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The Application of Virtual Reality to the Understanding and Treatment of Schizophrenia

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Abstract. Virtual Reality (VR) techniques are increasingly being used in education about and in the treatment of certain types of mental illness. Research indicates VR is delivering on it's promised potential to provide enhanced training and treatment outcomes through incorporation of this high-end technology. Schizophrenia is a mental disorder affecting 1–2% of the population. A significant research project being undertaken at the University of Queensland has constructed virtual environments that reproduce the phenomena experienced by patients who have psychosis. The VR environment will allow behavioral exposure therapies to be conducted with exactly controlled exposure stimuli and an expected reduction in risk of harm. This paper reports on the work of the project, previous stages of software development and current and future educational and clinical applications of the Virtual Environments.

1 Introduction

Schizophrenia is a debilitating mental illness that often strikes people in their prime. Psychotic symptoms include delusions, hallucinations, and thought disorder [1]. Most people with these symptoms "hear" voices, and a large proportion also "see" visual illusions. At present patients have to describe their hallucinations, and often feel that their therapists cannot really understand them. Therapists themselves have difficulties learning about the exact nature of psychosis.

Virtual reality (VR) provides a real option for translating a person's psychological experience into a 'real' experience others can share. VR techniques are increasingly being used in trial clinical programs and in the treatment of certain types of mental illness [4,5,6]. The ability of VR users to become immersed in virtual environments provides a potentially powerful tool for mental health professionals [2,3]. The University of Queensland research team have been collaborating for the past twelve months in the development of VR software to use in education, training and treatment of schizophrenia.

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2 The VISAC Laboratory and Remote Visualisation

The Visualisation and Advanced Computing Laboratory (VISAC) at the University of Queensland consists of an immersive curved screen environment of 2.5m radius and providing 150 degrees field of view. Three projectors separated by 50 degrees are used to project the images onto the curved screen. The curved screen environment is suitable for having small groups of people, eg patients and caregivers, to share the immersive experience. These facilities are managed by the Advanced Computational Modelling Centre (ACMC). The Centre has around 20 academic staff with expertise in scientific modelling, advanced computing, visualisation and bioinformatics (see http://www.acmc.uq.edu.au).

2.1 Stages of Software Development

Using the VISAC facilities the project has modelled the experience of psychosis in virtual environments. The ultimate goal of the project is to develop VR software that patients can use, in conjunction with their therapist, to re-create their experiences to allow for enhanced monitoring of their illness.

To ensure the re-created virtual world accurately models the patient's inner world, actual patients with schizophrenia have been interviewed and asked to describe their symptoms in detail. These descriptions have then been transcribed into models of the hallucinations that are personal to individual patients. Patients are interviewed for both feedback and evaluation on their individualised VR program.

The project commenced in October 2001, and since then, has undergone a number of distinct development phases:

Phase 1 The initial work involved building a model of an everyday environment, in this case a living room, using a commercial 3D modelling package called Realax.

The hallucinations modelled included: a face in a portrait morphing from one person into another and also changing its facial expression; a picture on the wall undergoing distortion; the walls of the room contracting and distorting so that the straight edges of the walls appeared curved; the blades of a ceiling fan dipping down; and the TV switching on and off of its own accord. In addition, a soundtrack of auditory hallucinations, provided by the pharmaceutical company Janssen-Cilag, was played in the background as the visual hallucinations occurred. This was in order to acheive a good approximation to the cacophony of voices that would be present for a patient who is attempting to concentrate on everyday tasks.

This initial model was presented to a number of patients with schizophrenia. Feedback from patients was generally positive. However, due to the generic nature of the auditory and visual hallucinations portrayed, it was not possible to confirm how realistic the model was. A number of patients commented that they liked the concept of virtual hallucinations, however, they felt the hallucinations modeled did not actually relate to them.

