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Amputee Virtual Environment Support Space— A vision for virtual military amputee support

The war in Iraq is the largest and longest sustained combat operation by the U.S. military since the Vietnam war. An estimated nearly 2 million U.S. military personnel have been deployed for Operation Iraqi Freedom and Operation Enduring Freedom [1]. Dr. Chuck Scoville, Col. Ret., Chief of Amputee Patient Care at Walter Reed Army Medical Center, stated that as of November 2009, 937 war fighters have suffered an amputation as a result of a battle injury. The successful recovery from a traumatic injury resulting in an amputation largely depends on care from clinical providers as well as peer support.

CURRENT AMPUTEE CARE—STAGES OF RECOVERY

As outlined by Berke, following amputation, five stages of care occur, during which an amputee interacts with clinical providers [2] (**Table 1**). Although the current standard of amputation care mainly focuses on healing the physical wounds and returning the patient to a desirable functional level, more attention needs to be focused on the psychological needs and social/peer support.

As discussed by Hashemi et al., after the initial trauma from an amputation, patients commonly experience denial, anger, depression, disconnection, disempowerment, and vulnerability [3]. These feelings usually produce a sense of pragmatic acceptance that life will be different for them. If patients recover psychologically and realize that things could have been worse, they are considered to be on the path toward acceptance with resilience. However, if they do not recover from their mental wounds, they fall into acceptance with resignation. At this stage, patients might feel abnormal and suffer from depression. This generally occurs because of a lack of social support, a severe physical condition, and/or poverty.

Table 1.
Stages of surgery and recovery.

Stage	Name	Duration	Description
1	Preoperative	Immediately	Decision to amputate or salvage limb
2	Acute hospital postoperative environment	5 to 14 days	Wound healing
3	Intermediate postacute hospital	4 to 8 weeks	Early rehabilitation Preliminary prosthetic fitting
4	Intermediate recovery	4 to 6 months	Further rehabilitation
5	Transition to stable	12 to 18 months	Relative stabilization of residual limb

SOCIAL AND PEER SUPPORT

Physical rehabilitation alone is not sufficient for a full recovery. A full recovery from limb loss requires deep psychological and social support that includes patience, tenacity, and help from friends, family, and the community [4]. Peer support potentially can provide information and education not achieved in any other team relationship. Various aspects of peer support, such as peer visitation, amputee support groups, and consumer awareness, have all been proven useful resources [2].

The literature suggests that peer support has been a salient factor in the successful recovery of amputees. In a study of land mine survivors who underwent amputations, Sperber-Richie et al. report descriptions from landmine survivors from various countries on the impact of family and community on their recovery [4]. They found that the interaction with other survivors provided a peer support network that empowered them to persevere despite their injuries. One survivor attributed the ongoing visits from other amputees as the first step in drawing himself out of a severe mental crisis. Many of the newer amputees found that seeing other recovered soldiers integrated back into society was helpful.

VIRTUAL WORLDS

The Internet has the potential to greatly affect the social bonds and independence of people with various disabilities. A Harris Poll in 2000 found that people with disabilities were less likely to be online than those without disabilities (43% and 57%, respectively), but those who did go online spent twice as much time online as those without disabilities [5]. Since this poll was conducted, the advent of Web 2.0 in 2004 has stimulated new opportunities on the World Wide Web (WWW). Gorini et al. write, "The introduction of Web 2.0 has facilitated the development of new forms of collaborative interaction between multiple users based on 3-D [three-dimensional] virtual worlds" [6]. These virtual world interactions far exceed historical WWW capabilities such as emails, chat rooms, and video

conferences. In short, a virtual world is a 3-D simulated environment accessed through a commercial Internet connection [6–7].

In these virtual worlds, people appear as avatars, which are computer users' 3-D self-representations [8]. Through their avatars, users create a sense of personal space, as well as the virtual representations of themselves. Virtual-reality environments are social spaces that use special platforms to meet the needs of the people who come together. They can provide a sense of belonging—the sense of being in the same place and doing the same things—for people who have an increasing desire to gather with friends via the network. Second Life, established in 2003, is currently one of the most popular and successful virtual environments [9]. Now known as Second Life Enterprises, it is one of the largest virtual world communities, with nearly 13 million users around the world.

Many large organizations have already started embracing virtual worlds and use them for a multitude of applications, including circulating health information and hosting discussion forums, educational lectures, and virtual visualizations of upcoming building projects [10]. **Table 2** lists sample projects that employ these virtual worlds.

