Challenges and Opportunities in Virtual Worlds: Informed Consent and Data Collection

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Abstract
This paper introduces innovative techniques for conducting research in virtual worlds. We analyze two unique methods: 1) informed consent via a 'consent bot' and 2) data collection via a 'Heads-Up Display'. Such methods represent novel solutions that can be extended to other online research settings.
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1 Introduction

1.1 Purpose and Scope

Conducting meaningful online information behavior research presents researchers with both opportunities and challenges in their research design, data collection, and informed consent procedures. Yet, such research becomes increasingly important as users experience blended offline/online lives. We leveraged the programmability of Second Life, a 3D social virtual world to conduct design research into new informed consent and data collection methods to study information behavior (Marino, Karlova, Lin, & Eisenberg, 2012). This paper describes how these methods were developed via an iterative design process, and the insights they shed on information behavior in programmable 3D virtual worlds.

2 Motivation

Phase 1 of our project focused on gathering rich qualitative data (e.g., interviews, participant observation, etc.) to better understand information use in virtual worlds. In the process, we designed and implemented a novel method of gathering informed consent (Lin, Marino, & Eisenberg, 2010; Marino, Lin, Karlova, & Eisenberg, 2010) and developed understandings of the nature of long-term, continuous use in online communities (Lin, Karlova, Marino, & Eisenberg, 2012). Questions remained, however, about how users solved information problems, such as how users select partners to work with on projects and events and how users organize information in three-dimensional spaces. We initially planned a series of small-scale experiments to individually probe these questions and others. We were challenged, however, by the limitations and costs of this plan. Instead, insights from Phase 1 lead us to design and implement the Future InfoExpo (Future of Information Seeking and Services Exposition) (Marino, Lin, Karlova, & Eisenberg, 2012).

The Future InfoExpo consisted of 6 exhibits, similar to booths at an expo; each exhibit offered residents a unique opportunity to play with novel and alternative methods of interacting with information inside Second Life (SL). Residents could experience all or none of the exhibits, in any order. The full report of the iterative design process and implementation of the Future InfoExpo will be detailed in a future publication. In this paper, we discuss the iterative design process of the informed consent procedure and the data collection utility, so as to support other virtual world and online researchers.

3 Related Work

3.1 Online Information Behavior

Information seeking, search, and other information behaviors in online settings have been the focus of a multitude of studies through the last several decades (e.g., Bates, 1989; Bilal & Kirby, 2002; Fidel et al., 1999; Head & Eisenberg, 2010). This rich terrain has also prompted new protocols for the design of research in online environments (e.g., Hill, 1999; Ju, 2007; Swanson, 2005). In particular, the accessibility and growth of virtual environments have revealed new ways in which people access, evaluate, use, and share information (e.g., Nowak & Rauh, 2005; Ostrander, 2008; Rieh, 2002; Yee & Bailenson, 2007). Few studies, however, have taken a comprehensive approach to how people interact with information for the purpose of solving problems in these environments. Moreover, little is known about why people will use many tools, or transition among many environments, in order to complete even simple tasks.

3.2 Virtual Worlds as Information Systems

Virtual environments hold promise that information problem situations will be supported by an environment in which information and communication systems are seamlessly integrated (D'Agustino, 2013). Wasko, et al. (2011) observed that virtual worlds are, "starting to hit the mainstream with potentially transformational technologies," (p. 654). They noted that, for example, 10-year-olds are more interested in the avatar experience in virtual environments (such as in the Disney-owned Club Penguin™) than in what other people are doing on social networking sites. In time, these users, in addition to a video gaming generation, will likely force changes in socializing and working, such that, "the borders between work, play, and learning dissolved or at least be reshaped" (p. 646). Such changes are already taking hold, as Livingstone (2011) recently noted: " … the educational use of Second Life has quietly, slowly, and gradually developed and grown – seemingly impervious to the media din" (p.62).

Further, Wasko, et al. argue that virtual world research will influence, "how perspectives around the design of information systems need to adapt and change to account for the flexibility and variability in virtual world environments" (p. 646). Virtual world research offers creative and innovative insights into the design of, not only virtual worlds, but other information systems as well. Chaturvedi, Dolk & Drnevich (2011) conclude that VWs form a new type of information system, a type that is not yet accurately described by current information system design theories, but will become increasingly integral to a comprehensive conception of information systems.

