

Video Game Technologies and Virtual Design: A Study of Virtual Design Teams in a Metaverse

Shaowen Bardzell¹ and Kalpana Shankar²

¹ School of HPER, Indiana University, 1025 E 7th Street, Rm 394, Bloomington, IN 47405, USA

² School of Informatics, Indiana University, 1900 E 10th Street, Rm 1032, Bloomington, IN 47406, USA

{selu, shankark}@indiana.edu

Abstract. Massively Multiplayer Online Games (MMOGs) are no longer just games. “Metaverses,” a variant of these games, which include Second Life and Active Worlds, represent some of the most immersive, interactive possibilities for learning, simulation, and digital design in use today. They also increasingly blur distinctions between work and play, as well as user and designer, prompting questions about the nature and practice of virtual design, that is, design that is practiced inside virtual reality by and on 3D avatars. This paper describes results from a qualitative study of collaborative design practices within Second Life, a popular metaverse and design environment. We analyze design processes, including the artifacts that avatar-designer create and use in the design activities.

Keywords: metaverse, virtual design teams, collaboration, artifacts, designers, boundary objects.

1 Introduction

The advent of collaborative virtual environments (CVEs) places geographically dispersed collaborators inside of 3D virtual reality as embodied agents (Snowdon et al., 2001). Coinciding with the emergence of such environments is the growing popularity of massively multiplayer online games [MMOGs]. One variant of these games is the “metaverse,” which is a participant-created virtual space. Examples include Second Life, Active Worlds, and There. Metaverses bring these parallel streams together; using game technologies, they offer complex character animation and interactive possibilities. Like CVEs, they offer sophisticated social and communication interfaces. They have progressed far beyond gaming: they are the site of collaborative design and building projects, mixed reality events, and MTV marketing efforts. Thus, metaverses lead naturally to the use of CVEs for both serious and pleasurable purposes (Benford et al., 2001).

Most events and locations in Second Life are made possible in part through their design and “builds.” *Design* in Second Life typically involves creating custom 3D environments, called “builds,” which include buildings, furnishing, and animated and interactive artifacts. As a multi-user platform, Second Life offers many features to

encourage and support collaboration. The question that this paper addresses is how the convergence of virtual collaboration and video game technologies affects design practices in Second Life.

This study follows two design teams designing spaces and artifacts in Second Life through a combination of observations and interviews, noting the design environment, activities, interactions, and conversations among team members. One group (70 active members) uses Second Life for risk management and disaster relief training. This group owns two virtual islands; their design is influenced by dioramas often used by emergency services. The other team consists of 25 entrepreneurial designers dedicated to recreating the clothing and animations of a specialized sexual fetish. In this paper, we report preliminary findings (November 2006 to January 2007) of the study and explore several key collaborative design issues, including tracing how a design idea is initiated, negotiated (among various collaborators), and implemented; and how it becomes integrated in other design activities.

2 Related Work

The study of design in metaverses such as Second Life presents intriguing relations between work and play as well as business and pleasure. The notion of collaborative design has been one of the central research foci in the field of computer-supported cooperative work (CSCW). Since the design process is both creative and personal, it highlights the tensions between the individual and the team when design activities take place in a group setting. Twidale and his colleagues believe the interplay between private and communal design is an important aspect of design and emphasizes the need to support the individual's freedom of expression as well as the formalization of design ideas so as to be shared and used effectively among team members (Twidale et al, 1993). In an ethnographic study of graphic designers' work, Murray finds briefing and job scheduling two of the most essential tasks in providing the necessary context, structure, and division of labor to ensure success (Murray, 1993). The meanings are negotiated and co-constructed by members of the team, and they are context-dependent and non-stable. In a metaverse such as Second Life, these design-related sense-making, support, and coordinating activities are also embodied, using the virtual body as a representational medium for communication and interaction. The 3D immersive environment allows direct manipulation of artifacts in-world, enabling participants to interact with each other and the artifacts naturally (as if in real life). However, since team members are scattered across different time zones and continents, it problematizes design processes.

