

The Distributed Studio: Towards a Theory of Virtual Place for Creative Collaboration

Viveka Weiley

Creativity and Cognition Studios,
University of Technology, Sydney and ACID
PO Box 123, Broadway NSW 2007, Australia
viveka@it.uts.edu.au

Yusuf Pisan

FIT, University of Technology, Sydney
PO Box 123, Broadway NSW 2007, Australia
Phone: +61 2 9514 4478
ypisan@it.uts.edu.au

ABSTRACT

Virtual environments intended to support creative collaboration are being built without an informed consideration of the implicit interaction design choices being made. This paper proposes a set of design principles for such environments. Drawing from theory and reflective practice we suggest a conceptual focus on a Distributed Studio designed around the following five principles: Support Reconfiguration, Mix Realities, Control Access, Be A/Synchronous, and Transform Space into Inhabited Place.

Categories and Subject Descriptors

H.5.1 Multimedia Information Systems: Artificial, augmented, and virtual realities, H.5.2 User Interfaces: Theory and methods, H.5.3 Group and Organization Interfaces: Computer-supported cooperative work, Synchronous interaction

General Terms

Design, Human Factors, Theory.

Keywords

Creativity Support, Mixed Reality, Place, Practice-based Research, Reflective Practice.

1. INTRODUCTION

When humans are confronted with difficult problems we seek creative solutions. Creativity support tools have been shown to have broad social benefits, and are now receiving prominent notice in the computing literature [28].

Rather than being the product of individual genius, creativity emerges from a social milieu and often from a collaborative process [31]. Geographically distributed teams have access to specialists and can be more diverse [12]. When well managed this diversity can in itself be a source of greater creativity [13]. Such teams can also, by their distributed nature, provide greater opportunities for participants in less central locations. Information and communication technologies support distributed work, coordinated over the Internet. However key aspects of creative work resist the structure required for formal and asynchronous coordination. Idea generation for example thrives on loosely construed concepts, developed synchronously [20] which can be worked with and developed while still not fully understood or completely articulated. Csikszentmihalyi's

flow [10], or being in a state of adaptive challenge, similarly demands a synchronous environment for collaboration.

To create such an environment is the goal of Collaborative Virtual Environments (CVE) research. Collaboration is given as the goal. Virtuality is the means, and many papers and conferences in the CVE field focus on the engineering challenges of providing Virtuality. This paper focuses on the interaction design of the Environment - an important consideration for creativity support [10, 25].

In section 2 we will set out relevant existing theories of collaborative place, from research into both virtual and real environments for creative collaboration. In section 3 we describe two experiments we have conducted, providing starting points for reflection on those theories as a foundation for design principles. Section 4 will set out our proposed principles, derived from both theory and reflective practice. While these principles are built on existing theory they have not been previously enunciated as such, and we consider the proposition of this list to be a useful and necessary starting point for further work in the design of virtual environments for the support of distributed creative collaboration.

2. PREVIOUS WORK

Real world collaborative environments have a long history, and indeed a long pre-history. When we consider a CVE as a kind of collaborative place (not just a site for social interaction) we can apply our understanding of the design of collaborative places that predate virtual environments.

2.1 Space and Place

Harrison and Dourish introduced CVE researchers to the distinction between empty space and meaningful place in their seminal 1996 paper [19]. In a ten-year retrospective paper Dourish [11] then drew out the continuum between the two concepts, pointing out that any designed space has some cultural context imparted by the decisions of its designer and therefore is to that extent a place. The key insights in these two papers are sourced respectively in architectural theory [32] and the related field of cultural geography. Although this work by Harrison and Dourish [19] is widely cited, much CVE research focuses on engineering and implementation, typically giving only passing mention of the design of the virtual places described, and no rationale for the design choices they embody [34]. Benford et al. [3] noted that the majority of CVEs are designed around a "virtual office" metaphor despite a lack of evidence that this is necessarily a good design choice. Benford's paper has subsequently been cited as a justification for continuing to make Virtual Offices [15] (fig. 1), despite the implicit critique of this approach that was intended. More generally, this tendency appears to be an extrapolation from the

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virtual office / desktop metaphor common in graphical user interfaces, which is itself facing critical review [6, 18, 21, 29].

Figure 1. A screenshot of the DIVE virtual office from



<http://www.sics.se/dive/> as extended by Frécon and Nôu[15].