3.3 Virtual Worlds as Immersive Technologies

The Future InfoExpo starts from the premise that 3D, immersive, social VWs like SL have not yet reached maturity, and that their affordances are not well explored, experienced, understood, or communicated (Bessiere, Ellis, & Kellogg, 2009). SL and similar environments have the potential to leverage their immersive, 3D, virtual, and social qualities and become a valued and preferred medium for information problem-solving for specific information seeking, use, and communication activities (Bainbridge, 2007). In addition, various virtual capabilities (avatars, 3D visuals, immersion, interactivity, movement in virtual space, for examples) will become commonplace in computer, communication, and recreational systems (Wasko et al., 2011). SL does represent a 3D, immersive, social VW with rich potential as an information problem-solving setting due to: 1) emerging patterns of use and expectations; 2) unique, immersive, and 3D capabilities; and 3) integration of cutting edge technologies.

4 Methods

4.1 Rationale

The Future InfoExpo was based on a design methodology to simultaneously demonstrate capabilities and evaluate improvements in support of diverse information practices through a particular technology – Second Life. The design-thinking approach also saved time in identifying, from users' evaluations, those specific design features requiring revision or worthy of further development. A similar approach has been used in the design of an environment for those affected by post-traumatic stress disorder (Moore, 1995). We struggled, however, with finding appropriate procedures or tools to help mitigate the challenge of obtaining informed consent in an online space and of collecting data from so many participants simultaneously. Thus, over a few months, we iterated and prototyped numerous design options before arriving at Hugo and the HUD. 132 participants interacted with Hugo and the HUD.

4.2 Automated informed consent via consent bot, Hugo

Conducting research in virtual environments can be challenging when it comes to addressing the often-conflicting complexities of institutional review boards, corporate owners of the virtual environment, and users' expectations. However, the programmable nature of some VWs enables the creation of features that can meet these requirements. To enter any of the exhibits, participants first proceeded through the Future InfoExpo Entrance. This served as the general welcome area, providing participants with textual information about the Future InfoExpo and about the informed consent process, required by our institution's internal review board. Seated at a desk in this welcome area, the consent bot was presented visually to participants as looking like a robot. Hugo served as a 'consent bot,' an automated system facilitating the informed consent process.

This system was originally designed and implemented in Phase 1 of our project. During that process, we sought to increase the transparency of our research activities. We wanted to ensure that all potential participants were offered fair and equitable opportunities to engage with the informed consent process. The consent bot in Phase 1 was a stationary object that automatically detected the presence of an avatar within 20 meters of its location. This 'consent bot 1.0' informed these incoming avatars of the researchers' presence, research objectives, research activities, and offered users the ability to accept or decline participation at that time. Similarly, Hugo, our Future InfoExpo consent bot, also provided these functions.

For the Future InfoExpo, however, we iterated several modifications in our adaptation of the earlier consent bot. The most noticeable change was that we created a robot-like visual appearance for the bot. Prior feedback from SL users suggested that this visual presentation, instead of a human-looking avatar, would invite a formalized, business-like interaction with participants, rather than a chatty, highly socialized interaction. It's unclear whether users expected a live human being behind a human-looking avatar, or if they expected a technologically sophisticated Artificial Intelligence, similar to IBM's Watson computer. While we did not aim to collect data about participants' interactions with Hugo, many participants commented to us via in-world live text chat. Because we were not expecting these comments, no formal analysis could have been conducted. Instead, we analyzed these comments in team debrief meetings and reflections. Given participants' positive feedback regarding Hugo (via anecdotal evidence), we anticipate that the design of Hugo the consent bot could serve as a model of the informed consent process for research in SL and other VWs.

4.3 Automated data collection via Heads-Up Display (HUD)

Our 'Heads-Up Display' (HUD) was a unique feature adapted for the Future InfoExpo to guide and assist each participant through the exhibits and survey instruments. A HUD is an additional visual element on the screen (appearing above the avatar) that stays with each participant and is only visible to that

participant. Our HUD Orientation provides an orientation and introduction to our HUD to familiarize every participant, regardless of experience, with its functions and use in the exhibits. Our HUD tracks progress through each of the exhibits via shading cues, provides exhibit-specific information, enables a help chat system connecting participants with researchers regardless of location within SL, provides teleportation back to the Future InfoExpo entrance, and determines eligibility for a gift upon completion of exhibits.

