Situated and Distributed Design

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ABSTRACT

Much attention within the design community has focused on understanding and supporting situated *or* distributed design. However, in the practice of design, including techniques such as participatory design, the relationship between situated and distributed design should not be considered an *or* relationship, but rather an *and* relationship. Furthermore, extending upon the notion of *distributed* we argue for two levels of distributed design 1) distributed in a collocated setting with other stakeholders; and, 2) stakeholders distributed across different geographical locations. In this paper we present an understanding of design, a review and critique of current design environments and a design environment we have developed– Public Social Private Design (PSPD).

Author Keywords

Design, Participatory Design, Sketching, Creativity, Technological Support, Public Social Private Design (PSPD).

INTRODUCTION

Design is a dynamic process – situated, distributed, synchronous and asynchronous (the space-time matrix). However, much research understanding and supporting design has scoped their work to one cell of this space-time matrix [e.g. 1, 2, 4, 5]. However, if we are to effectively support the process of design we need to consider all aspects of the space-time matrix. In this paper, we review and critique current design environments against a variety of studies we have conducted observing the process of design. Building upon our understanding and critique of existing tools, we present our own design environment - Public Social Private Design (PSPD) [6].

UNDERSTANDING AND SUPPORTING DESIGN

Many design environments have been developed to support situated-synchronous design. For example, the Environment and Discovery Collaboratory (EDC) [1], Caretta [5], and the i-LAND environment [4].

Figure 1. The Envisionment and Discovery Collaboratory (EDC)

The EDC [1] (Figure 1) supports the development of a shared understanding between Communities of Interest (e.g. users and designers). However, the EDC is constrained to an interactive tabletop, producing a public interaction space. This constrains the group composition of the design team. This can be detrimental to the design process. O'Neill [3] has shown that during the early stages of the design process users can be intimidated by designers, not wishing to appear unknowledgeable. Whereas designers wish to work through their ideas, preventing mistakes from being made and appearing unprofessional in front of users. Our own research [6] has shown how design teams dynamical switch between various group compositions – working on a design idea individually and then presenting it to the group. Such findings suggest we need to support the distributed nature of design team within a collocated setting with other stakeholders. This can be achieved through the support of the various group compositions of a design team – individual, sub-group and group compositions.
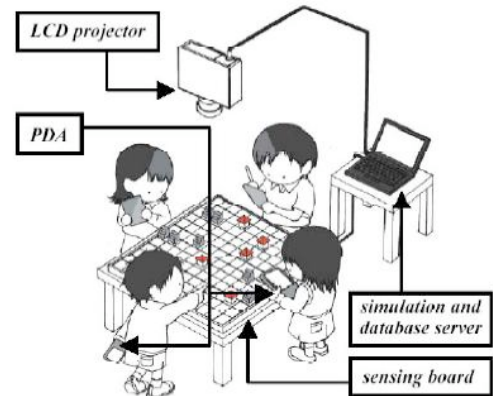

Figure 2. Caretta

Caretta [5] (Figure 2) and the i-LAND [4] (Figure 3) environment have progressed towards providing such support, providing situated-synchronous and situated-asynchronous design support. Caretta [5] expands upon the EDC, providing a personal interaction space for each member of the design team (e.g. a user or designer) through means of a PDA. However, no support is provided for the sub-group composition. The i-LAND environment [4] supports the various group compositions through the use of several 'roomware' components – DynaWall (e.g. group composition), InterTable (e.g. group composition), ConnecTable (e.g. sub-group composition) and CommChair (e.g. individual composition). However, as these technologies have been integrated into the existing architecture of the meeting room, it has created barriers between the interaction spaces and therefore the group compositions of the design team. For example, a stakeholder working in the CommChair cannot be within the same interaction space as either the ConnecTable or the InteracTable. Thus, particular combinations of architectural spaces and technologies impose barriers between different interaction spaces, potentially inhibiting the collaborative design process.

Figure 3. The i-LAND environment

The EDC [1], Caretta [5], and the i-LAND environment [4] have provided useful findings for the development of future design environments. Such as the development of a shared understanding between members of a design team through the use and creation of boundary objects [1]; the need to support stakeholders private activities [5]; and, the use of technologies to support the various group compositions of a design team [4]. However, they have primarily been constrained to the collaboratory. In our research [6] we have conducted a diary studies and ethnographic studies across the software development process. A dominant finding from this research is that design ideas do not just occur when in a design meeting. However, few tools exist to support this distributed form of design, whether synchronous or asynchronous. Current practice tends to rely on e-mail and alike media to support communication over spatial distance. Such means of communication may not always be suitable for one to express themselves.

TelePICTIVE [2] was developed to support distributed-synchronous design. TelePICTIVE [2] is a GUI design tool that allows novice and expert users to work together over spatial distance through a user's computer and an Internet connection. A disadvantage of this tool is that it considers everyone in the design team to be distributed. Even if stakeholders are collated, they are each separated by the constrained interaction space of their personal computer. While designers and users may be spatially distributed in a participatory design setting, users or designers respectively may be working together (i.e. collocated) requiring support for their own dynamic design activities.

Design environments of the future need to consider all aspects of the space-time matrix and understand the interactions between these cells, if we are to effectively support the entire process of design.

