AD_____

Award Number: W81XWH-06-1-0566

TITLE: CyberTherapy II, Virtual Healing, Designing Reality

PRINCIPLE INVESTIGATOR: Brenda K. Wiederhold, Ph.D.

CONTRACTING ORGANIZATION: Interactive Media Institute
San Diego, CA 92121

REPORT DATE: August 2006

TYPE OF REPORT: Final Proceedings

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

20060828028

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01-08-2006	Final Proceedings	12 Jun 2006 – 14 Jul 2006

4. TITLE AND SUBTITLE

CyberTherapy II, Virtual Healing, Designing Reality

5a. CONTRACT NUMBER

5b. GRANT NUMBER
W81XWH-06-1-0566

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Brenda K. Wiederhold, Ph.D.

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Interactive Media Institute
San Diego, CA 92121

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES
Original contains colored plates: ALL DTIC reproductions will be in black and white.

14. ABSTRACT

This year's theme for the 11th Annual CyberTherapy Conference, *"Virtual Healing: Designing Reality,"* acknowledges the importance of two related types of scientific studies: clinical applications of VR and other technologies, and experimental research on why it has such a powerful impact on behavioral healthcare, medicine, and neuroscience. The theme also highlights changes which have occurred in the past decade; that which was once in the realm of science-fiction has now increasingly become part of our reality. A critical aim of this symposium is to stimulate more clinicians and technical professionals to design and test these tools, improving the overall outcome of cybertherapy interventions. This conference serves as a platform for representatives from both governmental and private funding agencies, as well as internationally renowned clinicians and researchers. By utilizing technology for training and therapy, we are able to improve existing protocols, and disseminate care to a wider segment of the population.

15. SUBJECT TERMS
Clinical Application of VR; Cybertherapy; Technological Applications/Advances; Original Research/Findings; Therapy/Healthcare

16. SECURITY CLASSIFICATION OF:

a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES
U	U	U	UU	367

19a. NAME OF RESPONSIBLE PERSON
USAMRMC

19b. TELEPHONE NUMBER *(include area code)*

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

Table of Contents

Introduction

The field of cybertherapy is progressing at a rapidly increasing pace. It evolved from mere ideas and proofs of concepts to pilot studies and theoretical papers based on very few and almost anecdotal data, and now into a more mature and respected research field. We are still witnessing new developments, and I hope there will always be new applications. But we are now seeing more and more large scale studies using excellent methodologies and controls. We are venturing more often in areas such as treatment mechanisms, dismantling of treatment protocols, examination of side effects and comparisons with more traditional approaches.

In the eleven years since its inception, the conference's focus has expanded from virtual reality (VR) alone to now include such cutting-edge technologies as adaptive displays, E-health, videogames, and robotics. The collection of abstracts from this conference is evidence of that expansion with studies relating to the use of a wide variety of advanced technologies.

The 11th Annual CyberTherapy Conference: Virtual Healing – Designing Reality, organized by the Interactive Media Institute, (IMI) a 501(c)(3) non profit organization, in cooperation with the CyberPsychology Lab of University of Quebec in Outaouais (UQO), was held on June 12-15th, 2006, in Gatineau, Canada.

This year's theme, *"Virtual Healing: Designing Reality,"* acknowledges the importance of two related types of scientific studies: clinical applications of VR and other technologies, and experimental research on why it has such a powerful impact on behavioral healthcare, medicine, and neuroscience. The theme also highlights changes which have occurred in the past decade; that which was once in the realm of science-fiction has now increasingly become part of our reality. A critical aim of this symposium is to stimulate more clinicians and technical professionals to design and test these tools, improving the overall outcome of cybertherapy interventions. By utilizing technology for training and therapy, we are able to improve existing protocols, and disseminate care to a wider segment of the population.