Understanding the sociality of work in all of its manifestations has been the going concern of CSCW, which has been motivated by the role of language, the coordination of work processes, and the development of collaborative tools. However, more recently, the process by which objects, physical or digital, become accepted by all of the communities and individuals who have some jurisdiction over them requires numerous negotiations about their form, function, ownership, and purposes. There has been some discussion of how these processes transpire in various aspects of engineering design. Star and Griesemer (1989) call such objects, which mediate between communities of practice and help achieve standardization and consensus

among them “boundary objects.” This theoretical construct has taken hold in much of CSCW literature to describe and theorize many kinds of digital objects that serve as what Henderson (1991) calls “social glue” between individuals and groups responsible for working together. Databases, sketches, and any other artifacts mediate and facilitate distributed cognition and organizational memory (Ackerman and Halverson, 1999), shared meanings of critical working terms (Lutters and Ackerman, 2002), and establish jurisdictional expertise in projects. How “boundary objects” function and become stabilized has not been explored in virtual reality environments, though Prasolova-Forland and Divitini (2003) has explored how virtual reality spaces themselves can function as boundary objects and the implications for the design of artifacts. Guimarães (2005) explores the role of objects and knowledge about them in terms of trade, which is also an important mechanism for establishing and maintaining standards. In the teams we observed, the products of design work are not the only the boundary objects that engender trust in teams. Contracts, shared language, and Second Life itself are essential to bringing together multiple stakeholders.

3 Data Collection and Analysis Methodology

The subjects for the study are recruited from various Second Life electronic distribution lists and discussion forums. During the study, the researchers conducted both ethnographic observations and interviews to understand collaborative design practices.

As an exploratory first step, the researchers developed a sensibility toward design in Second Life. This included developing familiarity with Second Life as a content authoring tool, by creating some original content. It also included spending time informally in “sandboxes,” which are free content development areas open to the public, whose contents are deleted on a daily basis; the purpose of these informal observations were not to study any one in particular, but rather to get a feel for the vocabulary, practices, and space-time of Second Life content creation.

For the formal study, we first conducted exploratory interviews with the team leaders to understand the big picture and explore the domain believed to be important to the study. Ethnographic observations ensued, followed by structured interviews after each observation session. We then performed content analysis on chat logs collected during observations and interviews. This technique is used to identify keywords of interest, themes repeated by designers, and sequences of actions (e.g., history, consequence, repetition, etc.) performed during design activities. The results of the analysis provided a foundation for correlating the observations with open-ended interviews that we also administered to give the researchers the flexibility to explore questions and topics of interest.

4 Results

Our preliminary findings show patterns that reflect what we know about the use of information technologies in other kinds of computer-supported communication and

CSCW. In what follows, we summarize the results in the following five areas: work environment, virtual teams, design process, artifacts, and organizational knowledge.

4.1 Work Environment

Content creation in Second Life takes place on virtual land, which is not only a diegetic visualization of the world, but also a metaphor for server space. In other words, land costs money, and paying for it is equivalent to paying hosting costs. Because one cannot build without land, Second Life makes available a limited number of public sandbox spaces, mentioned above, in which users can develop content and save it to their inventories before it is automatically removed. For those doing serious work in Second Life, acquiring land of one's own, and paying for it, is essential.

Both of the teams we studied had acquired their own land for private development. When first acquired, land is typically presented as a more or less featureless, flat field. Since Second Life land initially lacks context, it is common for design teams to construct contexts appropriate to their situations, to make their design activities meaningful. For example, the disaster relief team constructed a virtual town and a virtual hospital on the land they own to create a situated context for the design activities. For the clothing and animation design team, rather than creating these specialized clothing and intimate animations out in the middle of a featureless field, the team first created a virtual house, complete with tall trees, a shaded garden and an enclosed shed, which provide a sense of context, scale, and visual coherence for their work. They designed and built this home setting not with the intention of selling the house (or copies of it), but rather to create for themselves a design environment that meets the specific needs and situation of the team. This practice demonstrates that members of the team regard their land, their development space not merely as physical coordinates in 3D virtual environment but as a socio-cultural construct (Harrison & Dourish, 1996; Wright et al., 2005).

