction as the Solution Team tries to develop a tool for clinical users without exactly knowing a priori how users are going to employ this tool to achieve their object, which is earlier and better diagnosis (Figure 2). Expansive learning is energised in the activity system through the university team leader insisting on the need to improve the user requirements exercise. This triggers a dialectical process of sorting out controversies and incompatibilities between developers and requirements specialists. This results in devising a method to involve users not only in contrive but also in thorough ways inside the development process. They refer to this idea as co-realization.

However, before moving on to involve users, the main challenge is for the Solution's specialists to learn to interact as one work team in order to build an innovative and solid system. In that direction, expansive learning between researchers and developers is energised as follows: gradually they set up multiple tools, which enable them to move on with the prototyping activity. As we often hear them name this activity "a moving target", we realize we are indeed observing the development of an evolving object. At the beginning, tools included different sorts of documents, which when produced enabled them to structure their activity such as the Critical Success Factors definition. Soon tools include a technical and a clinical emailing list and a code repository, which they set up to integrate the code built by all the developers form different organizations (CVS). At the beginning of the project, they experience many stalemates with defining project scope and requirements, but once they set up a TWiki tool, a digital collaborative text tool, which serves as a knowledge repository, work starts to flow and the designing activity is reinvigorated. TWiki has a versioning system enabling members to trace all project documentation posted online, which helps in terms of sorting out work the packages definition and proceed with setting up an ethnographic group to do a clinical workflow study. Using TWiki serves to integrate the project's community as even remote members can gain immediate access to project work.



The Solution Team's practice energises expansive learning as follows: This team tries to develop a TOOL for Clinical Users without exactly knowing a priori how users are going to employ this tool to achieve their object.

Fig. 2. The development of the Solution's Activity System over time

Although TWiki did not prosper as a dialogue tool as it was expected, once the Systems Administrator installed it, it proved useful in terms of enabling members to render work accountable and also in terms of prompting them to develop a collective conscience, as one work unit. Due to it's versioning system TWiki helped them gradually acquiring a sense of organizational memory.

In the second phase of the project people in the Solutions Team start building on existing tools and they are now using a digital issue management tool (Bugzilla) to detect errors in the building of both hardware and software overtime, an example of remote collaborative working occurring quite successfully. However, the main problem at this phase is the lack of organizational commitment and the project manager uses the newly signed Collaboration Agreement as "a stick" to enforce project demands on the two manufacturers, an exemplification of how other sorts of management tools (of legal origin) emerge in the Solution's ongoing work activity, besides purely technical ones.

5 Analysis of Conflicts

5.1 Developing a classification of conflicts using CHAT

We define conflict as awareness on the part of the parties involved of discrepancies incompatible wishes or irreconcilable desires (Boulding, 1963; Jehn and Mannix, 2001). The first step while analyzing data was to inductively identify types of conflicts from transcripts of audio-recorded meetings, ethnographic interviews and fieldnotes. This preliminary analysis indicated ten types of conflict during the development of the Solution's activity system from the initial meeting until February 2004, the six most characterized of which are the focus of this paper. Conflicts were classified into types using a set of three characteristics to identify each category. Once the characteristics were set out we constructed tables of episodes from fieldnotes and ethnographic interviews to demonstrate how each type of conflict emerges in the Solution's work system overtime. Then these episodes served as a basis for a new round of analysis: they were analysed deductively taking into account the cultural historical activity theory conceptual framework. This approach was pursued to analyse the impact of each conflict type on the Solution's activity system by drawing inferences over interactions using the elements of the activity theory triangle as a heuristic device (see Engeström, 2001). Again, this led to a third level of categorization of conflicts according to how they are manifested in terms of the CHAT framework on social interaction (conflict between

a subject and the rest of community). The aim here was to attempt to theorise the conflicts by drawing on CHAT. All conflicts were evaluated with regards to how they had an impact on the evolving object of the Solution's activity system: collaborating to produce a solid and innovative system with a social contribution. So, the main issue was to identify which conflict types were resolvable and which were not resolvable given their impact on the object. The attempt to theorise conflicts led to: a) distinguishing between developmental and non-developmental conflicts according to the value of each characterised type of conflict in promoting or not promoting expansive learning and b) revealing the resolution mechanisms, which enable the system to expand over time. Both features of our findings are deemed useful for executives and researchers who are designing HPWS in practice. Beacuse our classification of conflicts leads to enriching current stereotypical classifications such as Jehn's task, relationship and process conflict typology (Jehn and Mannix, 2001). Also it sets up a mindset for studying how conflict is transferred from the individual level to the organizational level and vice versa.