Body

The highlights of CT06 were the participation of our keynote speaker and the presentation of three separate categories of awards. The invaluable contribution of the CT06 keynote speaker, Dr. Michel Fleury, offered us the opportunity to gaze into future areas of applications for virtual humans. We were also proud to award the 2nd Annual CyberTherapy Excellence in Research Award. This award was presented to the person who had demonstrated outstanding achievements in the fields of virtual reality and behavioral healthcare. In addition, the CRC-Clinical Cyberpsychology New Investigator Award for a presentation of outstanding research quality was to reward the presentation of strong methodological study at the Cybertherapy conference. The recipient had to be a researcher who was new to the field of cyberpsychology. The award was delivered by Dr. Stéphane Bouchard, Chairholder of the Canada Research Chair in Clinical Cyberpsychology, and included a certificate and a check of $1000. Finally, this year's conference awarded three Student Poster Awards, each worth $250. Posters were judged for scientific merit and ease of presentation by the conference co-organizers, Drs. Brenda K. Wiederhold and Stéphane Bouchard, as well as the conference workshop chair Dr. Skip Rizzo and scientific chairs Drs. Giuseppe Riva and Russell Shilling.

A "Cyberarium" was held as part of the conference. Many presenters at the conference displayed their own virtual reality material during this event, in the evening of June 13, 2006. This show-and-tell presentation, which was open to the press, featured a variety of virtual reality products and demonstrations on how these tools are being applied for therapeutic purposes.

This year's conference topics included VR applications to such varied disorders as anxiety, addictions, autism, schizophrenia, and posttraumatic stress disorder. Furthermore, VR for neurorehabilitation and physical rehabilitation has demonstrated profound success, as has VR for other such diverse areas such as prosthetics and orthotics training, pain, cybertraining, education and simulations. In addition to VR, the conference's focus has expanded to include such topics as presence, neuropsychology, and new applications.

A feature that was continued this year was the pre-conference workshops. Our workshop chair, Dr. Stéphane Bouchard, once again provided a variety of both beginning and advanced pre-conference workshops, allowing those new to the area as well as more seasoned researchers to gain additional knowledge. Workshop 1, Basic Issues about Virtual Reality and its Clinical Applications, chaired by Drs. Evelyne Klinger and Sophie Côté, aimed to present the one hand concepts that are essential to understanding if one is interested in using virtual reality in clinical applications, such as: what is virtual reality, what kind of equipment is involved, what is the feeling of presence, what is cybersickness and how to prevent it, how to get or create virtual environments. Workshop 2, Virtual Reality and Pain Reduction, chaired by Drs. Dave Thomas and Jeffrey I. Gold, presented the empirical evidences showing the potential of virtual reality to distract people from their acute pain. Drs. Albert "Skip" Rizzo and Maria Schulthe chaired Workshop 3, VR and Neurological Assessment/Rehabilitation, which introduced an overview of the field of neuropsychological assessment and cognitive rehabilitation VR applications, and detailed their strengths and limitations. In Workshop 4, Virtual Reality and the Treatment of Anxiety Disorders, Drs. Brenda K. Wiederhold and Stéphane Bouchard, reviewed literature on this form of therapy, as well as presented treatment packages and tips to conduct effective exposure. In Workshop 5, Virtual Reality and the Treatment of Eating Disorders & Addictions, Drs. Giuseppe Riva, Rosa-Maria Banos, Patrick Bordnick, as well as Steve Baumann and Ken Graap, detailed the experiential approach of VR by describing a few empirical studies, followed by the presentation of two different treatment protocols. Drs. Tamar Weiss and Heidi Sveistrup (with Drs. Joyce Fung and Mindy Levin) chaired Workshop 6, Virtual Reality and Motor Rehabilitation, which presented the principles of VR-based therapy for motor rehabilitation in terms of a comparison to the achievement of therapeutic objectives via conventional intervention.

The 4-day conference featured an impressive 15 special sessions. Symposium 1, chaired by Drs. Patrice Renaud and Richard Laws, featured presentations on Cybersexuality. Symposium 2, chaired by Drs. Elmar Schmeisser and Alex H. Bullinger, introduced an array of presentations on the topic of Prosthetics and Orthotics Training. Symposium 3, chaired by Drs. David Thomas and Susan Schneider, offered presentations on Health Psychology & Pain. During

