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EXPLORING NEW FORMS OF ONLINE COLLABORATIVE DESIGN: WORKSHOP DISCUSSION PAPER

E. Bohemia, M. Blythe, L. Cruickshank, N. Fain, A. Kovacevic and J. Steane

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1. Introduction

A large body of research has signalled the shift from a linear and hierarchical model of product development, where everything happened in proximity, to a model of decentralized and dislocated product development, characterized by virtual partnerships [Lin and Lu 2005], [Ma and Davidrajuh 2005], [Pawar and Dharifi 2000] and the dispersal of the design process. The new global division of labour means that product development teams are now scattered across the world as they contribute to the different components of the same commodity. Proliferation of Information and Communication Technologies (ICTs) is enabling product development team members to work virtually 'together' while distributed around the globe [Ernst and Kim 2002], [Gratton 2007]. O'Sullivan [O'Sullivan 2003] argues that organising virtually has the potential to greatly reduce costs, particularly in relation to personnel disruption and travel. He also argues that it makes available: *...a world-wide pool of potential partners, thereby giving access to a wider range of competencies than otherwise and perhaps more flexibility in the terms under which development risks are shared...* [O'Sullivan 2003], (p. 94).

Recent report suggested that the globalisation is impacting on all workers engaged in knowledge production [Diamond et al. 2011]. These changes mean that these workers, including designers, will need to cultivate additional skills in addition to those required in a traditional work environment [The Design Skills Advisory Panel 2006].

These current trends of organisations increasingly undertaking new product development activities by distributed design team members inspired an idea to conduct workshops with aim to explore what it means for designers to work in this type of work environment and what roles and skills they might need to operate in virtual networked world.

The purpose of this paper is to initiate discussion and to use it as guide for the proposed workshop on issues in distributed cross-institutional and cross-disciplinary design. In order to do this, the paper overviews issues associated with undertaking design by distributed product development teams. First, we outline the context of why design is undertaken by distributed product development teams. Then, we describe the issues associated with distributed teams. Afterwards, we discuss some of the challenges faced by designers when undertaking product development within distributed product development teams. We suggest that many of the challenges are associated with 'distances' on dimensions of time, technology, geography, culture, and discipline. Finally, we outline the proposed workshop activities.

2. Background – context

The increasing globalisation of the production, distribution and consumption of goods and services is both the condition for, and the consequence of, major changes in the ways consumer products are developed and manufactured [Department for Business Enterprise and Regulatory Reform 2008], [du Gay 1997], [Reich 1992], [von Hippel 2005]. These changes include an emphasis on increasing flexibility of production, reducing product development time and enhancing quality (e.g. [Bohemia 2002], [Ernst and Kim 2002], [Harvey and Griffith 2007], [OECD Committee on Industry and Business Environment (CIBE) 2002]).

It has been suggested that: 'Through advances in ICT and efficiencies in production and logistics, global supply chains are becoming more disaggregated and open to greater competition. A country which understands and specialises on specific parts of the supply chain can grow in competitiveness and gain access to new markets' [Cutler 2008], (p. 46). Indeed, it is claimed that 'recent developments in ICT, such as Web 2.0, computer aided design and rapid prototyping are impacting on the design processes and in turn are changing the skills requirements of designers'. [European Commission 2009], (p. 19).

Engardio and Einhorn [Engardio and Einhorn 2005] provide examples of consumer electronics companies such as HP, Nokia, Nikon, Canon, Sony and Apple who engage other companies to undertake the majority of their product development. Thus, product development in these companies is often cross-organisational. For example, the Apple iPod is manufactured by subcontractors who source components from around the world, which in turn are designed by other companies such as PortalPlayer [Kahney 2004], [Leonard 2005]. Thus, the trend of moving production offshore, the increased cost and complexity of new product development, and advancement in information and communication technologies (ICTs) and manufacturing technologies, are contributing to the design development of products to be undertaken with partners in geographically distributed settings [Asokan and Payne 2008], [Bohemia and Harman 2008], [Gann and Dodgson 2007], [Hinds and Bailey 2003]. These type of arrangements are known as 'virtual organisations'. O'Sullivan [O'Sullivan 2003], (p. 94) describes a virtual organisations as having: *...diverse project membership conducting much of its work across time and space boundaries and mostly through horizontal communication enabled by distributed technologies…*