5.2 Findings: The role of conflict in expansive learning

Analysis of the data indicated ten types of conflict emerging in the Solution Team's work activity system over time, the most characterized of which are the following six: a) technical; b) on vision and drivers; c) on project scope; d) personal; e) on division of labour; and f) on organizational commitment (Table 1).

a) The conflict type, which emerges most frequently in the Solution Team's activity over the last twelve months is technical conflict. It is manifested between project parties and it is characterized by disagreement on how to perform a technical task or over using different terms in technical language. In many instances developers and researchers admit that natural language is not always a good vehicle for conveying what people want to build, cause there is ambiguity and inconsistency and as a result people often come out of the meetings with "different interpretations about how to build things". A characteristic of technical conflict therefore is that it impacts the design and development activity profoundly. One such conflict, which caused tension in the collaboration between university and manufacturers was the conflict over Content Manager (CM), a digital image archive, which serves to structure the data in the main database. This particular conflict is demonstrated in the following episode from transcribed fieldnotes:

Phase Zero, the proof of concept phase, starts with a big workshop about whether to use Content Manager (CM). This is a big debate. The University ComLab does not want to use CM. The large Manufacturer does, it's one of their tools and they want to try it on the project although they do not admit they are measured for using their tools. CM is too big and there are concerns the NHS would never buy it, as many people say at the ComLab. So, there are many interactions via email on CM, which are just going nowhere. Then, they decide to have a big face-to-face meeting, where both parties back down. They decide to use a light version of CM, but the Com Lab principle investigator will always say: "we conceded". In order for the Manufacturer to convince ComLab, the designer of Content Manager himself from Silicon Valley is dragged into the workshop to explain things!

The conflict is somehow resolved and the Solution's Activity System can develop because the team managed to overcome the particular technical stalemate. Drawing on CHAT, this is a tension between subjects and tools, which impacts on the object, their collaboration to move forward with the prototyping activity. This conflict is resolved through setting up their first workshop and the team now starts using workshops for the purpose of overcoming technical stalemates. In that respect, technical conflict is a type of conflict, which promotes expansive learning and therefore it is considered as *developmental conflict*. Most technical conflicts have proved to be developmental conflicts.

b) Conflicts on Vision and Drivers are characterised by awareness in the Solution Team of different viewpoints on what the project is to deliver. These conflicts impact on collaboration and they are normally manifested between project parties, i.e. at organisational level. This type of conflict is exemplified in the following interview texts:

" *We are not interested in what is clinically useful, but we want to be technically sellable"* (says the team leader of the large manufacturer).

"In all meetings it is revealed manufacturers want to deliver something that works, whereas we want to solve some real problems"
(says the Principle Investigator of the project at the University ComLab).

This type of conflict does not get resolved overtime and therefore causes the Solution Team's activity system to under-develop. In CHAT terms, this is a tension between subjects and the rules for engagement on the Project, which has not been mediated effectively and therefore causes the object to fragment. Importantly, it illustrates that parties have different objects. The University seeks to innovate whereas the manufacturers want to build a solid system fast enough, which entices the NHS to explore it as a possibility for its future systems. And this results in the object to appear rather fragmented. Collaboration between project parties remains highly problematic as it is hard for them to see through the interests and politics of their parent organizations. Although these conflicts are classified to occur between parties, they are often transferred at the inter-personal and individual level accentuating internal contradictions. Such a tension is manifested in the following episode from transcripts of an audio-recorded work meeting:

> *Developers are in a rush: they need to show deliverables to their superiors. One says they need to start showing quick progress on the solution. The team leader of the University ComLab says that researchers need papers out of this Project. One of the research assistants explains to developers that in order to be a good academic, one needs at least four publications per year and that they will have to provide for that in terms of project time.*

This episode demonstrates how a Vision and Drivers conflict transcends the organizational and institutional levels to have an impact on interpersonal collaboration. We observed that these conflicts do not seem to get resolved overtime and this leads us to argue that they do not promote expansive learning in the Solution Team. So far, they tend to be non-developmental conflicts.