"Land" converted into a meaningful place or context is the diegetic space in which design occurs, but designers also work in the non-diegetic Second Life content authoring environment. The authoring environment in Second Life includes a simple primitive-based 3D modeling environment, in which users create models out of simple shapes, such as cubes, cones, and spheres, which they can then position, scale, and distort; a scripting language (Linden Scripting Language, or LSL); and the capacity to import external media assets, including 2D bitmap graphics, or textures, to map onto 3D models, and 3D character poses and animations.

Significantly, the authoring environment is not separate from the rest of the virtual world. That is, Second Life content is not authored in an external application and then imported into the world; instead, one's avatar develops content in-world. This makes Second Life a social authoring environment, where a group of people can literally develop and modify builds simultaneously and in the same space, and in fact such collaboration is quite common. Further, as seen from our observations and interviews of both teams, collaborators often define their roles during building, with one person specializing (for example) in Photoshop and textures, while another specializes in building design/architecture, and in scripting. In addition, there will be people who are in charge of design research and content generation (as in the case of disaster

relief training team). Both teams have a leader who coordinates and manage all activities, and personnel. He is generally the one who sends out group notices and leads design and evaluation meetings.

4.2 Virtual Teams

While the setting is important in contextualizing the design activities of the virtual teams we studied, the composition of the team also demonstrates direct connections to how team members conduct design activities. According to Cohen and Bailey (1997), a team is “a collection of individuals who are independent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems and who manage their relationships across organizational boundaries.” This is evident in *Second Life* as well. Like other social groupings in MMOG, persistent groups in metaverses are formed to enhance human-human and human-artifact interactions in-world. Unlike most of the group construction in MMOG in which collaboration is essential in accomplishing a difficult game task (Duchenaute et al., 2004), the rationale behind group formation in metaverses often has more to do with commerce, education, business/professional networking, shared hobbies, and so on. In *Second Life*, an individual can belong to up to 25 groups. Of special note are the group titles, which appear in-world beside people’s names, signifying group membership.

The two design teams in *Second Life* we followed take advantage of the grouping mechanism to create team identity, solidify shared responsibility for outcomes, and facilitate group communications. Since group names appear over avatar heads along with their names, they provide instant contextual information to everyone within view of the avatar. Wearing a group title not only indicates affiliation with the group, but because an avatar can only have one group title active at a time, it also suggests that one is “working” when that tag is active, since commonly avatars activate different groups when they engage in different activities.

Grouping enhances the way team members communicate and conduct their work. The two teams we observed send meeting notices, event information, and new product/build releases to group members via the “Group Notices” mechanism, which is only available to group members. The access restriction settings established by groups also determine and structure team interactions: only team members are allowed to access lands owned by the team, and by the same token, only team members can build or edit artifacts on shared lands.

For a team to succeed, there needs to be a clearly defined purpose that is accepted and followed by all team members. These group-only and group-specific mechanisms that the two teams use to coordinate and restrict teamwork greatly enhances and promotes team identity. CSCW research shows that when people first enter group setting, they often have different kinds of knowledge and conflicting goals (Ackerman, 2001). Both teams we observed demonstrated that grouping over time incorporates people into a shared sense of purpose, where participants’ orientations and objectives are rearticulated and reconfigured. Since common grounds and understanding are established, it is easier to foster knowledge-sharing across the teams.

