

## **Distributed Design Teams as Communities of Practice**

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### **ABSTRACT**

The role of the team in design has long been established. Indeed the sheer size of design projects and the consequent range of design skills required makes teams an essential component of most successful design projects today. However, with the ever-increasing globalisation of design and manufacturing, teams are less likely to be co-located, and are increasingly having to work across time and space in virtual teams (Castells 1996). This paper applies Lave & Wenger's concept of Communities of Practice (1991) to case studies from the European product design, aerospace and construction industries. The authors suggest that whilst technology makes distributed design working possible, it is social practice which can facilitate the sharing of experience and tacit knowledge most effectively. However within present practice the authors observe that there are often barriers to the development of a productive social learning environment.

## **Distributed Design Teams as Communities of Practice**

### **INTRODUCTION**

The role of the team in design has long been established. Indeed the sheer size of design projects and the consequent range of design skills required makes teams an essential component of most successful design projects today. However, with the ever-increasing globalisation of design and manufacturing, teams are less likely to be co-located, and are increasingly having to work across time and space in virtual teams (Castells 1996). Information technologies and specifically computer mediated communications (CMCs) are facilitating this shift. For many, the information communication technologies (ICTs) themselves are seen as the driving force behind in this phenomenon. However, this paper argues against such a technologically deterministic position.

The authors suggest that whilst ICTs may facilitate communication amongst distributed designers, this in itself cannot ensure successful group working. In fact the nature of the 'traditional' co-located design team—with its hierarchies imposed from above, and local level management—is not easily distributed through time and space. Consequently, the familiar structures of management, resources, and roles tend not to exist, and designers are increasingly expected to use their own initiative and resources (Robey, D., Khoo, H., & Powers, C. 2000). If this is the case how do such distributed design projects work effectively? This paper uses the framework of communities of practice (CoPs) introduced by Lave & Wenger (1991), and the notion of situated learning to examine whether the traditional team is in fact the most effective methodology for distributed design projects.

Using case studies from the European product design, aerospace and construction industries the authors argue that it is the less formal social practices found in communities of practice, as opposed to formal teams, which can facilitate the sharing of experience and tacit knowledge most effectively.

## KNOWLEDGE MANAGEMENT

Globalisation is fundamentally changing the way designers work. Organisations are turning to distributed design teams, which are seen as an effective and efficient means of bringing a range of knowledge and experience to specific projects. These teams can cut across national and organisational boundaries, as in the case of the aerospace industries where cost and complexity is such that design and development has to be shared across companies. For these teams to work effectively the knowledge which individuals bring to the group must be shared, and more importantly the group must develop its own knowledge whilst solving the problems associated with the brief—in other words the group must *learn* to apply its knowledge to the specific context of the project.

Knowledge is increasingly seen as an invaluable asset, vital to the success of organisations, and one which needs to be managed effectively. Information technology makes the capture of knowledge specific to particular domains (Sachs 1995), so-called 'hard' knowledge, relatively easy. However, 'soft' or experiential knowledge is not always easy to articulate or to capture. Yet it is precisely the articulation and indeed generation of this type knowledge which is so valuable within design groups and especially in distributed teams where designers must use their own resources and initiative in order to create knowledge.

## COMMUNITIES OF PRACTICE

Lave and Wenger (1991) first introduced the idea of CoPs in the early nineties. It is now regarded as a seminal concept in the field of education (Lea & Nicoll 2002), and many commercial organisations such as IBM and National Semiconductor have adopted the concept and put strategies in place to foster CoPs. To Lave and Wenger, knowledge and intelligence are highly context dependent and socially situated. To them knowledge can be seen to be distributed through social practices. Lave and Wenger (1991) described a CoP as: "...a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping CoPs".

In the period since Lave and Wenger first put forward their notion of communities of practice there have been many alternative definitions offered—many with specific relation to a commercial setting. Seely Brown and Solomon Gray (1995) suggested that:

"At the simplest level, they are a small group of people who've worked together over a period of time. Not a team, not a task force, not necessarily an authorised or identified group... They are Peers in the execution of 'real work'. What holds them together is a common sense of purpose and a real need to know what each other knows. There are many communities of practice within a single company, and most people belong to more than one of them."

Wick (2000) points out that CoPs have variable life spans, which are dependent upon need. They should form quickly and dissolve to promote cross-pollination of ideas among different groups. Squire and Johnson (2000) suggest that learning in communities of practice is not separated from the activity or the meaningful social arrangements in which the activity takes place.