c) Project scope conflicts emerge though disagreements on whether to accept a change in project scope, they take place between parties and they denote clash in organisational interest. The first of these conflicts to occur in the Solution Team is described in the following episode:

> *On June 4th a conflict emerges with regards to the involvement of G2, a US digital mammography pioneer, on the project. As people are discussing around the table development of clinical applications on the workstation, the*

representative of the software manufacturer reveals his company is just about to sign a partnership agreement with G2. This triggers the reactions of the large manufacturer team leader: "as far as this project is concerned, this is a major change that can have a significant impact on the architecture: we are not ready for this". So, this prompts the Project Management to bring the issue of this change at the Project Board. And this is how the team decides to use -from now onwards- a Change Request Mechanism, where request for a change on the project's scope is submitted, people evaluate its impact and they adopt it or they reject it so that they can move forward.

This conflict is resolved. The activity system can develop because this is a tension between subjects and the rules for engagement, which is mediated effectively by starting to use the Change Request Mechanism, a tool for monitoring project scope. The Project Manager notes: "Working with G2 was never in the original scope. What we did not want to was to have things input into the project without evaluating this impact". We wanted to use the Change Request Mechanism as a baseline, so that we all agree what we're trying to do here once we got the critical success factors confirmed". The Change Request Mechanism has been used at three more instances during the development of the Solution Team's work and thus it has proved solidly functional to evaluate the impact of possible changes. Due to the emergence of this tool, Project Scope conflicts are mediated effectively. In this view, these are conflicts which are observed to promote expansive learning in the Solution Team as they enable the collaborative working activity to expand. Therefore, the project scope type of conflict qualifies as *developmental conflict.*

An attentive look at the previous two conflict types reveals that in terms of CHAT theorization they are both stemming from tensions between subjects and the rules for engagement impacting the object. However in the course of the Solution Team's work the first was not resolved whereas the second was resolved. This can be explained as follows: the team has not managed to invent instruments to mediate vision and drivers conflicts so far although everyone is aware of how detrimental these are in the context of daily collaboration. In the second case, the Change Request Mechanism emerged as a good tool to resolve project scope conflicts, but it was not invented by the team. It was rather "borrowed" as the Project Manager had used it in similar cases before.

Thus, the matter of concern is to provide for the possibility of accessing or inventing instruments to treat different tensions. Another explanation might be that diverting from the rules for engagement in the second case has consequences which clearly have an impact on project institutions and this renders stakes very high. So the there is an imminent need to resolve it. Whereas, in the first case, tensions tend to transfer at the individual level, which means that action is restricted to argumentation during project meetings, which is not resolved. This demonstrates how developments in external but interacting activity systems influence the development of the Solution Team's object profoundly.

d) Personal conflicts are characterized as awareness of interpersonal incompatibility and they include affective components such as feeling tension and friction among group members. The following episode from transcribed fieldnotes presents one such conflict and how it impacts on the evolving object: collaborate to build a clinically meaningful system.

> *During coffee break, some of the people in the team express a concern with one of the Research Assistants in the clinical team promising radiologists things they won't be able to deliver. The project manager -when asked- responds they now need to stop that premise before it gets out of control. But communicating with this research assistant becomes worse as the project proceeds. Due to his rough behaviour and arrogant style the others are reluctant to engage with him whenever he joins their meetings. As he tends to raise the clinical expectations of the project without considering the technical implications, this starts to enervate people in the Solution team. As a result of his insistence and arrogance he gradually becomes stigmatized. Many people declare they cannot work with him harmoniously because he talks a different technical language, he promises things they find impossible to deliver and he cannot be trusted. By the middle of November this begins to have an impact on the project. He is now isolated by the others, who have moved on with the technology and do not pay any attention to his remarks. One of the principle investigators explains to him openly that he's got to see things differently. Although at the beginning he was regarded almost as an expert by the others, now his views seem trivial. As he happens to be a critical link between the technical people and the clinicians, this stream of the*

team's work starts now to suffer. At the Requirements meeting of 10th November, this research assistant sadly notes: "radiologists have the impression the project does not listen to them anymore". No one responds to his remark, not even the project manager. People neglect him.