Symposium 4, Drs. Russell Shilling and Jeanne Talbot led a discussion panel on Posttraumatic Stress Disorder. In session 5, Drs. Paul Sharkey and Fabrizia Mantovani thoroughly discussed the maturing technology of New Applications. In Symposium 6, Drs. Heidi Sveistrup and Tamar Weiss focused on Rehabilitation. Symposium 7, a continuation of Rehabilitation 1, was again chaired by Drs. Tamar Weiss and Heidi Sveistrup. Drs. Stéphane Bouchard and Brenda K. Wiederhold chaired the first symposium, Symposium 8, on anxiety, Anxiety 1 - Large Outcome Trials. In session 9, Drs. Patrick Bordnick and Kay Howell chaired Addictions, which focused on the remarkable advances for the treatment of addictions using VR. Drs. Greg Mogel and Cristina Botella chaired session 10 on the continued topic of Anxiety 2 - New Developments & Treatment Mechanisms. Symposium 11, led by Drs. Cheryl Trépagnier and Jang-Han Lee, focused on developments in Autism and Schizophrenia. Drs. Giuseppe Riva and Christine Youngblut shared their expertise on Presence in Symposium 12. Dr. Ralph Chatam led a discussion panel on CyberTraining in session 13. Drs. Albert "Skip" Rizzo and Sarah Miyahira chaired Symposium 14 on Neuropsychology. Finally, in Symposium 15, Dr. Sharon Tettegah and Kona Taylor concluded the conference with a symposium on Education, Simulations and Virtual Reality.

Numerous programs targeted specifically to benefit the military were presented at the CyberTherapy 2006 Conference. The Virtual Reality Medical Center (VRMC), led by B.K. Wiederhold and M.D. Wiederhold, is currently conducting Stress Inoculation Training (SIT) and Posttraumatic Stress Disorder (PTSD) treatment for the United States Navy and Marine Corps, the combined result being a program that supports a *continuum of care* for troops. Their Critical Review titled, "From SIT to PTSD: Developing a Continuum of Care for the Warfighter," can be found in Appendix B (11-16). An Evaluation Study by M.C. Stetz, R.M. Wildzunas, and B.K. Wiederhold focuses on testing the effectiveness of Stress Inoculation Training (SIT) for female military medical personnel. The full paper of "The Usefulness of Virtual Reality Stress Inoculation Training for Military Medical Females: A Pilot Study" can also be found in Appendix B (47-55).

Key Research Accomplishments

Over 200 individuals attended the conference to present innovative information in the following areas:

- Clinical Studies/Observations

- New Technological Applications (in the Cyberarium)

- Critical Reviews

- Original Research/Research Findings

- Evaluation Studies

- Technological Advances

In addition, three categories of awards were presented at the CyberTherapy 2006 Conference:

- 2nd Annual CyberTherapy Excellence in Research Award

- CRC-Clinical Cyberpsychology New Investigator Award

- Student Poster Awards (3 awarded)

The conference also succeeded in accomplishing the following:

- Disseminating information (Cyberarium open to the press)

- Supporting continuing research and education

- Building new collaborations, networks

Reportable Outcomes

- Cutting-edge scientific studies were presented to the audience.

- New collaborations between research groups were established.

- Technology developers were able to connect with clinical partners to test their equipment.

- Investigators met with funders to begin the process of getting their research subsidized.

- Continuing Education credits were awarded by the American Psychological Association.

- Abstracts from the 11th CyberTherapy Conference are attached under Appendix A.

- Manuscripts from the 11th CyberTherapy Conference are attached under Appendix B.

Conclusion

Significant value was gained by all those who attended the conference activities, including clinical researchers, clinical psychologists, clinical psychiatrists, individuals with other M.D.s, hardware and software engineers, those in the networking field, experts in the graphics and animation field, funders, the military, and other branches of the federal government. This conference was the largest cybertherapy conference to date. The substantial attendance rate illustrates the growing interest and importance of technological advances.

The quality of the material presented at the 11th Annual CyberTherapy Conference reaffirms VR's key role in the future of health care. This conference serves as a platform for representatives from both governmental and private funding agencies, as well as internationally renowned clinicians and researchers. By stimulating more clinicians and technical professionals to design and test their tools, we can improve the overall outcome of cybertherapy interventions. By utilizing technology for training and therapy, we are able to improve existing protocols, and disseminate care to a wider segment of the population.

The 12th Annual CyberTherapy Conference: Advancing Healthcare through Technology will be held June 11-14, 2007, in Washington D.C.