Lave and Wenger (1991) described this process of acquiring knowledge through sociocultural interaction within the community—Legitimate Peripheral Participation (LPP). These concepts of CoP and LPP are grounded in the

notion of situated learning, which Lave & Wenger suggested: "...implied emphasis on comprehensive understanding involving the whole person rather than 'receiving' a body of factual knowledge about the world" (Lave & Wenger 1991). Thus, in CoPs it is culture (which includes the practice of the CoP) that is shared, and from this comes learning—as learning is seen to be an integral part of generative social practice in the lived-in world (1991). In situated learning 'meaning' is only given through the sociocultural practice of the community—just as language is only given meaning by its use within a particular culture (Morgan & Welton 1986). Learning cannot be separated from the sociocultural practice, and by inference "all engagement in social practice involves learning" (Lea & Blake 2002).

Jonassen (1994) defines situated learning as occurring when people work on authentic and realistic tasks that reflect the real world. In other words, knowledge is authenticated by its real world application and context. If knowledge is decontextualised then it becomes 'inert'—whilst a person may take in a new concept, she is unable to apply or utilize that because there is no authentic context for its use. For Lave and Wenger (1991) situated learning is a general theoretical concept which deals with relational character of knowledge and learning, and also the negotiated character of meaning. Thus, all knowledge must be situated within socio-cultural contexts, and participants negotiate the meaning of this knowledge through their experience of membership of a given community—moving from the periphery to the centre.

Of course learning is not something unique to educational contexts. Lave & Wenger explain: "learning through legitimate peripheral participation takes place no matter which educational form provides a context for learning, or whether there is any educational form at all" (Lave & Wenger 1991). Communities of practice are made up of 'old timers' and 'newcomers', the latter learning from the former by being allowed to participate in the social activity of the community. Eventually newcomers move from peripheral to full participation in the community. However, the learning that takes place within these communities is not simply a narrow passing down of practical skills, but a broad social learning achieved through legitimate peripheral participation. Communities of practice do not necessarily have to share location or recognisable social boundaries (Kimble & Hildrith 2000)—in fact often they will traverse traditional social boundaries. But CoPs do imply a shared purpose, and participation in activities of which all participants have a common understanding.

Wenger (1998) suggested that CoPs form out of necessity to accomplish tasks and provide learning avenues. They can exist within, between and outside organisations. Furthermore, CoPs form through sustaining mutual engagement in the pursuit of enterprise together, to the extent that significant learning is shared. CoPs are not 'formed'—rather they evolve out of members' usage (Liedka 1999). Wick (2000) also defines CoPs as being composed of people who share similar responsibilities and roles.

A key feature of CoPs is community knowledge, where the sum of this community knowledge is greater than the sum of the individual knowledge of members (Gheradi & Nicolini 2000). As Wick (2000) and Hildreth & Kimble (2000) assert, knowledge is one of the most valuable commodities any organisation possesses. Wick further suggests that it is not knowledge per se which is valuable, but rather the ability of participants to generate new and relevant knowledge.

## COMMUNITIES OF PRACTICE AND TEAMS

It is important not to conflate the traditional team with community of practice. Kimble & Hildrith (2000) draw a useful distinction between teams and CoPs. They suggest that legitimation is the key to genuine CoPs. In a team, legitimation is drawn from the formal hierarchy imposed by some form of management. Whereas in a genuine CoP, legitimation is more informal—members earn their status in the community which comes from their contributions. Whilst it is possible for a team to evolve into a CoP, CoPs cannot in effect be simply imposed on a

group. Looking specifically at commercial organisations, Kimble, Barlow and Li (2000) define a virtual team as: “a micro level form of work organisation in which a group of geographically dispersed workers is brought together to accomplish a specific organisational task using ICTs”. There is clearly a fundamental difference between this and the definitions of community of practice reviewed above. To get from the former to the latter one must consider two points, firstly what constitutes a virtual community, and secondly is a virtual community of practice feasible.

