Annual Review of Cybertherapy and Telemedicine

Volume 7 Year 2009 ISSN: 1554-8716

Advanced Technologies in the Behavioral Social and Neurosciences

Editors:
Brenda K.Wiederhold, PhD, MBA, BCIA
Giuseppe Riva, PhD, MS, MA

Interactive Media Institute

Second Life, Bio-Sensors, and Exposure Therapy for Anxiety Disorders

Christine LISETTI[a,1], Emmanuel POZZO[a], Marie LUCAS[a], Frank HERNANDEZ[a], Wendy SILVERMAN[b], Bill KURTINES[b] and Ana PASZTOR[a]
[a]*School of Computing and Information Sciences, FIU, Miami, USA*
[b]*Department of Psychology, FIU, Miami, USA*

Abstract. We give an overview of the Second Life (SL) virtual world, explaining what objects can be manipulated to implement user-defined scenari in SL, and give an example of a work-in-progress scenario of exposure therapy for anxiety disorders, coupled with automatic processing of bio-sensed emotional signals. Both e-Health and emotion recognition researchers can benefit from such experiments.

Keywords. e-Health Interventions, Second Life, Bio-Sensors, Exposure Therapy, Anxiety

Introduction

Research has shown that virtual environments with the ability to digitally recreate the realism of the physical world on a video screen (e.g. on a PC) can play an important role in computer-based psychotherapy [1,2], in addition to their already established popularity as virtual games. The *Second Life virtual environment* [3] has proven to be a particularly promising scientific tool [4]. Second life (SL) is an online virtual world, and a massively multiplayer online game (MMORPG) with an active community of developers and players. SL combines social networking and online gaming, which has evolved in terms of its usage: it started as a platform dominated by teenagers and young adults who used it as a social networking platform, and it now includes a wide variety of uses – ranging from educational facilities that build virtual campuses to give remote lectures (e.g. Univ. Ohio), businesses that have virtual corporate headquarters where they advertise their products (e.g. IBM), and research institutions that explore new ways to experiment with therapeutic and sociological settings [4].

1. An Overview of Second Life

Users who wish to connect to SL need only to download a desktop client for either Mac or PC, called the *SL Viewer*. Once connected, the user chooses an avatar and the SL experience begins. From then on, the user controls the movements and interactions of its **avatar** in the virtual world with the keyboard and mouse. Communication with

[1] Corresponding Author: School of Computing and Information Sciences, Florida International University, 1200 S.W. 8th Street, Miami, FL 33199, USA; E-mail: Lisetti@cis.fiu.edu.

Figure 1. Avatars in classroom created in *Second Life*.

Fig. 2.a GSR2 skin conductance device

Fig. 2.b Pulse Plethysmograph.

other users (via their avatar) occurs either via text or voice. Instant messaging, text, or voice can be used for private chat between two or more SL residents. One of the most important aspects of the SL experience is a user's online identity, manifested in a person's avatar. SL provides both default avatars from which the player can build a specific identity by choosing the avatar's gender and appearance (e.g. body type, facial features). In addition, *templates* can be manipulated with high-end graphic editing programs to fine-tune aspects of the avatar (e.g. curls, irises, body-part textures, fabric). Examples of avatars in a classroom setting are shown in Figure 1. SL is filled with 3D objects, mimicking real world objects created by SL residents (e.g. buildings, houses, rooms, vehicles, animals). Because of its sophisticated graphics and game engine, SL makes it possible to create prototypes of virtual worlds and to design custom-made objects. Actions can be added to objects via scripts written in the SL programming language that can be used to write high-level AI scripts. As explained subsequently, Figure 2 shows the bio-sensors that we use to collect and automatically analyze physiological signals (GSR, HRV) elicited by emotionally loaded stimuli [5].

2. Exposure Therapy for Children with Anxiety Disorders

Exposure therapy is a psychotherapeutic intervention that exposes the patient to feared situations and objects, found to be effective in the reduction of phobic and anxious symptomatology (e.g. phobias, anxiety disorder, Post-Traumatic Stress Disorder (PTSD) [1,6]. The principle is to slowly increase the level of intensity of the feared stimuli over multiple sessions, with the goal to slowly desensitize the patient to the stimuli by developing strong expectations of successful outcomes in the recreated situation (e.g. the student delivers successful oral presentations). Until recently, clinical psychologists 'exposed' patients by either asking patients to recreate feared situations in their *imagination*, or by working *in vivo* with a real life situations. Although exposure has proven useful for a variety of mental disorders, it has limitations: patients greatly vary in their ability to generate mental imagery, and working in vivo remains

Table 1. Fear Hierarchy for Agoraphobia

Feared Situation	Fear
School cafeteria	7
Classroom	7
Movie theaters	6
Waiting in line at store	6
Public transportation (e.g. train)	5
Restaurants	5
Church or temple	4
Stores or malls	4

Table 2. Fear Hierarchy for Social Situations

Feared Situation	Fear
Oral reports/reading aloud	8
Asking the teacher a question	7
Asking the teacher for help	6
Working or playing with a group of kids	6
Starting or joining a conversation (w/ classmates)	6
Inviting a friend to get together	5
Writing on the chalkboard	5
Walking in the hallways	4

difficult to control and to reproduce. The appeal of using virtual environments to simulate specific situations crafted for a specific user is an attempt to approach these limitations. We used *fear hierarchies* that appear to reoccur in children with anxiety disorders, shown in Tables 1 and 2 [6]: the feared situation is associated with the level of fear intensity it can elicit (on a scale from 1-low to 8-high).

As shown in Figure 1, we designed a classroom populated with students and a standing teacher to address the 'oral report' feared situation in Table 2. Increasing levels of fear intensity will be manipulated in various ways and their effect measured simultaneously with bio-sensors for GSR and HRV. Bio-signals are starting to be mapped automatically to specific affective state characteristics [5], but one of the limitations faced by automatic recognition is the ability to capture reproducible emotional stimuli-response for algorithm development. Stimuli variations will include changing the SL child's view between first-person and third-person, the number and attitudinal body language of the students in the class, the teacher appearance, the classroom design itself, etc. Interdisciplinary experiments will be conducted to *both* (1) test and document the effect of SL exposure therapy, and (2) enable the concurrent reliable capture of physiological signals for automatic recognition of emotions.

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