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Assistive Technology Interoperability between Virtual and Real Worlds

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Abstract

Accessibility is an important area of interoperability between real and virtual worlds that must be considered during standards-setting. The number of persons with disabilities is large and increasing, as is their use of virtual worlds. All elements of virtual worlds must be accessible.

Four types of real world disability impact functioning in virtual worlds: keyboard/mouse; print; hearing/speech; and cognitive. Some virtual worlds include accessibility features, such as resizable UI elements and fonts. Alternative keyboards and mice usually work adequately in virtual worlds. However, common text-to-speech, speech-to-text, and screen reader software doesn't interface well with virtual worlds.

Existing accessibility guidelines and legislation (Universal Design, Internet accessibility standards and guidelines, and online game accessibility guidelines) might be applicable to virtual worlds. Practical limitations to implementation of these solutions include their complexity and cost. As government agencies, universities, and employers increase their use of virtual worlds, specific standards for virtual world accessibility, including interfacing with common assistive technology, need to be created and enforced.

Accessibility is an important area of interoperability between real and virtual worlds that must be considered during standards-setting.

1. Why should we consider accessibility?

The subpopulation of persons with disabilities is large and increasing. More than a billion people worldwide have some form of disability (UN, 2011). For types of disabilities that impact virtual world functioning, 11% of US adults say that "because of a physical, mental, or emotional condition, they have serious difficulty concentrating, remembering, or making decisions;" 9% have serious hearing difficulties or are deaf; and 7% are blind or have serious problems seeing, even with glasses (Fox, 2011, p. 2). Between 10 and 40% of adults report upper extremity disorders (Huisstede et al., 2006).

Internet usage is now common for commerce and information provision. Barriers to Internet use by persons with disabilities (PWDs) are well documented, but are decreasing (Aidis Trust, 2006; Fox, 2011). PWDs are active in a variety of forms of online communities (casual games: PopCap, 2008; peer support groups: Madara, 1997), but accessibility is still an issue (AbilityNet, 2008).

Figure 1: Computer control with speech-to-text

Use of virtual worlds is increasing as well; over a billion people worldwide are registered in a virtual world (K Zero, 2011). PWDs are active in virtual worlds, where research is beginning to show they reap unique benefits (Murphy et al., 2012).

2. Where might accessibility be problematic?

Virtual worlds (VWs) are usually entered through an Internet-based sign-in process. The VW experience has two major components: the platform and user interface designed by the world developer; and the content, which in worlds like Second Life® (SL) is created by the world's residents using platform tools instead of by the developer. All elements must be accessible. Accessibility needs may differ for two kinds of VWs: those where the designer creates all the content, and those where the world allows user content creation.

Accessibility of website sign-in and user interface is controlled by the VW designer, as is accessibility of designer-created content. A more interesting problem occurs in worlds where the content is participant-created. There, a portion of the user interface consists of content creation tools. Not only do the tools need to be functionally accessible, but the materials created using them must also be accessible.

For example, the SL default name for a user-created object - chair, door, or horse - is "Object." Unless the creator changes an object's name, screen reader software will describe it merely as "Object." In a VW allowing user content creation, the object creation tool could pop up a reminder ("Rename?") before the creator first saves the creation. This would encourage content creators to provide meaningful object names, equivalent to alt text descriptions of images on websites.

This is analogous to laws requiring that seatbelts be installed in all new cars, then requiring drivers to use them. While laws can't force drivers to wear seatbelts, drivers can be reprimanded for not complying. Additionally, the car offers reminders (the annoying DING DING interlock between seatbelt and ignition) for compliance.

3. Are virtual worlds accessible?

Physical or mental impairments may become disabilities when the impairment interacts with environmental or social barriers to cause inaccessibility or limit opportunities (Stineman & Streim, 2010). Accessibility includes enabling use of assistive technology, as well as design features that make functioning easier for persons with various disabilities.

Four areas of real world disability impact one's opportunity to function in virtual worlds: keyboard/mouse; print; hearing/speech; and cognitive. All can be addressed by proper attention to interoperability between real world adaptations, assistive technology, and the VW.