## VIRTUAL COMMUNITIES

Mentis et al (2001) suggest that learning communities, whether face-to-face or virtual, are brought closer through commonality and interdependence. Virtual communities use ICT to establish and maintain collaboration across space and time. Whilst traditional communities are situation specific—and tend to have clearly defined membership—virtual communities are task centred, and are formed as a need arises (Johnson 2001). Virtual communities do not experience much of the non-verbal communication which is a central aspect of face-to-face communication. Similarly they may often cross cultural boundaries—bringing together participants from cultures which have different norms of behaviour. Pallof and Pratt (1999) have defined the formation of virtual communities as a multi staged process. This includes the definition of the community’s purpose, and establishing norms and code of conduct, together with the establishment of member roles. This rubric used to ‘create’ a virtual community is useful as marking the distinction between a virtual community (which can be ‘created’) and a community of practice—which cannot be ‘created’ as such. Johnson (2001) further elaborates this distinction, suggesting that: “a virtual community is a group separated by space and time, and is in effect a designed community”. In contrast, a CoP is what may emerge from the designed community. Furthermore, a CoP will almost certainly use the community’s artefacts (technologies, processes etc.) in ways different from their original purpose.

## VIRTUAL COMMUNITIES OF PRACTICE

Many authors have raised the question: ‘can CoPs be virtual?’ (Johnson 2001; Pallof & Pratt 1999; Kimble & Hildrith 2000). Johnson (2001) suggests that if the goal is a virtual community of practice, one must firstly design a virtual community and hope that a CoP will emerge from within. If this is to happen, periphery to centre movement must be possible, together with a legitimate task oriented purpose for the CoP. Simply setting up a virtual community infrastructure will not automatically cause a CoP to form.

Johnson (2001) suggests that current web based and text based environments are conducive in allowing CoPs to form and operate as ‘learning entities’. Kimble & Hildrith (2000) assert that some aspects of CoPs such as common purpose or shared interest should translate from the co-located to the virtual world fairly easily. However, ideas such as narration, or story telling, might be less easy to transfer as the listener also requires their own soft knowledge to make sense of the information— therefore simply reproducing narration electronically might not suffice. Legitimate peripheral participation could be another concept which does not transfer well. Learning undertaken within LPP is situated, as is the problem solving. The success or otherwise of the move to a virtual CoP may depend on the reason for the situatedness. If members need to be co-located in order to work on shared resources, then Kimble & Hildrith suggest the transfer should be fairly straightforward. If however the learning is situated because face-to-face interaction is essential for learning how the job is done, then the distribution of the CoP will be harder to achieve. It is also suggested that the whole concept of peripherality may also be a problematic notion to reproduce virtually. For Lave and Wenger (1991) the periphery was social, yet in a virtual CoP there will also be a physical periphery which will have influence on participation. As such, Kimble & Hildrith raise the question of whether it will be harder to achieve legitimacy in a virtual CoP. Participation is central to the evolution of the community, and the key means of gaining legitimacy. If participation is restricted by the means of communication, it will be harder for the CoP to develop.

In case studies of virtual CoPs in commercial environments (Kimble & Hildrith 2000; Kimble, Li & Barlow 2000), face-to-face communication was found to be a very important component. In a study of a management team of IT support workers (2000) it was found that regular face-to-face (6 monthly) contact helped the group maintain momentum on projects, and that between face to face meetings momentum gradually declined. The members of the CoP felt that physical meetings allowed them to build relationships better than electronic meetings would. Also all members regarded having a good personal relationship with the other members as essential—and these relationships carried the community through the periods of electronic communication. Another practice which produced very positive results was the sharing of a document within the CoP and across physical boundaries. A planning document was worked on by several members of the community across various sites over a period of time. It was felt that this in effect produced a living document which grew and matured over time with input from various members. The completed document was eventually adopted as a planning strategy for the management team (Kimble & Hildrith 2000).

## EMPIRICAL STUDIES

This work contributes to an ongoing EPSRC funded research project aimed at providing future scenarios for distributed design teams in the aerospace, construction and product design sectors. The final outcome will make recommendation make for innovation and improvement in the use of distributed design teams.

This study is being addressed as follows:

### INTERVIEWS

A series of semi-structured interviews with designers from TTP, PDD, Design Council, IDEO, Tangerine, YooMedia and Seymour Powell were undertaken. The purpose of this was to investigate current working practice in the product design industry and identify future sector drivers.

In addition, existing tools (IT and design specific) used by design teams to enhance distributed working were investigated.

### DETAILED CASE STUDY

A detailed study of current design team characteristics for both co-located and distributed working, is now being undertaken through observation and interview on two design projects in each industry sector.