References

Please see Appendix A and Appendix B.

Personnel

1. Ms. Summer Carnett

2. Ms. Ruth Kogen

3. Ms. Jamie Sung

Appendix A

Abstracts from CyberTherapy 2006:

CyberTherapy and Telemedicine –

Virtual Healing: Designing Reality

Abstracts from CyberTherapy 2006

The Effects of Virtual Reality on Presence and Dissociative Experience

Frederick Aardema, Sophie Côté, and Kieron O'Connor

Correspondence:
Sophie Côté
Fernand-Seguin Research Centre, Canada
E-mail: psycote@videotron.ca

Dissociative experiences, in particular derealization and depersonalization in particular, are characterized by a sense of unreality and detachment. The concept of detachment has a conceptual overlap with the idea of presence (i.e. the feeling of "being there"). The current study investigates the effects of immersion in a virtual reality environment on the sense of presence, and symptoms of derealization in objective reality using a non-clinical sample of ten participants. To measure presence both inside and outside of the virtual reality environment an adapted version of the iGroup Presence Questionnaire was used. To establish the extent of dissociative experience, the state version of the Cambridge Depersonalisation Questionnaire was administered to the participants. After completion of the initial baseline measures, participants were instructed to explore a virtual reality environment for twenty minutes. The experimental manipulation was followed by a second measurement of sense of presence and symptoms of dissociation (in normal reality). Results are discussed in terms of possible common underlying imaginative processes related to presence (or the absence of presence) in virtual reality environments and feelings of unreality and detachment in objective reality.

Biofeedback and Virtual Reality for Fear of Flying

Jayme Albin, and Robert H. Reiner

Correspondence:
Robert H. Reiner
Behavioral Associates, NY, USA

E-mail: robert.reiner@nyu.edu

Current literature reviews reveal that virtual reality (VR) treatments are effective in reducing anxiety related to fear of flying (FOF). Furthermore, close examination of these studies suggests that biofeedback techniques based on respiratory sinus arrhythmia (RSA) may bolster the VR protocol, and thus, are worthy of investigation. RSA is frequently employed as a breathing technique designed to generate feelings of relaxation, by psychologists, who seek to help patients reduce sympathetic arousal. Biofeedback equipment is used to measure heart rate, EKG, respiration rate, diaphragmatic (belly) breathing and thoracic (chest) breathing. By engaging in slow (approximately six breathes per minute) diaphragmatic breathing and making sure to keep chest breathing to a minimum, patients gradually enter a state of RSA. This is clearly revealed on the computer monitor when inhalation is paired with an increase in heart-rate and exhalation is paired with a decrease. A "scalloping" effect emerges as both waves move together. The greater the disparity between maximum inhalation heart-rate and exhalation heart-rate drop, the larger the RSA, and thus, the more relaxed the patient appears to become. It appears that deep states of RSA are accompanied by feelings of deep relaxation, which can later be paired to phobic situations, in virtual reality, that typically generate anxiety. The present study will examine an experimental biofeedback (RSA) treatment protocol using VR for fear of flying phobia in comparison to the existing state of the art VR treatment therapy protocol of exposure therapy and extinction (no biofeedback). Treatment will be delivered over an eight-week period at Behavioral Associates (BA), in NY, investigating 40 patients seeking treatment for fear of flying. Participants will be randomly assigned to one of two treatment groups after they sign informed consent. Both groups will meet with their therapist for 45-minutes once a week for eight consecutive weeks. Furthermore, both groups will be requested to do at home exercises for 15 minutes daily and will receive Virtual Reality treatment as the method of exposure. One group will receive a treatment protocol of VR only. The experimental group will

receive a combination of RSA biofeedback and VR exposure. Assessment will include a set of self-report measures at baseline and at the end of treatment, assessing personality, (MMPI2), anxiety symptoms, sleep patterns, medication and treatment history In addition, physiological responses of heart rate, respiratory rate and galvanic skin resistance will be recorded while being exposed to the feared stimulus via VR. It is expected that both treatment groups will exhibit clinically significant reductions in anxiety, but a greater reduction of anxiety is expected in the experimental group. Thus we expect to see an interaction by treatment group. Outcome will be based on both subjective self-reports of anxiety and objective physiological responses (from biofeedback instruments).