This conflict is not resolved and it causes the activity system to under-develop as a channel of communication between the technical and the clinical side weakens overtime. In CHAT terms, this is a tension between a subject and the rest of the community, which causes the object, getting a clinically meaningful outcome out of this project, to contract. Personal conflict is not effectively mediated and thus it does not promote expansive learning in the Solution Team's activity overtime. Personal conflicts prove the most difficult to resolve. It is revealed the activity system lacks instruments to foster interpersonal communication. Maybe this is the case because such instruments emerge out of the dynamics of human interaction and thus need to be invented rather than borrowed from an external source.

e) The division of labour type of conflict is characterized by disagreement over assigned tasks and incompatibility due to lack of human resources. These occur both between parties and group members. The following episode demonstrates how this type of conflict appears like in practice:

During this early phase of the project, when the architecture needs to be defined, all members of the technical solution team have to write documents to devise steps for the different parts of the designing activity. Work gets very analytical. However, some of the developers are not used to writing documents and complain that delivering documents keeps them from the real stuff: writing code. In one of the weekly progress review meetings (18/4) one of the University principle investigators tries to convince developers that writing documents is an essential part of doing research. At the very end of the meeting, the manufacturer team leader says: "maybe we should discuss what we mean by research here" but the issue is left unexplored. When I approached him he said that he is a doer and does not find any interest in either writing documents or in doing project management.

This conflict was resolved and the Activity System expanded due to the installing and starting using a TWiki tool, an online collaborative text tool serving as the Solution Team's digital briefcase. TWiki served as a digital knowledge repository, which prompted all members to post their documents online thus serving to commit them in delivering written work and also to render that work accountable against the views of other members. So, this particular division of labour conflict is effectively mediated through initiating a new tool, TWiki. This energized expansion of the team's activity and therefore the particular conflict, which led to the introduction of a new instrument is considered a *developmental conflict*.

f) Conflicts over organisational commitment are conflicts between members and parties, which are characterized by awareness of controversy because work is not delivered according to schedule. We observed such conflicts to take place within the Solution's activity system twice. The first was when there was much concern about the results of the requirements capture exercise. This triggered a conflict between specialists inside the University ComLab. It was resolved by scheduling more time and resources than it was agreed in the initial proposal to create a new cross-functional requirements team. This team began to gather on a weekly basis and delivered a series of user requirement documents, which were decisive for the Solution Team to proceed. It can be explained as a tension in the community about the division of labour, which caused the prototyping activity to stagger over several months. Starting to use this new face-to-face team enabled the activity system to develop and the conflict was resolved. This was thus a conflict promoting expansive learning in the Solution Team. It qualifies therefore as developmental conflict.

In the second occasion the problem was with the small manufacturer. The following text from a transcribed ethnographic interview is indicative of that conflict:

> *"The fundamental problem is organizational commitment. The important thing now is the applications that sit in front of the Grid and the finger is again pointing at M2: You need to deliver this by this date.*

This conflict is not resolved and the Solution's activity system cannot develop. It is a tension in the community about the rules for engagement. It has not been mediated effectively and this causes collaboration over designing and developing to distabilise

four almost three months. An interview with the Project Manager reveals that if the Collaboration Agreement is signed, this could be used as “a stick” to enforce project demands on Manufacturer 2, who is now interested in intensive commercialization and not research, especially after being taken over by a US big firm. The Collaboration agreement could be a tool to energise expansive learning in this case and this indicates that expansive learning might occur not only through assertive (TWiki, Change Request Mechanism) but also through enforcement mechanisms. This type of conflict for the time being qualifies as non-developmental.

Even though this conflict is manifested at the inter-organizational level, it originates at the individual level. This is clearly illustrated in the case of the CEO of the second manufacturer, a leading academic, who also happens to be the project’s Principle Investigator. He is obviously in a conflict of interests situation arising from the duality of his role: to back the strategy of his company but also to deliver a system’s prototype for the project. This renders the Solution Team’s effort to invent a resolution mechanism even harder. At the end of the day, the most difficult conflicts to resolve prove those, which relate to individual identity and organisational identification.