PUBLIC SOCIAL PRIVATE DESIGN (PSPD)

Extending the ideas embodied in the above mentioned design environments, PSPD [6] (Figure 4) utilises the different interaction spaces supported by different technologies to support the various group compositions of a design team – in this case, an interactive tabletop (group activities), tablet PCs (sub-group activities) and PDAs (individual activities).

Figure 4. Public Social Private Design (PSPD)

Tabletop – This technology provides a public interaction space, allowing all group members to engage around the technology, collaborate with each other and technology.

Tablet PCs – This technology provides a social interaction space, allowing a sub-group to collaborate with each other and interact with the technology.

PDAs – This technology provides a private interaction space, allowing members of a group to work individually.

Each technology runs a concept sketching application allowing the creation and dissemination of design ideas through means of various externalizations – sketches, annotations and text.

Figure 5 presents an example design sketch created by a group of interaction designers using PSPD. The externalisation acts as a point of reference for the design team. Rather than this externalization being a polished, stand-alone artefact, it is considered a shared representation by the design team that has extend beyond their verbal communication to help develop a shared understanding and establish common ground.
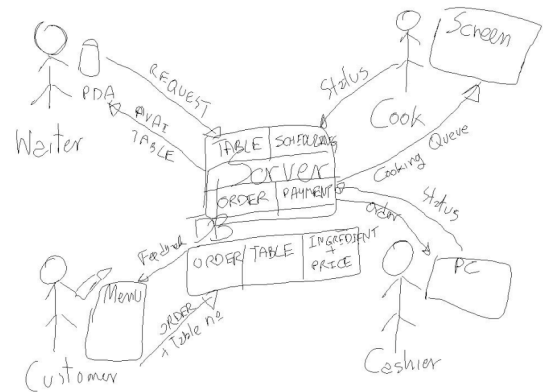

Figure 5. An example design externalisation

PSPD does not just support distributed design in a collocated setting, but also allows this communicative tool to extend beyond the collaboratory through the use of its ubiquitous technologies. We shall next consider how PSPD supports the various cells of the space-time matrix.

Situated-synchronous and situated-asynchronous design – the interactive tabletop, tablet PCs and PDAs, provide a public, social and private interaction space respectively, supporting the group, sub-group and individual activities of a design team. Using these technologies, members of a design team may collaborate around one or more of the technologies. Furthermore, due to the different interaction spaces provided a member of the design team will never be constrained from expressing an idea and coming back to it during the design process.

Distributed-asynchronous design – while the interactive tabletop is constrained to the collaboratory, the tablet PCs and PDAs may extend beyond the collaboratory. The collaboratory hosts a server running an ad-hoc wireless network, that centrally stores and distributes design externalizations between the devices. Each device stores the latest copy of the server's memory it has access to and updates when connected. This allows the user(s) to see design externalizations while not in the server's range. In addition to this, if a user is using a device that is not in the range of the server's network the device stores the externalization and updates the design externalisation when it is next connected to the server.

Distributed-synchronous design (future work) – currently PSPD cannot be used for distributed-synchronous design. However, when a user connects to a network with an Internet connection the server could be accessed via a web service. This would allow information to be synchronously distributed between devices. However, while this supports communication through our shared space, the design teams primary means of communication is lost – verbal communication. TelePICTIVE [2] faced a similar problem with their design environment. While the TelePICTIVE environment had inbuilt Instant Messenging functionality, they found that conference calling worked well as a means of re-establishing verbal communication between the design team over spatial distance. Their future work aimed to integrate this functionality in the software itself, including the ability to videoconference. A similar solution could be integrated into PSPD using VoIP and web-cam functionalities (as illustrated in Figure 6).
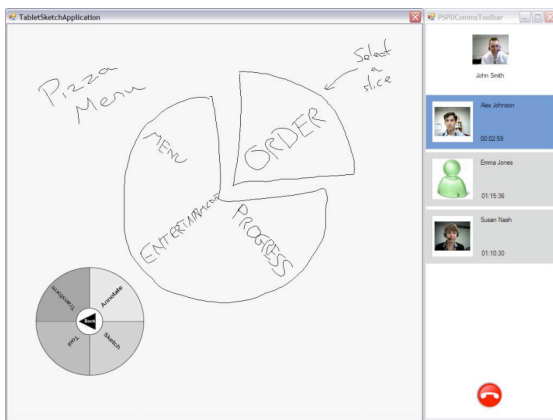

Figure 6. PSPD and a proposed communication toolbar

PSPD is an exemplar design environment building upon the lessons learnt from previous research [e.g. 1, 4, 5]. Extending beyond a single cell in the space-time matrix, to consider the cells of the matrix collectively and the interactions between them.

CONCLUSIONS

In this paper we have shown that design is not merely situated *or* distributed, but should be considered as situated *and* distributed. Furthermore, we extended the notion of distributed to that of the same and different geographical locations.

Much research [e.g. 1, 4, 5] has considered either situated or distributed design practice, with a particular focus on synchronous or asynchronous interactions – each a cell in the space-time matrix. However, design practice in reality occurs across all the cells of this space-time matrix and future research needs to address how we can effectively support such a process.

PSPD is a design environment we have developed to support the process of design, whether situated, distributed, synchronous or asynchronous. Through our future work we wish to understand how to effectively support the design process across this space-time matrix.

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