Phase 2 The second phase of the project involved modeling the actual experiences, as described, by one specific patient with schizophrenia. In this way, a model of psychosis would be built from the patient's perspective. The virtual environment was moved from a living room to a psychiatric ward.

Development of the virtual environment for Phase 2 comprised two main steps. The first step involved creating the model of the psychiatric ward, and models of static elements of the scene (eg. furniture) using a 3D modelling package. In order to build a model of a psychiatric ward and the objects within it, the model was built from photographs of an actual psychiatric unit at the Royal Brisbane Hospital in Brisbane. The static models of the psychiatric ward and objects were saved as VRML files for inclusion into the main program.

The second stage of development involved writing the main program which loads, positions and displays the static elements, and also which implements the dynamic parts of the scene, such as sounds and movements of objects. The software was written in C/C++, in conjunction with an open source, cross platform scene graph technology. This method of implementation was chosen as it will allow us to eventually port the software from the current IRIX platform to a PC platform. This will enable the software to be used, for example, in a psychiatrist's office or in a hospital, making it more accessible to patients, caregivers and mental health workers. The software was designed so that the user is able to navigate around the scene using the mouse and keyboard, and various hallucinations are triggered either by proximity to objects, by pressing hot keys, or by clicking an object with the mouse.

Hallucinations modelled included an apparition of the Virgin Mary, which would appear and "talk" to the patient; the word "Death" appearing to stand out of newspaper headlines; random flashes of light; a political speech, which changes to refer to the patient; choral music; and auditory hallucinations described by the patient.

Feedback from the patient who described her personal hallucinations was positive. She reported the virtual environment was an "extraordinary experience" and "captured the essence of the experience". The patient also commented the virtual environment was effective in re-creating the same emotions that she experienced on a day-to-day basis during her psychotic episodes.

3 Application of the Software in Education and Training

Virtual Reality (VR) has enormous potential in teaching students about the complex nature of schizophrenia. It has been used successfully in education to provide a more interactive learning experience for students [7]. The use of VR can provide students with first hand knowledge of what hallucinations "feel" like with the outcome that practitioners will empathise more readily with patients with psychosis. Empathy is recognised as an essential component of effective mental health care. It is related to the constructs of rapport and therapeutic alliance and forms part of the core clinical skills repertoire for health professionals. An important focus of training in psychiatry is to facilitate through training the development of empathy or rapport as a result of a practitioner's appropriate attention to the client.

The first application of the VR psychosis software has been into the psychiatry classroom. A survey was conducted with students on their experiences with current teaching methods as compared to the use of VR as a teaching tool. 75% of the students indicated that the use of VR in the classroom assisted them to better understand schizophrenia. More importantly, 67% of the students reported the use of VR clarified many of the ambiguities of schizophrenia not resolved for students by current teach-

ing methods and tools. Through open-ended questions students commented that the most useful application of VR in their training was to provide them with "as close a first hand experience as one would like to get and students can also better empathise" with the people suffering from schizophrenia [8]. In essence, the application of VR technology to the education of medical students facilitates an improved understanding of the impact of the psychological experiences of patients with schizophrenia. Future research will apply a specifically developed measurement tool to determine statistically whether practitioners score significantly higher as empathic to patients with psychosis after VR training than before VR training. Level of experience in mental health and exposure to other sources of psychotic experience are also expected to influence scale scores and will be entered as covariates.

4 Application of the Software to Clinical Environments

VR is also proposed as a new medium of cognitive behavior therapy for patients with schizophrenia. The processes of habituation and extinction, in which the feared stimuli cease to elicit behavioral and psychological responses make it's meaning less threatening [9]. The use of VR in therapy is predicted, through activating the responses and modifying them, to improve symptoms of schizophrenia.