Recent report by European Commission [European Commission 2009], (p. 6) states that 'companies must adapt to globalisation, increasing competition and diverse consumer demand. Innovation is a key driver of competitiveness and economic growth, and part of the solution to environmental and social challenges.' The report asserts that the 'Design is an important part of the innovation process. Research shows that design-driven companies are more innovative than others.' [European Commission 2009], (p. 14). For example, 'in view of growing competitive pressures on global markets, the [European] Commission has developed a research strategy for the design and development of consumer-centred and personalised products in manufacturing. It aims at the development of tools that enable the design of products everywhere — with the customer as co-designer — and the manufacture of these products anywhere in the world.' [European Commission 2009], (p. 52). As a result product design development team members could be working in cross-cultural, cross-disciplinary and cross-institutional teams whose interactions are mediated by ICTs (e.g. [Brandl and Neyer 2009], [Hinds and Bailey 2003], [Zakaria et al. 2004], such as Web 2.0 technologies [Cutler 2008].

Despite significant technological advances distance still matters in collaboration particularly in corporate contexts [Cherian and Olson 2007]. Previous projects undertaken between School of Design at Northumbria University with external commercial collaborators confirm that at distance collaboration remains difficult because of complex issues such as protecting intellectual property, organisational IT policies and cultural differences [Bohemia et al. 2010]. Although, the UK design sector is clearly creative, I has been suggested that the workforce lacks diversity and is therefore ill-equipped to work in increasingly multi-cultural and global markets' [The Design Skills Advisory Panel 2006], (p. 10). This is supported by research which suggests that it is often a complex challenge to successfully negotiate cross-cultural and cross-organisational exchanges [Diamant et al. 2009], [Kono and Lynn 2007].

At this time, literature and discussions on how ICT is impacting on the new product development activities is not unified. For example, on the one hand, it highlights the potential of distributed mode of product development in the sense of higher levels of creativity and innovation [Felgen et al. 2004], (p. 1476). On the other hand, it also points to some of the challenges associated with the geographic distribution of workgroups, i.e. intersection of organisational, cultural and disciplinary boundaries in virtual product development teams [Nambisan 2003]. It would be important to understand these intersections as it is claimed that social and cultural aspects of individual design team members play a significant part during the design process [Strickfaden 2004].
Additionally, the Design Skills Advisory Panel [Design Skills Advisory Panel 2006] in the UK suggested that:

> *...'working globally and in partnership (both remotely and face to face) with overseas designers and suppliers will require language and communication skills that go way beyond current needs, while designing in, and for, different cultures and contexts will stretch designers' abilities and methodologies to the limits.'*

2.1 Challenges

While the literature highlights the potential of distributed mode of product development, it also points to some of the challenges associated with the geographic distribution of workgroups. For example, as highlighted above there are multiple challenges for the development of collaborative relationships in virtual organisations, as boundaries that were formerly more distinct in more traditional forms of organising begin to intersect.

2.1.1 Physical and Virtual co-locations

Sharifi and Pawar [Sharifi and Pawar 2001] propose that physical co-location differs from virtual co-location on a number of characteristics (Table 1).

Table 1. A comparison of the typical characteristics of physical or virtual co-located design Source: [Sharifi and Pawar 2001]

Physical Co-location	Characteristic	Virtual Co-location
Close	Physical Proximity	Remote
In small and medium sized companies with one or few sites	Typical Use	Multi-national and International organisations with different sites
Limited variety of cultures, since the team members may come from same company site	Cultures	Different people from different countries or sites, with a variety of experiences
Opportunity for sharing formal and informal information (ideas, dilemmas) between team members	Information Exchange	Limited opportunity to share informal information because of the dispersed location
Ample opportunity for face-to-face interactions	Relationships	Limited opportunity to interact and build relationships
An evolving common sense of purpose	Purpose	A directed common sense of purpose
Ample opportunity for sharing of resources (technical, human, financial)	Resources	Limited access to similar technical and non-technical resources
Fewer hiccups due to possible sharing of technical systems	Technology	Possible problems in terms of hardware, software and resources, due to variation in technical systems
A higher sense of belonging within the team	Working Environment	Feeling of isolation, and frustration, and possible absence of sense of belonging
Availability of information at anytime to every member	Accessing Information	Limitation in time and space for accessing information
Greater visibility of the design work	Transparency of design activities	Lack of visibility of work being carried on by the group
Similarity of work method and employment	Educational/ Training background	Differences in education, language, training, time orientation and expertise
A lower degree of empowerment and closer supervision	Empowerment and Management of the team	A higher degree of empowerment and delegated authority and looser control