Though space and grouping provide a coherence and identity to members, we also observed a fair amount of off-topic behavior. Some members of the disaster relief team, for example, have face-to-face relations in real life; as a result, during collaboration in-world, their discussions sometimes drifted to the personal. One member of the clothing/animation team revealed during an open-ended interview that she had several email and IM exchanges with the spouse of the team leader, which helped her obtain deeper understanding of the work patterns and habits of her team leader. Off-topic behavior demonstrates that personal and emotional relationship building is essential in the emergence of trust, effective communication, and effective leadership and teamwork (Powell et al, 2004).

4.3 Design Process and Coordination

The overall design process used by the two teams we observed fell into two categories: what Rosson and her colleagues (1988) call a phased development approach versus an incremental approach. The disaster relief team adapts the phased development approach to compartmentalize design activities into design, implementation, and evaluation; while the clothing/animation team uses incremental method where the design and implementation are highly intertwined and iterative; they spend little time on explicit evaluation during the design process. The difference in approaches, of course, is presumably related to the nature of the design project as well as team size. The disaster relief training team has about 70 people and the resources needed to devote to different tasks, especially the evaluation of their training materials, given that they are accountable to the government agencies that fund their projects. The smaller intimate clothing/animation team, on the other hand, needs to produce products in a short time frame to meet market needs and beat the competition; as a result, design and implementation are done simultaneously in a timely fashion. The user testing is literally done after products are launched, when they are in the hands of the users.

It is evident from our observations and interviews that regardless of the approach, both teams follow a member co-created vision as opposed to sheer intuition during design. In general, the two teams start with information gathering, which involves needs assessment (in the case of the disaster relief training team) and comparative analysis of competing lines (in the case of the clothing/animation team). Information and ideas are then passed through multiple meetings where group discussions take place for refinement of ideas and resolving problems. Only when a common frame of reference is achieved can the team begin working together successfully. Collaboration intensifies during the actual design phase where work planning, coordination among different designers, maintaining shared understanding (of the tasks and objectives) across the team, learning (of how to work with team members and team lead), negotiation (of tasks, time, workload, etc.) all have to happen in harmony. Both teams rely not only the in-world communication channels (e.g., IM, chat) to collaborate, but make use of other mechanisms, such as VoIP (Skype), email, and Google chat. These alternates are popular among team members because of the intrinsic limitations of in-world chat/IM systems for long-period collaboration. Research has shown that since people generally speak more and faster than when typing, the adoption of multi-modal

communication greatly enhances team performance (Sallnäs, 2001), and both teams accordingly have adopted communications technologies external to Second Life.

4.4 Artifacts

Trust within a team often coalesces around shared documents and artifacts (Star and Griesmer, 1989). The disaster relief team we observed is a particularly strong example of a community that relies upon artifacts and policies to maintain effective collaboration with stakeholders, which include officials from the federal government (whom they term “content experts” who possess and transmit knowledge about the disaster scenarios to be modeled), educators working with students who are to use the scenarios, and other design businesses in Second Life from whom off-the-shelf artifacts are occasionally purchased. But when time concerns are pressing, there is little luxury for allowing trust to unfold organically. In one interview, the team leader noted that he outsources some of his design work, but “outsourcing takes experience...you really need to breathe [Second Life] air to work effectively...know the SL community and identify good designers.” He felt that trust is built through the design portfolios and good customer relations when working with content experts, who may not understand the capabilities of SL. –As the team leader noted, “Our target audience and content experts know little about virtual environments let alone web conferencing...so we really had to take the bull by the horns and show them what could be done.” For example, the team built a virtual auscultation tool (to hear heart sounds and murmurs) just to show a team of nurses (content specialists) what could be done with Second Life – “a carrot”, the team leader called it.

4.5 Organizational Knowledge

Our findings suggest that for virtual design teams in Second Life, the process of creating new information and synthesizing that information to create shareable knowledge is dependent upon negotiating several themes that are central to understanding how organizations learn and grow: the harvesting of tacit knowledge and its contributions to innovation strategies. Although the concept of tacit knowledge has its roots in the philosophy of Michael Polanyi (1966), more recently organizational theorists have used his central paradigm of “we do not know what we know” to understand and harness the knowledge of individuals who constitute organizational settings (Nonaka, 1994).