VIRTUAL WORLD SUPPORT GROUP FOR MILITARY AMPUTEES

As mentioned, peer support is a salient factor in the recovery of combat-wounded amputees. While in the hospital setting, amputee war fighters are often surrounded by their peers and can readily find support in their fellow servicemen and -women. As they move through the system of care and find themselves back in the home setting, alternative and accessible options for continued peer support are important. The virtual world potentially provides this platform for a peer support group for amputees.

In the virtual world environment, no set time exists for engaging in peer support. In fact, one could sign on at any time, day or night, and likely find someone to whom they can talk. The virtual world also provides anonymity because users are

Table 2.
Current applications of virtual worlds.

Organization	Purpose
Centers for Disease Control	Circulate health information in form of online media and podcasts. Provide virtual microscopes in virtual laboratories to educate. Host health fairs.
American Cancer Society	Provide virtual lectures and support groups.
Britain's National Health Service	Educate and help students prepare for medical school [1].
University of Illinois	Educate and help students prepare for medical school [1].
Palomar Pomerado Health	Set up a virtual hospital to allow future residents to experience new building before construction completion [2].
U.S. Army Training and Doctrine Command	Explore capabilities for potential strategic messaging, networking, collaborations, training, and education [3]. Create Second Life venue for Wounded Warrior Education Fair. Initiate classroom in Active Worlds for Army and interagency partners. Recruit future soldiers as part of the Future Soldier Training Program by having virtual recruiters, drill sergeants, and soldiers who have recently completed initial entry training.

1. Bruck L. Second Life: Test-driving real-world innovations. *Hosp Health Netw.* 2008;82(10):50–54. [PMID: 19031844]
2. Solovy A. Get a [Second] Life: Powerful virtual world is transforming health care in ways that astound and inspire [Internet]. Chicago (IL): Hospitals & Health Networks; 2008. Available from: http://www.hhnmag.com/hhnmag_app/jsp/articledisplay.jsp?dcrpath=HHNMAG/Article/data/08AUG2008/0808HHN_BusMatters&domain=HHNMAG
3. Army Exploring Virtual Worlds [Internet]. Washington (DC): Department of the U.S. Army; 2008 [2008 Nov 21; cited 2010 Jan 9]. Available from: <http://www.army.mil/standto/archive/2008/11/21/>

stripped of their physical identity and, in some cases, their disabilities [11]. For example, Nomav, a tetraplegic with a rare form of muscular dystrophy, is involved in a Second Life support group environment. While he cannot breathe without a ventilator in real life, he can walk, dance, and even fly in Second Life [12]. Gorini et al. note that virtual worlds provide a greater feeling of presence among the avatars than one might experience in a disembodied chat room [6]. This presence makes the clinical communication process easier to facilitate, positively influences group processes, and provides cohesiveness in group-based therapies. In Second Life, amputees could participate in live lectures to learn about new rehabilitation techniques or prostheses or for other educational purposes. They could also browse similarly themed document collections in the virtual environment in their spare time. Most importantly, the amputee war fighters would be able to reconnect with individuals who have fought similar battles, both on the physical and psychological fronts.

AMPUTEE VIRTUAL ENVIRONMENT SUPPORT SPACE FOR MILITARY VETERANS WITH AMPUTATIONS

Based on all the potential benefits of virtual peer support for military amputees, the Telemedicine and Advanced Technology Research Center (TATRC, Fort Detrick, Maryland), in partnership with ADL Company (Bloomington, Minnesota) and Virtual Ability, Inc (Aurora, Colorado), set out to create a successful virtual island for amputee peer support groups.

In September 2009, the Amputee Virtual Environment Support Space (AVESS) two-phase development program was launched. During the initial phase, planning sessions, advisory panel discussions, hardware/software demonstrations (i.e., the functionality of the Second Life Enterprise), and concept demonstrations were performed to assess the benefits and functionality of the virtual environment for military amputee peer-to-peer and family support. The advisory panel members included an active Second Life military amputee, the spouse of

an injured Army veteran, an Army amputee athlete, a disabled military personnel peer support group leader, and an amputee leader from the Department of Veterans Affairs and Department of Defense.

