NeuroVR 1.5 - A Free Virtual Reality Platform for the Assessment and Treatment in Clinical Psychology and Neuroscience

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Abstract. At MMVR 2007 we presented NeuroVR (http://www.neurovr.org) a free virtual reality platform based on open-source software. The software allows non-expert users to adapt the content of 14 pre-designed virtual environments to the specific needs of the clinical or experimental setting. Following the feedbacks of the 700 users who downloaded the first version, we developed a new version – NeuroVR 1.5 – that improves the possibility for the therapist to enhance the patient's feeling of familiarity and intimacy with the virtual scene, by using external sounds, photos or videos. Specifically, the new version now includes full sound support and the ability of triggering external sounds and videos using the keyboard. The outcomes of different trials made using NeuroVR will be presented and discussed.

Keywords: Virtual Reality, Assessment, Therapy, NeuroVR, Open Source

1. Introduction

The use of virtual reality (VR) in medicine and behavioral neurosciences has become more widespread. Healthcare virtual reality applications have experienced double-digit growth both worldwide and in the United States since the turn of the century, and the 2010 U.S. market for virtual reality in surgery, medical education, therapy and other areas will grow to $290 million, according to a new report from research firm Kalorama Information [1].

The growing interest in medical applications of VR is also highlighted by the increasing number of scientific articles published each year on this topic: searching Medline with the keyword "virtual reality", we found that the total number of publications has increased from 45 in 1995 to 286 in 2007, showing an average annual growth rate of nearly 15 per cent.

Although it is undisputable that VR has come of age for clinical and research applications [2-4] the majority of them are still in the laboratory or investigation stage.

In a recent review [5], Riva identified four major issues that limit the use of VR in psychotherapy and behavioral neuroscience:

- the lack of standardization in VR hardware and software, and the limited possibility of tailoring the virtual environments (VEs) to the specific requirements of the clinical or the experimental setting;
- the low availability of standardized protocols that can be shared by the community of researchers;
- the high costs (up to 200,000 US$) required for designing and testing a clinical VR application;
- most VEs in use today are not user-friendly; expensive technical support or continual maintenance are often required.

To address these challenges, we presented At MMVR 2007 NeuroVR (http://www.neurovr.org) a free virtual reality platform based on open-source software [6]. The software allows non-expert users to adapt the content of 14 pre-designed virtual environments to the specific needs of the clinical or experimental setting.

Following the feedbacks of the 700 users who downloaded the first version, we developed a new version – NeuroVR 1.5 – that improves the possibility for the therapist to enhance the patient's feeling of familiarity and intimacy with the virtual scene, by using external sounds, photos or videos.

2. NeuroVR 1.5

2.1. Features

Using NeuroVR 1.5, the user can choose the appropriate psychological stimuli/stressors from a database of objects (both 2D and 3D) and videos, and easily place them into the virtual environment. The edited scene can then be visualized in the Player using either immersive or non-immersive displays. Currently, the NeuroVR library includes 14 different virtual scenes (apartment, office, square, supermarket, park, classroom, etc.), covering some of the most studied clinical applications of VR: specific phobias, cognitive rehabilitation, panic disorders and eating disorders. Specifically, the new version now includes full sound support and the ability of triggering external sounds and videos using three different approaches: the keyboard, timeline or proximity.

The NeuroVR Editor is built using Python scripts that create a custom graphical user interface (GUI) for Blender. The Python-based GUI allows to hide all the richness and complexity of the Blender suite, so to expose only the controls needed to customize existing scenes and to create the proper files to be viewed in the player.

NeuroVR Player leverages two major open-source projects in the VR field: Delta3D (http://www.delta3d.org) and OpenSceneGraph (http://www.openscenegraph.org). Both are building components that the NeuroVR player integrates with ad-hoc code to handle the simulations.

The whole player is developed in C++ language, targeted for the Microsoft Windows platform but fully portable to other systems if needed.

2.2. Applications

The key characteristics that make NeuroVR suitable for most clinical applications are the high level of control of the interaction with the tool, and the enriched experience provided to the patient.

These features transform NeuroVR in an "empowering environment", a special, sheltered setting where patients can start to explore and act without feeling threatened. Nothing the patient fears can "really" happen to them in VR. With such assurance, they can freely explore, experiment, feel, live, and experience feelings and/or thoughts. NeuroVR thus becomes a very useful intermediate step between the therapist's office and the real world. Actually, NeuroVR is used in the assessment and treatment of Obesity [7], Alcohol Abuse [8], Anxiety Disorders [2], Generalized Anxiety Disorders and Cognitive Rehabilitation.

3. Conclusions

In this chapter, we introduced NeuroVR 1.5, the new version of an advanced platform designed for the creation and customization of highly flexible VEs for clinical psychology and behavioral neurosciences.

A future goal is to provide software compatibility with instruments that allow collection and analysis of behavioral data, such as eye-tracking devices and sensors for psycho-physiological monitoring. Beyond clinical applications, NeuroVR provides the VR research community with a free "VR lab", which allows the creation of highly-controlled experimental simulations for different of behavioral, clinical and neuroscience applications.

4. References

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