6 Conclusion

In this paper we focus on analysing the value of different types of conflict in promoting or not promoting expansive learning. Even though the subjects in the activity system we studied have accumulated large amounts of specialist knowledge and they are experienced with most of the practices needed to develop the new system these are not enough to produce the anticipated outcome. Processes such as contradictions, tensions and conflicts must be considered in order to develop a HPWS. Our analysis revealed the role of developmental conflicts in promoting expansive learning. Findings indicate that creating a HPWS requires having a clear understanding of the object of the activity through mobilization processes of enrolment and negotiation within the activity system. At the end of the day, what we wish to propose is that HPWS be conceptualised as evolving socio-cultural objects, which are dynamic in nature rather than static economic objects based on sets of prescriptive features as Ashton and Sung suggest (Ashton and Sung, 2002). What managers and researchers of HPWS need to understand therefore is ontogeny. This runs contrary to current theses in the HRM literature, which emphasise efficiency and effectiveness without paying sufficient attention to the management of developmental processes, notably the inherent

conflictual nature of innovation in workteams. In the HRM literature, teamwork is often thought of as being rather consensual. And the notion of teamworking skills implies that there's a set of specific skills, which enables you to interact with people. Actually one of the essences of good teamworking may actually be that members ague, so there's conflict because that conflict leads to the development of the activity system. The notion of conflict is there in Activity Theory, but is all conflict necessarily good conflict for the purposes of expansive learning?

References

Appelbaum, Eileen, Bailey, Thomas, Berg, Peter and Kallberg, Arne (2000) Manufacturing Advantage, Ithaca, Cornell University Press

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

Barley, Stephen and Kunda Gideon (2001): Bringing Work Back In, Organization Science, 12(1), 76-95

Boulding, K. (1963) Conflict and Defense, New York: Harper & Row

Dewey, J. (1910) How we think, Boston, D.C. Heath&CO

Edwards, R.J. (2002) Mobilizing lifelong learning: governmentality in educational practices, Journal of Educational Policy, 17, 3, pp 353-365

Engeström, Yrjö (1987): Learning by expanding: an activity-theoretical approach to developmental research, Helsinki: Orienta-Konsultit

Engeström, Yrjö (1999): Innovative learning in work teams, in: Engeström, Yrjö; Miettinen, Reijo and Punamaki, Raija Leena. (Eds.): Perspectives on Activity Theory, Cambridge: Cambridge University Press, 377- 404

Engeström, Yrjö (2004): Theorizing Transformations in Practice: an Activity-theoretical Perspective, Seminar Paper at the Information Systems Department, London School of Economics, 22nd January 2004

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

Fenwick, T. (2003) Anchoring the object of innovative knowledge: learning in portfolio work. Paper presented at the 3rd International Conference on Researching Work and Learning, Tampere, Finland. July 25th –27th 2003

Foot, K.A. (2003) "Pursuing an Evolving Object: A Case Study in Object Formation and Identification" *Mind, Culture and Activity*, 9 (2), 132-149

Geertz, C. (1973) The Interpretation of Cultures, New York: Basic Books

Green, Francis; Mayhew, Ken and Molloy Eamonn (2003): Employer Perspectives Survey, London, Department for Education and Skills (DfES)

Guest, D and King, Z (2002): Voices of the Boardroom, London, CIPD

Jehn, Karen and Mannix, Elizabeth (2001) The Dynamic Nature of Conflict: a Longitudinal Study of Intragroup Conflict and Group Performance, Academy of Management Journal, Vol 44, No 2, 238-251

Mintzberg, H and Mc Alexandra (1985) Strategy Formation in an Adhocracy, Administrative Science Quarterly, 30, 160-197

Leander, Kevin. M. (2002) Polycontextual Construction Zones: Mapping the Expansion of Schooled Space and Identity, Mind, Culture and Activity, 9(3), 211-237

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

Punch, K.F. (1998) “Introduction to Social Research”, London: Sage

Reich, Robert (1992): The Work of Nations: Preparing Ourselves for the 21st Century Capitalism, New York: Vintage Books

Spillane, J.P., Halverson, R. and Diamond, J. B. (2000) “Investigating school leadership practice: a distributed perspective” *Educational Researcher* 30 (3), 23-28

Stake, R.E. (1995): The Art of Case Study Research, Thousand Oaks, Sage

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

Wertsch, J.V. (1991) Voices of the Mind: a sociocultural approach to mediated action, Cambridge, Harvard University Press