The second phase of the AVESS development will focus on the construction of the AVESS environment, as well as human-use studies to determine the efficacy of the online peer support groups. The AVESS environment will be deployed on Second Life Enterprise, a stand-alone server cluster that ADL Company will host for the duration of the project and that will be accessible from TATRC's Second Life laboratory to review real-time progress. The AVESS environment consists of four main virtual environment regions (**Figure**). The AVESS environment includes a number of regions, as shown in the **Figure**. The overall island (**Figure (a)**) includes the orientation region (**Figure (b)**), where users learn how to navigate and are introduced to the immersive environment; the meeting region (**Figure (c)**), which allows private group meetings among users; and the avatar customization area (**Figure (d)**), where users can change their avatars to express their identity in the virtual space.

CONCLUSIONS

The AVESS program continues to research the peer support needs of military amputees and establish protocols and prototypes for addressing these needs and supplementing pre-existing peer-to-peer and family support with other online and telemedicine resources.

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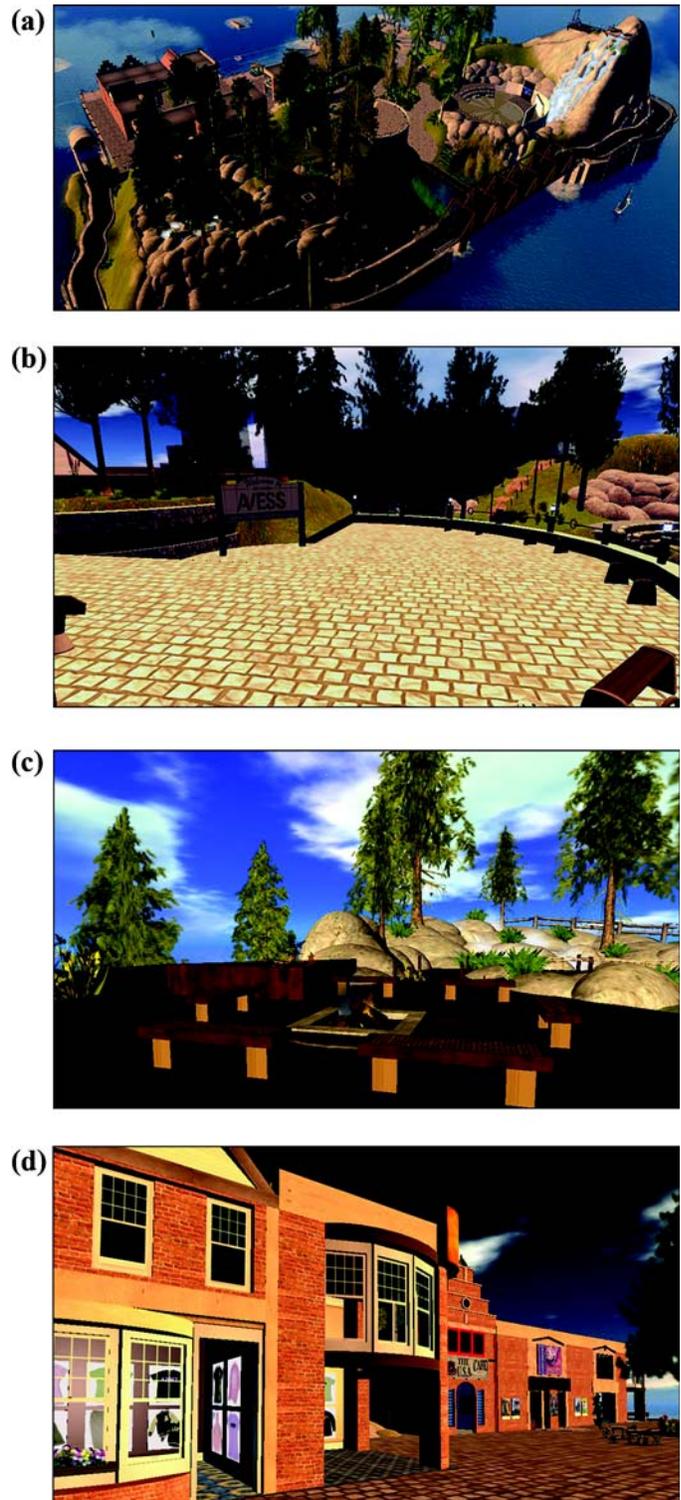


Figure. (a) Amputee Virtual Environment Support Space, (b) orientation region, (c) small group meeting region, and (d) avatar customization region.

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