It would be important to understand these intersections as it is claimed that social and cultural aspects of individual design team members play a significant part during the design process [Strickfaden 2004]. However, Strickfaden [Strickfaden 2004] also states that the relationship between the design process and the social and cultural aspects is not well understood. This is re-echoed by Felgen et al. [Felgen et al. 2004], (p. 1476) who argue that a potential benefit of 'the diversity of viewpoints in intercultural design teams is that it could support creativity or lead to more innovative products'. This has implication when undertaking design in international distributed design development teams.
In addition, challenges associated with distributed teams might be related to complex amalgam of sometimes incompatible communication technologies across virtual organisations [O'Sullivan 2003], [Zakaria et al. 2004]. Indeed, companies and design consultancies that are operating globally are finding work in distributed international settings challenging. This suggests that the shift to virtual teams and the subsequent dispersal of design processes may not always be a seamless transition [Bohemia and Harman 2008]. It was reported that design teams operating in distributed settings have experienced the following problems:

- They struggled with the long term planning for their projects and coordination that was required for the magnitude of the projects [Adams 2002], [Kristensen 2004], (p. 124)
- They lacked knowledge of using current tools, information and communication technologies [Kaplan et al. 2000], [Rogers and Rodden 2004]
- They lacked understanding of how to share ideas, documentation and materials [Bilén et al. 2002], [Jänsch and Birkhofer 2004], [Svengern 1998]
- Poor interpersonal skills [Buffinton et al. 2002], and
- Weak intercultural communication abilities [Birkhofer and Jänsch 2003], [Felgen et al. 2004]

In addition, Hinds and Mortensen [Hinds and Mortensen 2005, p. 302] proposed that 'it is not yet clear how distributed team dynamics compare to those of collocated teams'. Global virtual teams 'continue to face a complex interplay of challenges of technical, organizational and cultural nature' [Damian 2003], (p. 179).
In addition, a research suggests that feedback provided between the geographically separated groups tended to be either written or verbal [Bohemia et al. 2009]. This raises the question of how might designers be encouraged to use visual modes of communication to communicate ideas and provide feedback? Studies such as these would contribute to a better understanding of the ways designers use information and communication technologies in a distributed design setting.

3. Aims and objectives of the proposed workshop

While product development processes are increasingly distributed, very little is known about virtual product development in distributed workgroups (e.g. [Altenkirch et al. 2003], [O'Sullivan 2003]) and various authors advocate that further research is required [European Commission 2009], [Sharifi and Pawar 2001], [Thomson et al. 2007] especially in the area of 'translating knowledge' [Ernst and Kim 2002], [Leonardi and Bailey 2008]. In order to explore this important topic the workshop will aim to involve participants with diverse disciplinary backgrounds. The idea is to harness the diverse thinking and experiences instilled amongst the network participants in order to generate new research questions that intersect across participants' boundaries.
The major aim of proposed workshop is to build on this challenges and to stimulate new debates around how designers, who undertake design in collaboration with cross-institutional, cross-cultural and cross-disciplinary team members, are 'translating' knowledge using digital technologies in order to communicate their ideas and concepts to their counterparts located in other institutional and geographic locations [Kono and Lynn 2007]. This is an important aspect as it will provide a platform to further explore how ICTs, such as Web 2.0 technologies are transforming designers' practices. For example, the workshop will aim to explore what new opportunities digital technologies are opening for 'designers' in areas of interaction, information sharing, communication and creativity. Examples include co-design with design development team members and/or with potential end users located in different geographic locations, as well as the development of new opportunities in creating virtual industry-academia partnerships to boost innovation [Fain and Kline 2011], [Horváth 2006],