### FINDINGS

From the initial data collection the following issues have been identified:

#### 1. NATURE OF PROJECT

- It was found that the more conceptual a project is, the more face-to-face communication is needed to be sure that everybody concerned fully understands.
- The more innovative and radical a concept is, the more face-to-face contact is needed—again, to be sure of a common understanding.
- The shorter the project timescale, the greater the need for 'real time' communication. This allows for a more rapid response to any issues arising.
- It was found that when problems occur, more 'dwell time' is required to address them.
- A lack of client knowledge requires more face-to-face contact to aid the clients understanding.

## 2. NATURE OF RELATIONSHIP

It is essential to have face-to-face contact at the start of a project with new clients. It was found that a development of 'trust' is required, and this can only be achieved through face-to-face communication.

With new client's, formal communication etiquette is needed at the start to help portray a familiar, professional image of the design company. This is important as some design consultancies have a very informal approach to design, helping innovative concepts to be achieved. However, if a new client was to see this on the first visit, they may not understand its importance and potentially perceive it in a negative way. In light of this informal emails at the outset of a project can therefore be detrimental to relationships.

## 3. STAGE IN THE DESIGN PROCESS

- Engineering specifications that are detailed and methodical are easier to deal with remotely through IT/Email exchanges than more conceptual issues arising in the early design stages.
- Relationships need to be handled according to the stage of the development process.
- Formality is necessary at the beginning of a new projects.
- Face-to-Face communication is essential at critical decision stages.
- Frequent information needs to be supplied regularly

Throughout the process.

- Process needs to be developed according to the project needs. People types need to be allocated accordingly to the process stage and therefore communication determined according to stage and people requirements. Broadly speaking, the more methodical the task, the more remote the form of communication can be.
- Cost/value analysis of form of communication related to type of information exchange is required at various stages of the project.
- A shared vision is required at outset.

## 4. COMMUNICATION

- Secure access to documentation is essential.
- All work must be archived appropriately.
- Offline communication is important. E.g. photocopier/water cooler discussions.
- Tools need to be simple.

## CONCLUSIONS

It is clear from these empirical studies that the concept of distributed CoP's can offer insight into the way distributed design teams function. One of the key findings identified in the study was the importance of face to face contact at certain points within the life cycle of design projects. Firstly, face-to-face contact was identified as essential at the outset of a project where new clients are involved. We suggest that this relates to trust

between client and designers. The two parties are variously investing money, reputation and potentially future corporate survival into these projects. Under such circumstances *both* sides were observed to need the familiarity of face to face protocol before making a commitment to the project.

At this stage there is no CoP in operation, whilst there may well be 'old timers' and 'newcomers' involved they are not yet operating in terms of a shared common purpose (the project) and so periphery to centre movement is not established. Following face-to-face meetings, the group effectively moves into virtual team mode where formal hierarchies (particularly the client/supplier relationship) are still important. This was further evidenced by instances of 'over familiar' emails adversely affecting relationships early in the life of the project, and in the case of some consultancies which work very informally, where frequent internal meetings were needed in order to maintain shared vision on the project.

Similar features were evident in the cases of highly conceptual or more radical projects, where more face-to-face contact was required to ensure that a common understanding emerged. Working towards a common purpose is a key feature of CoP's, and with these more radical/conceptual projects, it took longer to establish such purpose and also required more face to face contact to maintain it. The same situation was also identified in cases where client knowledge lagged behind that of the designers/consultancy.

This study confirms the findings of earlier studies (Kimble & Hildrith 2000, Hildrith, Kimble, & Wright 200) which identified some face to face contact as being a central component in the formation and maintenance of distributed CoP's. Furthermore, the study has shown that the traditionally hierarchical client/supplier relationship presents significant barriers to the evolution of distributed CoP's. This issue also manifests itself in the notion of common purpose—theoretically essential to any CoP. The client/supplier relationship (i.e. client is uninformed/supplier is motivated primarily by fees), can be very hard to get away from. In such a climate it can be difficult to propagate a sense of common purpose. Clearly if CoP's are to be successfully propagated in distributed design teams this issue will need to be successfully addressed, as will the notion of periphery to centre movement. Other issues identified in the study as problems or potential problems included a concern that the informal office 'photocopier discussion' would be hard to reproduce virtually. Here again further work will need to be done, possibly trialing the integrated discussion tools (virtual whiteboard, asynchronous/synchronous discussion boards etc) provided in readily available commercial Virtual Learning Environments.

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Along side his work at the University Andrew is a practising designer, working on a number of product design and development projects.