Virtual Reality as a Research Tool in Neuropsychology: Depth Estimations in the Peripersonal Space

Claudia Armbrüster, Marc Wolter, Jakob T. Valvoda., Torsten Kuhlen, Will Spijkers, and Bruno Fimm

Correspondence:
Claudia Armbrüster
IZKF "BIOMAT."
University Hospital Aachen
Aachen, Germany
E-mail: armbruester@psych.rwth-aachen.de

Neuropsychology discovered the advantages of virtual reality. High realism, interactivity and control provide a wide spectrum of experimental possibilities. However there is a fundamental problem scientist have to deal with when using VR applications: depth perception. A large variability between subjects was observed regarding their ability to perceive distances in VR. Results on distance estimation are especially inaccurate, when objects are far away. In an experimental series different estimation tasks were compared to examine where participants perceive a virtual object in peripersonal space. This is the 3D space in which prehension movements take place and it is controlled by the dorsal cerebral cortex. In three experiments participants had to estimate distances in a simple virtual environment (blue space with a red target sphere) projected on a rear projection screen. In the two experiments verbal estimations were given, in the third experiment participants had to either point to the location where they perceived the target or had to fulfil a matching task with a real ball. The distance of the virtual sphere from the observer in Experiment 1 and 2 was 40 cm and 45 cm in Experiment 3. In Experiment 1 and 2 mean estimation values are 39.2 cm and 38.8 cm for the 40 cm sphere with no significant differences between estimated and true values. In Experiment 3 participants underestimated the distance of 45 cm in the matching task and overestimated it in the pointing task. So, the output transformation has an influence on the accuracy of depth estimation in VR. When discrepancies are compared between the verbal, pointing and matching task, MANOVA results reveal significant differences. Significant pair wise comparisons identify the matching task as the worst condition with an average discrepancy in percent of -29.6%. Accurate depth perception of peripersonal and extrapersonal distances in virtual space is essential for (neuro-) psychological research using VR. Targets have to be perceived where they are projected to avoid confounding effects. The purpose of this work was the identification of the influence of different output transformations. The verbal and the pointing task show that participants are able to perceive peripersonal distances in virtual environments correctly. There are no differences between estimating verbally or using ones own hand to describe a distance. From a neurological point of view this is important because especially in the peripersonal space depth perception plays a fundamental role for action control. When VR is used as a research tool, it is essential that depth perception is not limited, only then generalizability can be ensured. On the basis of the results, it is not expected that confounding effects occur when virtual objects are presented in the peripersonal space. But problems occur when real object (e.g. the hand) can be seen in the virtual scene or, as we know from previous studies, when distances beyond the peripersonal space are displayed. Hence, we recommend to use neuropsychological paradigms in peripersonal space without any real objects, which can cause depth confusion, to avoid confounding effects due to an unsatisfying depth perception.

Simulation-Based Training of Communication and Emotional Competence for the Improvement of Physician-Patient Relationship

Luigi Anolli, Fabrizia Mantovani, Alessia Agliati, Olivia Realdon, Valentino Zurloni, Marcello Mortillaro, Antonietta Vescovo, and Linda Confalonieri

Correspondence:
Luigi Anolli
Centre for Research in Communication Science (CESCOM)
University of Milan
Bicocca, Milan, Italy
E-mail: luigi.anolli@unimib.it