[Kovacevic 2008]. The major focus within the workshop will be on knowledge translation in the changing design processes.
For the purposes of this discussion paper, Knowledge Translation is defined as a process that takes place within a complex system of interactions between designers and knowledge users which may vary in intensity, complexity and level of engagement depending on the nature of the research and the findings as well as the needs of the particular knowledge user [Giannakis 2008]. The workshop will aim to explore how digital technologies are affecting and changing this process within the area of New Product Development and innovation.
We are also interested to explore the intersection of different disciplinary and institutional cultures and their impact on distributed product development processes and how these processes are being transformed by incorporation of ICTs, such as Web 2.0. The need for such action is echoed by IBM's Nic Donofrio who 'points out that the innovation process itself is complex and changing in unpredictable ways, and involves new skills, technologies and organisational structures'. He points particularly to Web 2.0 technologies increasing social networking and the extent of engagement of users in producing innovations' [Cutler 2008], (p. 34).

4. Workshop activities

The workshop will facilitate inquiry amongst the participants around emerging forms of creative practices impacted by use of the ICT while working with product development team members at distance. This will be done through the following activities. The participants will be allocated to specific groups. Each group will map out design processes used by designers while collaborating with distributed team members with help of a facilitator. Two prompt research strategies will be used:

- Mapping the use of technologies during the different stages of the product development process in a distributed product development process.
- Examining which technologies product development team members find useful for information and concepts exchange and why.
- Considering how these technologies enable/constrain the successful completion of a product development process.

During this workshop the authors will aim to facilitate generation of initial research cross-disciplinary proposals amongst the workshop participants.
What? Participants will visually map the landscape describing their personal design practices when undertaking design within distributed design teams and then plot collectively the overall terrain of creative disciplinary space highlighting boundaries, intersections, and edges. We will examine closely the participants' individual knowledge translation and transformation processes when using digital technologies to communicate their ideas, feedback and concepts to their other design members or/and users.
Why? To examine current issues in knowledge translation while working in international and distributed design teams. We will aim to define the significant drivers of the participants' challenges associated with the described topic.
How? Workshop participants will physically co-create a number of unique visual maps of emerging forms of design practices undertaken by international distributed design teams. These maps will highlight disciplinary locations, movements, populations, edges and intersections. We aim to uncover individual participants' decision-making processes, drivers and movements in and across disciplinary boundaries with the support of a range of methods and tools including Issue-Based Information Systems (IBIS) [Cao and Protzen 1999].
Outputs Participants will create their own unique individual process map illustrating the key drivers and particular movement while working at distance across disciplinary, conceptual, theoretical, and methodological boundaries that are facilitated by digital technologies. Workshop participants will collaborate in groups to create a series of group maps of contemporary design practices illustrating key knowledge translation methods in international distributed teams facilitated by digital technologies.

5. Points for discussion

To start exploration and discussions with the workshop participants, possible points for discussion will include:

- How do members of the product development team from different disciplinary areas structure and interpret problems? What are the differences and similarities?
- How do product development team members from different subject backgrounds approach collaboration?
- How do organisational cultures impact on the way cross-institutional projects are conducted and their ability to be sustained?
- What challenges and opportunities do cross-cultural and cross-disciplinary teams provide for product development process and outcomes?
- How are product development processes managed in globally distributed design teams?
- How can the formal education of designers, engineers and other professionals be activated for effective engagement in distributed product development enterprises.
- What new opportunities are the digital technologies opening for 'designers' in areas of interaction, information sharing, communication and creativity?
- How are translating and transforming of design ideas/proposals from one medium to another affecting designer approaches?
- How might design processes change in response to these translations and transformations?

Additional question of on-going interest is how are existing technologies for collaboration actually used by designers in distributed teams? Additionally, the workshop will aim at exploring how the use of existing technologies, relevant for the design practice is changing within distributed design teams.

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Dr. Erik Bohemia
Northumbria University
Design Building
NE1 8ST Newcastle upon Tyne, United Kingdom
Telephone: +44 191 243 7724
Telefax: +44 191 227 3148
Email: erik@theglobalstudio.eu