2.2 Pattern Languages

One immediate further application of architectural theory which is not yet represented in the CVE literature is pattern languages [1]. A pattern language is a way of framing solutions to design problems in a way that can be generalised and re-used. For example: Scattered Work (pattern 9), Adventure Playground (pattern 73), Small Work Groups (pattern 148). Taken together they make a pattern language that could be applied in the development of a place to support creative collaboration. Another useful principle from architectural theory that could form part of this pattern language is Brand's theory of 'Low Road' architecture [7], which exalts the creative possibilities of an easily reconfigurable environment. Brand offers MIT's building 20, "the only building on campus you can cut with a saw" [7, p. 24], as an ideal configurable collaborative place.

2.3 Creative Place in Early Childhood

An unexpected wealth of relevant material is available in early childhood education research - a field where particular attention has been devoted to the problem of making places to support creative collaboration. In this field, Vygotsky expounded the constructivist theory of collaborative learning through the social process of play in his insightful and groundbreaking 1933 paper [33]. Nicholson focused on the role of the collaborative place, developing the influential Theory of Loose Parts in 1971 [26], demonstrating that creativity is directly enabled by environments filled with a large number of diverse and non-prescriptive materials and tools. Another relevant concern is boundaries; Osmon [27] defined the fundamental tension as one of access vs. protection; of balancing the necessity of connection to the community with the requirement of protecting the creative interactions that go on inside from interference - an issue that is echoed in the design of CVEs.

2.4 Creative Place for Situated Collaboration

A common assumption in the design of CVEs is that they should aim to entirely immerse the user, such that they become unaware of the real world around them. However it is now becoming recognised that users of CVEs are rarely in a completely immersive virtual environment [14]. Instead they are situated in a real environment, with the shared virtual environment embedded within it [11,4]. Billinghurst et al. [5] describe a seamless Augmented Reality (AR) interface, where users can see through the virtual reality to their real environment. A key benefit described is the availability of participants' familiar tools and resources in the mixed reality environment. Extending this further, Dourish [11] argues for a

consideration of overlapping spatialities. He gives the example of a user in a real space, conscious of network spaces accessible through mobile devices and simultaneously apprehending a CVE as a shared virtual space. Situated [9] creative collaboration has been explicitly explored in work on creativity in virtual environments [24, 32]. Of particular interest is the perspective provided by the 場(ba)-principle from Japanese cultural theory. Shimizu [29] defines ba as a dynamic, inhabited place which is imbued with not only history but also ongoing collaboration and emerging relationships. Furthermore, ba is defined from the perspective of its inhabitants - negating Cartesian dualism by including those inhabitants in the definition of the place.

3. TWO EXPERIMENTS

3.1 Methodology

To begin designing environments to more effectively support distributed collaborative creativity we are undertaking a programme of practice-based research, beginning with the aim of establishing a set of design principles. These principles are derived from reflective practice, working with users in virtual collaborative place, considered through the lens of existing theories in the design of real collaborative place. To this end we have conducted action research [22] experiments with an established distributed team, observing and assisting them as they attempt creative collaboration in a virtual environment. We have also reconstructed a real place of creative collaboration as a virtual environment. We have previously documented our process of making that reconstruction [34]; we now report on the experience of using and demonstrating the prototype as that experience pertains to the theory we are constructing.

3.2 The Distributed Team Gets Virtual

We recruited a group of five participants who were attempting to collaborate remotely; the ACM SIGGRAPH Digital Arts Committee (hereafter the Committee). This team is comprised of artists, designers and researchers distributed around the world, and engaged in developing publications and online services for a global digital arts community.

We first examined the existing practices of distributed collaboration undertaken by the Committee by observing them in real-world meetings, and then by conducting a survey to ask them about their use of computer-mediated collaboration. Following the survey we conducted five guided collaboration sessions ranging from half an hour to two hours in duration over two months in Second Life [23], a mass-market multi-user virtual environment. Each session took place in a different social and architectural environment within Second Life, to explore whether and to what extent the environmental context would effect their interactions and their stated aim of distributed collaboration. Second Life generates a transcript of all text chat conducted during a session. We communicated by text, and retained the transcript for analysis.

Observation of real-world meetings showed that the Committee was a high-functioning team, which quickly generated and elaborated on ideas when meeting in person. The survey showed that they were widely distributed across the globe in four main time zone bands, and that this was making it difficult to organise formal meeting times for synchronous conferencing. Furthermore, each committee member maintained an account with a different, incompatible instant messaging service, and each had experience with different and incompatible groupware

and virtual environments technologies. Only one was a frequent user of Second Life, and three had never used it.