Importantly, our HUD administered our survey instruments to participants. It presented an exhibit-specific survey to participants upon their completion of that exhibit. Participants used our HUD to answer the survey questions, including providing written responses and scale responses. Out of 132 participants, 95 (72%) specifically commented on the HUD via one open-ended, text-response question on the Orientation survey; these responses were formally analyzed using content analysis. Most participants experienced a good interaction with the HUD; comments included:

- "It was helpful to be offered the URL for the PDF outlinging the actual Study."
- " … the clarity of the graphics and interactivity helped keep my focus and made perfect sense."
- "It is a lovely build, very easy to navigate because it is set up in a logical flow."
- "This is fantastic. the CVL has an orientation as well as the VAI and this is as good if not better. I think it will help a lot. easy to understand."
- "Useful setup especially for new residents. Simple and not overwhelming"

While the HUD concept has been used in other SL projects (e.g., Holloway 2013), our HUD represents a unique system for tracking participant progress and for delivering and organizing information that as yet has no counterpart outside of the VW environment.

5 Discussion

5.1 Challenges and Weaknesses

During the processes of designing and implementing, we encountered challenges general to the project, but also specific to each tool, Hugo the consent bot and the 'Heads-Up Display' (HUD). Designing for an optimal user experience, especially regarding Hugo, presented us our first challenge. This challenge was three-part: first, we needed to ensure the logistics of informed consent were executed thoroughly and sufficiently to our institution's review board requirements; second, we needed a method of doing so that would scale to support numerous users simultaneously; third, we wanted this process to be open and user-friendly for participants. Technological innovations, designed in cooperation with our developers, 2b3dStudios helped us resolve the first two parts. Although we tried to imagine and test many different scenarios of how users might interact or respond to Hugo, a small number of participants were still confused by and/or uncertain about notifications provided by these tools or their next steps after interacting with these tools. Due to the inevitability of these situations, at least one researcher was present and identified as a research team member to help answer questions and guide participants.

The HUD design process mandated a twofold approach: the participants used the HUD to help track their progress, provide information about the exhibits, etc.; we, however, used the HUD to capture survey input data. Given this double duty of the HUD, we faced concerns about the HUD's user-friendliness; to address these concerns in part, we also developed a HUD Training module, required for participation. Moreover, the HUD required visual appeal and clarity to avoid overwhelming participants. On our end, the HUD design process presented significant technical difficulties, largely related to exporting the data out of Second Life and getting it into a human-readable format suitable for analysis. Additionally, we tested many different types of survey questions and data formats. After much iteration, we figured out a way to email each participant's formatted responses to a dummy email account. These responses, however, still required cleaning and additional formatting.

5.2 Opportunities and Strengths

We needed to innovate these tools because almost none existed ready-made. The dearth of available tools reflects the newness of online research, especially virtual world research. Informed consent can be daunting for both researchers and participants, but most participants responded so well to Hugo the consent bot and to our HUD that we believe both tools could be models for other informed consent procedures. For example, in online research, scale can be a troublesome issue, but both Hugo and our HUD deftly handled multiple simultaneous participants, while providing a consistent experience for all. For example, ensuring participants have relevant study information can be challenging, but by serving as participants' first point of interaction, Hugo also prepared participants for our HUD's automated information delivery mechanisms.

Looking beyond our own study, Hugo the consent bot could be modified in various ways. For example, Hugo could be used to screen study participants, based on their avatar data, or to offer participants different or specific levels or types of participation, rather than just a blanket level or type for all participants. Our HUD could be modified visually to reflect the context of another study, and we would be especially interested in additional ideas for data collection and for resolving the difficulty of exporting the data out of Second Life and into other clean formats.

6 Conclusion

This paper presents the unique opportunities and challenges afforded by conducting information behavior research in virtual worlds. This paper also presents the rationale and design of the automated informed consent bot, 'Hugo', and the automated data collection device, the HUD.

Phase 2 of our project sought to extend our understandings of information problem-solving in virtual environments and how general users, as well as information providers, can leverage immersive, 3D capabilities for effective and efficient information seeking, use, organization, and sharing. Information and communication systems are becoming more immersive and pervasive. Concurrently, new affordances and uses are possible, which users and information providers will need to learn and adopt to become efficient and effective.

Whether the promise of virtual environments is realized remains to be seen. However, the exploration of information behavior in virtual environments is useful in clarifying a vision of the future in the digital age. It remains to be seen how the affordances of these environments may change information behavior. When the moving picture camera was first invented, it was used to film stage productions from the back of the theater—the new and exhilarating ways to tell a story with a film camera had not at first been imagined. This project seeks to imagine some of the possibilities of new and exhilarating ways to learn, communicate, and solve problems in the digital age.

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