3D Virtual Worlds: Assessing the Experience and Informing Design

Sean P. Goggins, Drexel University, USA
Matthew Schmidt, University of Missouri, USA
Jesus Guajardo, University of Texas Health Science Center, San Antonio, USA
Joi L. Moore, University of Missouri, USA

ABSTRACT
Teams meet in 3D virtual worlds more frequently than ever before, yet the tools for evaluating 3D collaboration environments are underdeveloped. To close the 3D collaboration tool evaluation gap, the authors integrate lessons from the gaming industry and distributed work research. They develop two complementary approaches. First, the individual user’s perspective using eye-tracking (ET) is addressed, and second, the collaborative experience of the group using a technique called All-Views-Qualitative-Analysis (AVQA) is evaluated. The latter integrates the points-of-view of all subjects in a small group collaborating on a creative work task in a 3-dimensional virtual world. The authors show how these techniques enable evaluation of 3D environment design from the perspective of human computer interaction theory and theories related to distributed work. The paper discusses why designers should seek ways to leverage the advantages of 3D collaboration technologies and avoid recreating mirrors of physical space in these environments.

Keywords: 3D, AVQA, Collaborative Work, CSCW, Eye Tracking, IT Design, User Experience

INTRODUCTION
Over one billion hours of collaborative play have been logged in the game Halo (Grossman, 2007). Put into easily understood commercial terms, that’s about 526,315 person years of work effort; or the entire population of Ljubljana, Slovenia playing Halo instead of going to work, school or anywhere else during the day for an entire year. This milestone underscores the increasing acceptance of virtual worlds as legitimate, compelling places for humans to interact with one another, making it likely that 3D interaction technologies will be adopted beyond the realm of play. In fact, there is evidence that 3D virtual worlds are becoming a prominent framework for human-computer interaction (HCI) to support distributed, collaborative work (Kaptelinin & Czerwinski, 2007).

Much of what is known about HCI in 3D emerges from the study of video games. Qualitative studies of how gamers experience...
virtual worlds show that new games are adopted faster if they follow familiar interaction styles (Clarke & Duimering, 2006), and that game play sometimes leads to a new category of virtual community (Nardi & Harris, 2006). These studies provide preliminary guidance for HCI designers searching for new metaphors that might support deeper engagement in collaborative work among geographically dispersed groups (Carroll, 2003; Dyck, Pinelle, Brown, & Gutwin, 2003; Rapeepisarn, Wong, Fung, & Depickere, 2006). Designing software for distributed group work is recognized as a wicked problem with many challenging dimensions (Fitzpatrick, 1998). Grudin (1994) identified eight of the most significant challenges of designing software for collaborative work. Each of Grudin’s eight challenges takes a slightly different form as technology changes. In this paper, we specifically address one of Grudin’s eight challenges for the 3D generation of collaboration technologies: Evaluation.

Before explaining how evaluation of 3D environments might be different than evaluation of other types of collaborative work systems, we need to understand how users experience 3D collaboration differently. Dyck et al.’s (2003) analyses of gaming as an interaction metaphor reveals the core dimensions of effortless community, learning by watching, deep customizability and fluid system-human interaction. These dimensions of 3D games present an opportunity for 3D collaboration software designers to transfer ideas from gaming (Rapeepisarn et al., 2006). Wrapped up with this opportunity are challenges to long accepted heuristics for interface design, including simplicity, consistency & ease of use for all users. Dyck et al (2003) describe how these accepted HCI design heuristics do not transfer to 3D interaction design. HCI convention is further undermined by evidence that gamers enjoy learning a game quickly but then wish for it to become more difficult as they advance through different stages.

Gaming style interactions like those encountered in 3D environments are more compelling than conventional windowing systems (Paiva et al., 2002; Larson, 2007) and could form the basis for more engaging and productive HCI. The evaluation heuristics that we communicate to designers of these types of systems must, then, necessarily reflect both the fundamental differences and potential advantages of 3D collaboration. First, we must make a critical distinction between 3D virtual worlds and games: In the 3D environments tuned for work, collaboration is measured by creative output and group efficacy, not by a body count or other discrete score. One of the premises underlying the work presented here is that while the HCI community might learn from the example of game developers, building worlds to support creative collaboration is distinct from the challenge of creating a really great first person shooter (FPS) game. While the gaming community knows what works (Crawford, 1982; Rollings & Adams, 2003), the development and evaluation of collaborative 3D environments are in a more formative state.

There are a few aspects of 3D games that are salient to 3D interaction more generally and not tightly coupled to gaming interaction. First, interaction in 3D environments is more immersive, includes interactions with avatars and other social-emotional representations of people, and follows a set of interaction metaphors that have no corollary in traditional user interfaces. Each 3D environment embeds some combination of its own navigational scheme and existing conventions for movement, like the WASD buttons on a QWERTY keyboard (used for walking around and setting direction of a user within the world). Second, emotion is a more prevalent dimension in 3D interaction, the frequently lampooned legacy of Microsoft’s Bob in HCI notwithstanding (Linnett, Fries Duvall, & Powelson, 1997). Avatars add emotional dimension to interaction in 3D spaces that is not present in conventional user interfaces designed to support collaborative work. Our evaluation design, then, must make sense of how users adapt to new types of interactions associated with the first aspect, and new types of collaboration associated with the second aspect of 3D environments.
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