The action research observations confirmed that situated cognition is very much in evidence in virtual environments. Despite their clearly stated intention to collaborate on specific projects, in practice the participants' interactions were largely dictated by the affordances of the environment where each session took place. For example in a mall the participants became distracted by the objects for sale. In a crowded social space (fig 2a) they were overwhelmed by chatter and then when they moved to a quieter place nearby, they were interrupted by a stalker (fig 2b).



Figures 2a,b. Welcome Area; A Stalker Interrupts a Virtual Meeting

In places where the system's permissions were set not to allow them to build, they could manage some coordination work (through text chat), but no active synchronous collaboration.

The group also felt constrained by the immersive nature of the system, feeling disconnected from their familiar tools:

[19:35] P: I'm not personally a 3D guy.
 [19:35] P: I'm expert in 2D design and imaging.
 [19:36] P: Photoshop, Illustrator, InDesign...

The only place where some collaboration occurred was the virtual home of one committee member who had built a significant presence in Second Life (figs 3a, 3b).



Figures 3a, 3b. Visiting an Inhabited Place

Participants commented that they felt able to create more easily in a place belonging to one of the group, but expressed a wish for a place belonging to and built by the group:

[19:32] P: I like the idea of a custom meeting place suited to us, but we'd need to frequent it.
 [19:33] K: True. We could create something like a studio that held our works in progress. Images on the wall that showed what we were doing. something like a blackboard.

3.3 Reflecting on a Virtual Reconstruction

The second investigation was a practice-based enquiry into a real place of creative collaboration (Jorn Utzon's studio in Hellebaek during the design of the Sydney Opera House) conducted by reconstructing it as a virtual place. Practice-based research affords practitioners a process for investigation whereby a creative artefact produced as a result of reflective practice can be the foundation of that investigation [8].

For this study the virtual reconstruction was shown as a demo at the IE2007 conference, presenting an interactive virtual environment (figs 4a, 4b.) which attendees could navigate and including loose objects that they could manipulate [34].



Figures 4a, 4b. Virtual reconstruction of Utzon's studio allows users to explore, move objects [Weiley 2007]

The demo process provided an opportunity for discussion, and for reflection on the principles of design embodied in that place.

The intent of the reconstruction was to promote creative play; however in fact participants explored in a mode of historical reflection rather than creative engagement, approaching the virtual environment not as inhabitants but as visitors. On reflection, it appears that it is not the surface aesthetic of a place that makes it work as an environment for creative collaboration. Rather the aesthetic emerges from the underlying affordances [16] presented to participants by the environment - that is to say, what the environment allows participants to do. From this reflection came the motivation to encode those affordances in a set of design principles.

4. DESIGN PRINCIPLES

4.1 Support Reconfiguration

Allow participants to easily reconfigure the space to adapt it to their work. Provide non-prescriptive, manipulable loose parts to promote playful social creativity.

4.2 Mix Realities

In order to support work on real-world tasks, consider the virtual environment as just a part of the larger reality inhabited by each user; a shared space in a distributed mixed reality. Connect to the physical and networked realities of each member of the distributed team, so that they can access their familiar tools and the resources present in their real environment.

4.3 Control Access

By default, make the Studio accessible only to its members, but visible and connected to a wider social milieu. Then allow inhabitants to tweak access control to find their own level.

4.4 Be A/Synchronous

Support synchronous operation to promote flow and idea generation and manipulation. Provide access to a persistent connection to the shared space, to keep group members aware of each others interactions with it, even when those are asynchronous; and to support ad-hoc collaboration when participants notice each other in the space.

4.5 Transform Space into Inhabited Place

Following the above principles, create a flexible distributed studio that can be customised by its inhabitants to create a habitation of which they are a part.

5. DISCUSSION

Current CVE platforms are not optimised for building a shared, distributed studio. For example new users of Second Life are immediately presented with tools for customising their avatar's appearance, but no private space. Land is available for sale through a comparatively complex system requiring some hours of cultural immersion in the system to understand. To set up land access controls is another learning experience. At the other extreme experimental CVEs tend to be entirely private, disconnected from a social milieu beyond the experimenters themselves. In both commercial and experimental CVEs mixed-reality systems are the exception rather than the rule. In these isolated Virtual Realities intended as complete simulacra [2], only in-world tasks are meaningful, and the only tools visible and available are those instantiated in the virtual world. In order to support real-world creative work designers must adopt a theoretical framework, to help make meaningful judgements between competing considerations. The principles set out in this paper are a first attempt to enunciate that framework. When building a CVE they may now serve as partially tested rules of thumb; for those with interest in pursuing this line of enquiry further they are a foundation for further testing and research.

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