Yin, Robert K. (1994): Case Study Method, Thousand Oaks: Sage

Table 1. Episodes of Conflict Types: Developing a classification using CHAT

Conflict Type	Characteristics	Transcribed Fieldnotes from Audio-recorded Work Meetings	Transcribed Texts from Ethnographic Interviews	Impact of Conflict on Activity System	Value of Conflict for Expansive Learning
Technical	• disagreement over technical task • between project parties • impact on prototype D&D activity	M1 developer proposes to use Content Manager (CM) in the database design. University researchers seem skeptical. Then their team leader objects. He says CM is too big and the NHS would never buy it. M1 team leader pursues it more.	"We had so many interactions via email on CM, which were just going nowhere". "I'll always say we conceded on that one"	Conflict Resolved. Activity System can develop HOW: this is a Tension between Subjects and Tools. They start using Workshops to resolve technical stalemates	Promotes Expansive Learning developmental conflict
on Vision & Drivers	• awareness of different viewpoints on what is the Project to deliver • between parties • impact on collaboration	Developers are in a rush: they need to show deliverables to their superiors. One says they need to start showing quick progress on the solution. University researchers say they need papers out of this project. One notes a good academic needs at least four publications per year!	"We are not interested in what is clinically useful, but we want to be technically sellable" "In all meetings it is revealed M1 wants to deliver something that works, whereas we want to solve some real problems"	Conflict not Resolved. Causes the Activity System to under-develop. HOW: It is a Tension between Subjects about the Rules for Engagement in the Project, which is not mediated effectively in the long run and causes the Object to under-develop	Does Not Promote Expansive Learning
Project Scope	• disagreement on whether to accept a change in project scope • between parties • clash in organisational interests	M2 team leader reveals his company is about to sign a partnership with a US digital mammography pioneer. This triggers the reaction of M1 team leader. He says this is a major change that will impact the architecture and they are not ready for this.	"Working with R5 was never in the original scope. What we did not want was to have things input into the project without evaluating this impact. We wanted to use the Change Request Mechanism as a baseline, so that we all agree what we are trying to do here once we got the critical success factors confirmed"	Conflict Resolved. Activity System can develop HOW: It is a Tension between Subjects and the Rules for Engagement, which is mediated effectively. They start using a Change Request Mechanism, a tool for rolling scope.	Promotes Expansive Learning *developmental conflict*

Conflict Type	Characteristics	Transcribed Fieldnotes from Audio-recorded Work Meetings	Transcribed Texts from Ethnographic Interviews	Impact of Conflict on Activity System	Value of Conflict for Expansive Learning
Personal	• awareness of interpersonal incompatibility • includes affective components such as feeling tension and friction • among group members	During coffee break some people express a concern with one of the clinical researchers promising radiologists things they won't be able to deliver. Due to his insistence and arrogance, he becomes stigmatised. In one meeting, he sadly notes radiologists have the impression the project does not listen to them anymore. No one responds to his remark, not even the project manager. People neglect him.	"And I say to Tim I have a problem I want to kill John and Tim says this is not a problem, it's a solution and everybody laughed"	Conflict Not Resolved It causes Activity System to underdevelop. HOW: It is a Tension between a Subject and the Community which clearly impacts the object: get a clinically meaningful outcome Not always effectively mediated.	Does Not Promote Expansive Learning
On Division of Labour	• disagreement over assigned tasks • incompatibility due to lack of human resources • among members and parties	Developers are not used to writing documents and complain that delivering documents keeps them from the real stuff: writing code. The principle investigator announces the clinical manager of the project is now gone for good: He fell in love and went to live in New Zealand. Most people around the table aren't surprised.	"I'm not that interested in writing documents or managing, you know, I'm a doer. I like building things like this operational model during summer" "It's also very evident things that were said to Ryan (CL) never actually went to the engineer building the application there. So we have a big communication problem"	Conflict Resolved the Activity System Develops HOW: It is tension between Com and DL. It is mediated via starting to use TWiki, an online collaborative text tool serving as their new digital bookcase. Conflict not Resolved The Activity System cannot develop. HOW: it is a Tension between Subjects and DL, not mediated.	Promotes Expansive Learning *developmental conflict* Does Not Promote EL
On Organisational Commitment	• Awareness of controversy because work is not delivered according to schedule • among members and parties	In one meeting people express disappointment with Company 2 not dedicating much effort and human resources to the project particularly since it's take over by a big US firm.	"The fundamental problem is organizational commitment. The important thing now is the applications that sit on the front (of the Grid). And the finger is pointing at M2: you need to deliver this by this date".	Conflict Not Resolved the Activity System cannot develop. HOW: It is a Tension in the Community about the Rules for Engagement. It is not mediated effectively so far.	Does Not Promote Expansive Learning