

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

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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

1.1 Distributed Creative Collaboration

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 [30].

Rather than being the product of individual genius, creativity emerges from a social milieu and often from a collaborative process [33]. 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.

The formation of geographically distributed teams is facilitated by information and communication technologies, in the expectation that while team members may meet in person from time to time, they will be able to work primarily in a distributed manner; greatly reducing the need to travel as they coordinate their efforts 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]

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 [34] 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 [redacted]. 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

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extrapolation from the 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 Nöu[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, here are some patterns compiled from Alexander et al. [1] that bear on the design of collaborative place:

- Scattered Work (9)
- Work Community (41)
- Common Land (67)
- Connected Play (68)
- Adventure Playground (73)
- Self-governing Workshops and Offices (80)
- Office connections (82)
- Flexible Office Space (146)
- Small Work Groups (148)
- Settled Work (156)
- Home Workshop (157)
- Structure Follows Social Spaces (205)

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 can be found in 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, after Piaget had established the role of play in learning [28], Vygotsky expounded the constructivist theory of collaborative learning through the social process of play in his insightful and groundbreaking 1933 paper [35]. 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 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. In an isolated Virtual Reality intended as a complete simulacrum [2], only in-world tasks are meaningful, and the only tools available are those instantiated in the virtual world. 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]. Billingham 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] has presented an argument 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 [31] 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. METHODOLOGY

3.1 Reflective Practice

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 of 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 a real distributed group, 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. The process of making that reconstruction has been previously documented [36]; 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 [redacted] Committee (hereafter the ARC). 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 ARC 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 a series of guided collaboration sessions over two months in Second Life [23], a mass-market multi-user virtual environment (MUVE). 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.

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 2a, 2b.) which attendees could navigate and including loose objects that they could manipulate [36].



Figures 2a, 2b. Virtual reconstruction of Utzon's studio allows users to explore, move objects [redacted 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. RESULTS

Observation of real-world meetings showed that the ARC was a high-functioning team, which quickly generated and elaborated on ideas when meeting in person. The survey of the ARC 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 programme 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 3a) they were overwhelmed by chatter and then when they moved to a quieter place nearby, they were interrupted by a streaker (fig 3b).



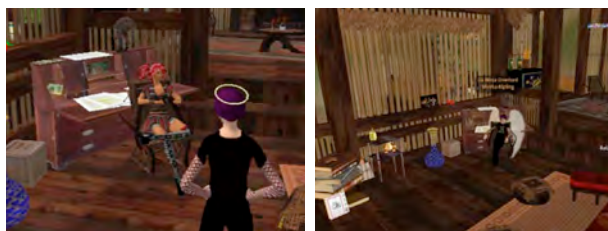
Figs 3a,b. Welcome Area; A Streaker Interrupts a Virtual Meeting

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 4a, 4b).



Figures 4a, 4b. 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.

5. PRINCIPLES

Current CVE platforms are not optimised for building this kind of shared, distributed studio. With greater consideration of the kind of place being built, CVEs could more effectively support creative collaboration. While there are many properties of a system that can be optimised in order to describe it as "more effective", designers must determine the desired function and adopt a theoretical framework in order to make meaningful judgements between competing considerations, make the most appropriate tradeoffs, and ultimately judge whether the design works for the intended purpose. A set of principles must therefore not try to optimise every conceivable aspect, but instead prioritise and direct design efforts. The following principles are a first attempt to enunciate that direction.

5.1 Support Reconfiguration

Allow participants to easily reconfigure the space to adapt it to their work [1,7]. Provide non-prescriptive, manipulable loose parts [26] to promote playful [28] social creativity [35].

5.2 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 [9,14]; and acting as a shared space in a distributed mixed reality [4]. Pervasively connect to both physical and networked realities, contiguous to and accessible by each member of the distributed team, so that they can continue to have access to their familiar tools [5] and the resources present in their real environment.

5.3 Control Access

By default, make the Studio accessible only to its members, but visible and connected to a wider social milieu [12, 27, 33]. Current CVE implementations tend towards all-or-nothing. Instead, start in the middle and allow inhabitants to tweak access control to find their own level.

5.4 Be A/Synchronous

Support synchronous operation to promote *flow* [4] and idea generation and manipulation [20]. Provide access to a persistent connection to the shared space, to keep group members aware of each others interactions with it [17], even when those are asynchronous; and to support ad-hoc collaboration when participants notice each other in the space.

5.5 Transform Space into Inhabited Place

Following the above principles, create a flexible distributed studio that can be customised by its inhabitants to create a sense of place of which they are a part [31]. A pleasurable [25] creative situation [9, 32] - a habitation.

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