Avatar control and interaction with the user interface employs a keyboard and mouse. Inability to use these elements should not bar a person with paralysis, missing upper limbs, or blindness from participating in a VW.

Figure 2: Computer control with stylus and foot trackball

Most instructions and communication among residents of VWs occurs as printed text onscreen-user interface labels or messages, inworld signage, chat and instant messages. A person who cannot see or understand text, due to dyslexia, vision impairment, blindness, color blindness, or non-native language background, will find it difficult to function in the VW.

The introduction of Voice in VWs changed their culture; some deaf and/or mute individuals are left out of interactions. Sound effects marking danger or drawing attention will be missed by deaf residents.

Persons with cognitive impairments from attention deficits, chronic fatigue, learning disabilities, PTSD, autism, Down syndrome, or lowered mental capacity, face a steep entrance learning curve. Even if they learn to function in a VW, their participation may be markedly slow.

4. Do common accessibility tools work in virtual worlds?

Some worlds include user interface accessibility features such as adjustable size UI elements and fonts. Alternative keyboards and mice usually work adequately in a VW. An onscreen keyboard in SL, however, disappears in Mouselook mode, as does the ability to use the onscreen ESC key to exit that mode.

Common text-to-speech (e.g., Kurzweil 3000™[1]) and speech-to-text (e.g., Dragon NaturallySpeaking[2]) software does not interface well with virtual worlds, nor does the common screen reader JAWS®[3]. As a workaround, blind VW residents can access most functionalities using a text-based, non-graphical viewer read aloud by screen reader software. A quadriplegic can dictate into an external text box, then copy/paste into local chat. A dyslexic can copy/paste local chat into a read-aloud program.

5. What are some proposed solutions?

Existing accessibility guidelines and legislation might be applicable to VWs. An international consensus panel of consumers and industry stakeholders could be convened to discuss existing guidance, including the following:

- Universal Design (North Carolina State University, 2011). Well-designed environments should be optimized for all persons, regardless of disabilities or assistive technology. These principles can apply in VWs (Krueger, Ludwig & Ludwig, 2009).
- Internet accessibility standards and guidelines, such as the ADA Sections 504 and 508 (US Department of Justice, 2005), and the WCAG (W3C, 1999, 2008).
- Online game accessibility guidelines (IGDA, n.d.; Ossman, 2006; UPS Project, 2004). These would apply to VWs, but additional elements must be considered.

Existing solutions, and the assistive technologies they support, could be harvested by VW developers. VWs must be designed so users can switch seamlessly between them and other environments.

Practical limitations to implementation of these solutions include their complexity and cost. The needs of PWDs are diverse, and the solution for one type of disability may make the system less accessible to a different disability type. As a class, PWDs are low income and thus less able to purchase technology, which may be a disincentive to developers.

6. Should virtual worlds be accessible?

We believe so. As government agencies offer information, universities hold classes, and companies work in VWs, specific standards for VW accessibility, including interfacing with common assistive technology, need to be created and enforced. Assuming optimal design, VWs can be made to be more accessible to people with a broad array of disabilities than the real world. Standards will provide the guidance for VW designers to open their products to a wider audience.

The need for interoperability standards among/between VWs has long been recognized (Bell, Dinova & Levine 2010; Martens, 2007). Numerous groups have attempted to create those standards

[1] http://www.kurzweiledu.com/products.html

[2] http://www.nuance.com/dragon/index.htm

[3] http://www.freedomscientific.com/products/fs/jaws-product-page.asp

(IEEE, 2010). However, there does not seem to be any movement to include accessibility standards related to interoperability between real and virtual worlds.

Some believe additional accessibility standards need to be enacted, pertaining directly to VWs (Hansen et al., 2008). While some have argued that as long as virtual worlds are inaccessible, they should be avoided (Kelly et al., 2007), others believe virtual worlds are "too important not to be accessible" (Abrahams, 2007). We encourage equivalent discussion and consideration on this important topic.

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