This further stage of the VR and Schizophrenia Project will investigate the software as a tool with which cognitive-behavior therapy can be effectively delivered to patients with schizophrenia. The focus is on implementation and evaluation as outlined in the following two stages:

4.1 Stage One: Case Reports

There is a growing body of literature suggesting that the use of VR in exposure therapy for specific phobias, including claustrophobia, acrophobia, arachnophobia, is effective [2, 6, 9]. To date no research exploring the clinical use of VR in psychosis can be located. Case studies will be conducted where patients will be exposed to the specific hallucinations they have described during therapy sessions. It is proposed therapy will be conducted twice weekly, for a total of twenty sessions. This is based on the use of non-technology assisted cognitive-behavioral therapy [10].

4.2 Stage Two: Controlled Outcome Data

A pretreatment assessment will be conducted for a VR augmented treatment group, a standard treatment group and a wait-list group. Immediately following the pretreatment assessment the first treatment session will be conducted in which patients will be familiarised with the VR equipment. Following this session participants in the treatment group will receive a pre-determined number of weekly individual treatment sessions (approximately 20) consisting of exposure to their individualised hallucinations. Full assessments will be conducted at pre and post-treatment for each of the three groups of participants. These will involve measurement of changes using the CPRS, MADRS & SANS measures.

5 Conclusion

Virtual Reality (VR) is a high-end multimedia tool that has enormous potential in teaching students about the complex nature of schizophrenia. Even during the early stages of this project it has been used successfully in psychiatry lectures to provide a more interactive learning experience for students [7]. Medical students surveyed have reported the virtual schizophrenia environments have provided them with first hand knowledge of what hallucinations "feel" like.

To date no research exploring the clinical use of VR in psychosis can be located. It is expected clinical trials will commence within the next twelve months. As outlined, the main aims of the project are the development of the virtual reality software for use in clinical environments and to design it to be deliverable on consulting room PCs. This project has the potential to have a significance impact on the field of psychiatry in both the assessment and ongoing monitoring of patients with schizophrenia.

References

[1] Kaplan, H., Sadock, B.(2000) *Comprehensive Textbook of Psychiatry, vols. 1-2*. LippincotWilliams Wilkin, Philadelphia

[2] Hodges, L., Anderson, P., Burdea, G., Hoffman, H., Rothbaum, B. (2001) Treating Psychological and Physical Disorders with VR, *IEEE Computer Graphics and Applications.* Nov/Dec, pp. 25–33

[3] Kahan, M.(2000) Integration of Psychodynamic and Cognitive-Behavioral Therapy in a Virtual Environment. *Cyberpsychology & Behavior.* 3, pp.179-183

[4] Riva, G., Gamberini, L.(2000) Virtual Reality in Telemedicine. *Cyberpsychology & Behavior*. 6, pp. 327-340

[5] Riva G.(2000) From Telehealth to E-Health: Internet and Distributed Virtual Reality in Health Care. *Cyberpsychology & Behavior*. 3, pp. 989-998

[6] Anderson, P., Rothbaum, B., Hodges, L.(2001) Virtual Reality: Using the Virtual World to Improve Quality of Life in the Real World. *Bulletin Menninger Clinic*. 65, pp. 78-91

[7] MacPherson C., & Keppell, M. (1998). Virtual Reality: What is the state of play in education? *Australian Journal of Educational Technology*, 14, pp. 60-74

[8] Tichon, J. & Loh, J. (2002) The Use of Virtual Environments in the Education and Training of Psychiatry, Unpublished Manuscript

[9] Rothbum, B.O., Hodges, L.F., Ready, D., Graap, K., & Alarcon, R.D. (2001) Virtual reality therapy for Vietnam veterans with posttraumatic stress disorder. *Journal of Clinical Psychiatry*, 62(8), pp. 617-622

[10] Sensky, T., Turkington, D., Kingdon, D., Scott, J.L., Scott, J., Siddle, R., O'Carroll, M. & Barnes, T.R. (2000) A randomized controlled trial of cognitive-behavioral therapy for persistent symptoms in schizophrenia resistant to medication, *Archives of general Psychiatry*, 57(2), pp. 165-173