Not surprisingly, establishing and harnessing tacit knowledge – often acquired through activities outside of Second Life- is essential to the pursuit of design activities in Second Life. Tacit knowledge, a personal and implicit knowing that which is difficult if not impossible to articulate and capture for re-use, is often conceptualized as “embodied” knowledge. This kind of knowledge is often perceived to be the most crucial to organizational functioning, but the most maddening to harness. Although tacit knowledge is often acknowledged to be most readily exchanged in face-to-face interactions, Lave and Wenger (1991) and Wenger (1997) have argued that deliberately creating and engaging in larger “communities of practice” that share informal conversation as well as formal tasks is one way to get around the “body problem”.

The design teams we observed in Second Life share a sense of joint enterprise that is enriched by the constant sharing of information to develop and strengthen group identity. Although it would seem that sharing tacit knowledge in a community of practice is complicated by a computer-mediated environment, many previous studies have shown empirically that computer-mediated communication and virtual design contribute to the sharing of design knowledge benefit from and are not harmed by the mediated form of communication (Woo, Clayton, et al, 2003).

The world of Second Life and its affordances appeared to contribute to a sense of shared enterprise and knowledge sharing. A member of the clothing/animation team commented on this when she told the researchers that she and her business partner were able to meet in Second Life in a way that would not have been possible in the real world, and they could bring their knowledge and experiences from outside of Second Life to their business in it by allowing them to design artifacts that would not have been as easily made or sold.

5 Discussion

Observation and interviews of the two Second Life design teams reveal interesting and challenging aspects of Second Life as a collaborative design platform, especially in relation to the issue of embodiment.

A number of CSCW studies show technical problems have a negative impact on team members' perception of and experience with team performance (Kayworth & Leidner, 2000; van Ryssen & Godar, 2000, cited in Powell et al, 2004). The common Second Life performance problems (e.g., lag, low frame rates) make communication difficult, highlighting the issue of awareness of the presence of team members in collaborative design settings. According to Sallnäs (2001), the notion of "presence" is related to the feeling "as if being more or less physically inside a computer-generated environment that feels like reality" (Sallnäs, 2001). The subjective perception of team members (represented by their avatars), coupled with one's psychological state of being in-world is what makes the feeling of "being there" possible. In demonstrating a newly built tool, the disaster relief training team spent a significant portion of its time and effort ensuring that everybody was present and looking at the same artifact under discussion. The perceptual disconnect and the psychological uncertainty with the team as a whole, brought on largely due to the partial rezzing of the avatars of the team members (i.e., lack of embodiment), greatly undermined team performance.

Interestingly enough, embodiment also factors in design research. One member of the clothing/animation team, who specializes in design research, often seeks out avatars in clubs to test out competitors' intimate animations. After the intimate encounter, she reports back to her team her (and her partners') reactions to the intimate animations. This type of research would not be possible were it not for the sexual desire of the partners she meets in clubs (who are often there to meet partners for cybersex), and she indicates that finding partners is even easier, because a real-life picture of herself is available in her profile, and men find her attractive.

6 Conclusion and Future Work

The Second Life environment, which unifies authoring, social interaction, and avatar action, create an unusually strong bond among avatars, environments, artifacts, and authoring tools. In unifying these, which have traditionally been spread across multiple windows, applications, and temporalities, Second Life constructs a unity around the avatar that is much stronger than traditional CVEs and CSCW applications, and the new unity also affects the practice of design.

Timeliness of delivery, good working relations, and designs that work are essential to creating an environment of trust, whether in work or play. Uncertainties are managed through use and re-use of artifacts and traces, but in virtual reality, we have found that the unfolding of the design process itself is a boundary object (and not just the end product of that process). In this phase of our research, we have identified collaborative design process and practices as well as some boundary objects and in subsequent stages, we expect to map them more systematically.

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