

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

NeuroVR 1.5 in Practice: Actual Clinical Applications of the Open Source VR System

Giuseppe RIVA^{a,c,1}, Laura CARELLI^a, Andrea GAGGIOLI^{a,c}, Alessandra GORINI^{a,b}, Cinzia VIGNA^a, Davide ALGERI^a, Claudia REPETTO^a, Simona RASPELLI^a, Riccardo CORSI^d, Gianluca FALETTI^d, Luca VEZZADINI^d
^a*Applied Technology for Neuro-Psychology Lab, Istituto Auxologico Italiano, Milan, Italy*

^b*Research Institute Brain and Behaviour, Maastricht University, The Netherlands*

^c*Psychology Department, Catholic University of Milan, Italy*

^d*Virtual Reality Multimedia Park, Turin, Italy*

Abstract. At CT 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. 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. Actually, NeuroVR is used in the assessment and treatment of Obesity, Alcohol Abuse, Anxiety Disorders, Generalized Anxiety Disorders, and Cognitive Rehabilitation.

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

Introduction

The growing interest in medical applications of virtual reality (VR) is 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 291 in 2008 [1].

Although it is undisputable that VR has come of age for clinical and research applications, the majority of them are still in the laboratory or investigation stage. In a recent review [2], 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;
- the low availability of standardized protocols;

¹ Corresponding Author: E-mail: giuseppe.riva@unicatt.it

- the high costs (up to 200,000 €) required for design and testing;
- 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 CT 2007 the NeuroVR software (<http://www.neurovr.org>): a free virtual reality platform based on open-source software [3]. 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 [1].

Following the feedbacks of the 700 users who downloaded the first version, we developed a new version: NeuroVR 1.5.

1. NeuroVR 1.5

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 has the ability to hide all the richness and complexity of the Blender suite, as 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>).

2. Clinical 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.

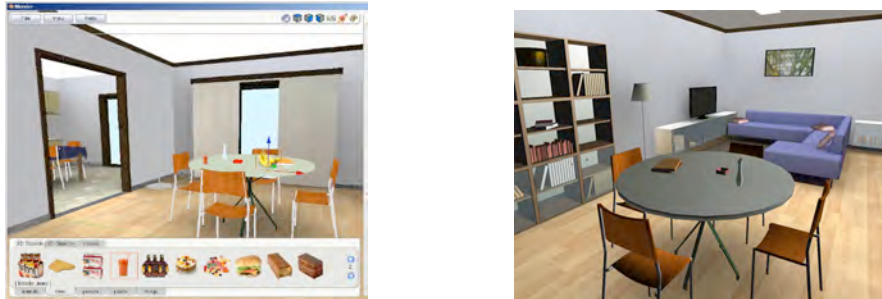


Figure 1. The NeuroVR Editor (*left*) and Player (*right*)

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 [4], Alcohol Abuse [5], Anxiety Disorders [6], Generalized Anxiety Disorders [7], and Cognitive Rehabilitation [8].

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.

References

- [1] G. Riva, and A. Gaggioli, Virtual clinical therapy, *Lecture Notes in Computer Sciences* **4650** (2008), 90-107.
- [2] G. Riva, Virtual reality in psychotherapy: review, *CyberPsychology & Behavior* **8** (3) (2005), 220-30.
- [3] G. Riva, A. Gaggioli, D. Villani, A. Preziosa, F. Morganti, R. Corsi, G. Faletti, and L. Vezzadini, NeuroVR: an open source virtual reality platform for clinical psychology and behavioral neurosciences, *Studies in Health Technology and Informatics* **125** (2007), 394-9.
- [4] G. Riva, M. Bacchetta, G. Cesa, S. Conti, G. Castelnuovo, F. Mantovani, and E. Molinari, Is severe obesity a form of addiction? Rationale, clinical approach, and controlled clinical trial, *CyberPsychology and Behavior* **9** (4) (2006), 457-479.
- [5] E. Gatti, R. Massari, C. Sacchelli, T. Lops, R. Gatti, and G. Riva, Why do you drink? Virtual reality as an experiential medium for the assessment of alcohol-dependent individuals, *Stud Health Technol Inform* **132** (2008), 132-7.
- [6] A. Gorini, and G. Riva, Virtual reality in anxiety disorders: the past and the future. *Expert Review of Neurotherapeutics* **8** (2) (2008), 215-233.

- [7] A. Gorini, and G. Riva, The potential of Virtual Reality as anxiety management tool: a randomized controlled study in a sample of patients affected by Generalized Anxiety Disorder, *Trials* **9** (2008), 25.
- [8] F. Morganti, A. Gaggioli, L. Strambi, M.L. Rusconi, and G. Riva, A virtual reality extended neuropsychological assessment for topographical disorientation: a feasibility study, *Journal of Neuroengineering and Rehabilitation* **4** (2007), 26.