Recent research has determined that the training of health-care professionals in communication and emotional skills management is related to patients' satisfaction and compliance towards medical treatments. Moreover, a good communicative and emotional competence enhances the physician's sensitivity to the psychosocial aspects conveyed by patients and it may also help physician to cope with his/her own emotions, then reducing the burn-out effect. The learning of these capabilities is rooted in the real experience, since they require a number of cues that are managed *hic et nunc* in the flow of the communicative exchange. Therefore communication competence has been traditionally considered as a typical face-to-face/classroom learning topic. However, recent work on computer-based interactive simulations and autonomous agents is offering new opportunities for the training of communication and emotional competence in different professional contexts, as the medical one. In this way, the physician-patient interaction can be developed and enhanced in a realistic, but non-threatening situation. Practitioners in the medical field can train their communicative style in critical settings through different interactive scenarios that lead user's identification and experience in a safe context. The present work, as part of the EU-funded "MYSELF-project-*Multimodal* e-learning System based on *Simulations*, Role-Playing, Automatic Coaching and Voice Recognition interaction for Affective Profiling" (www.myself-proj.it), aims at investigating the potential benefits of computer-based interactive simulations for enhancing communication and emotional competence training in physician-patient relationship. In particular, this work is focused on the development of 3D interactive simulations and targeted multimedia exercises to improve specific communicative and emotional skills, such as empathy, emotional coping, non verbal communication management, reassurance, focusing on patient's needs, personal commitment. Within the e-learning simulations, the trainee interacts with virtual patients (modelled and animated with Poser 5) facing a number of problematic situations; he/she plays the role of the physician and is asked to actively manage the interaction with the patient. The system is endowed with speech-recognition capabilities, so that conversational interaction in the simulation is mainly voice-based. Throughout the learning path, a 3D animated virtual tutor that provides consistent feedback and monitoring assists the trainee. The research is currently in progress: the simulations and related exercises will undergo a validation study starting from the month of June. *Developing training simulations requires a process of translation of real interactive situations into virtual environments and animated characters, and poses a number of challenges concerning how to elicit trainees' sense of presence in the simulation and how to ensure an effective transfer of learning into real professional context. This work represents an effort to face such challenges by focusing on key features for maximizing the simulation experiences: first of all, the development of an adequate model of the complex real-world social dynamics with which the user interacts; second, characters' design and animation with focus on believability and multimodality.* The limitations and potential of such approach will be discussed into depth from theoretical and technological perspectives.

A VR Application for Dealing Difficulties with Hardship and Enhancing Resilience: A Treatment for Adjustment Disorders

Rosa María Baños, V. Guillén, C. Botella, S. Quero, A. García-Palacios, and N. Lasso de la Vega

Correspondence:
Rosa María Baños
Universidad de Valencia, Spain
E-mail: banos@uv.es

An Adjustment Disorder (AD) is a debilitating reaction to a stressful event or situation. It differs from Post-Traumatic Stress Disorder (PTSD), which usually occurs in reaction to a life-threatening event and can be longer lasting. ADs disorders are very common and can affect anyone, regardless of gender, age, or lifestyle. The stressful event can be anything: it might be just one isolated incident (e.g. car accident), or a string of problems that wears the person down. (e.g., illness, divorce). An AD occurs when a person can't cope with a stressful event and develops emotional or behavioral symptoms. People with AD may have a wide variety of symptoms, depending

on the particular subtype of AD and personality and psychological variables. AD has failed to interest researches (Stein & Wilkinson, 1998). However, this lack of interest contrast with the high prevalence of this disorder (5-20% of individuals in out-patient treatment, according to DSM-IV, APA19094) . and especially with the vast concurrent interest in related topics such as PTSD and life-events research into the precipitation of a range of mental disorders (Casey, Dowrick & Wilkinson, 2001). In previous studies, we have developed a Virtual Relaity (VR) application in order to treat PTSD, named "EMMA's world" (Botella et al. 2005). In that RV application the therapist and the patient could represent the experience suffered by the patient according to the specific therapeutic needs. In the present study, the potential for using new technologies (VR) with the aim of treating AD is examined. An adaptation of "EMMA's word" has been developed. The goal of this VR application is also to work with emotions related to the participants' psychological problem. The specific emotions depend on the specific ways in which the problem is symbolized in each of the scenarios. The VR application is designed to help the person experience the emotions and experiences which he/she is going through, to touch them and feel them; in short, to accept them and to live with them from another perspective. The therapy target is not only to help patients to cope with the stressful situation but also to train them in resilience skills. So, as Positive Psychology proposes, the target is more than an end to suffering, but also to help individual leading meaningful and fulfilling lives (Seligman. & Csikszentmihalyi, 2000). In this work we present the VR application, the clinical treatment protocol for AD, and the initial data about its efficacy in a controlled study.

The Use of Virtual Reality in Cognitive Neuropsychology: A Meta-Analysis

Frédéric Banville, and Pierre Nolin

Correspondence:
Frédéric Banville
Centre de Réadaptation Le Bouclier
St-Jerome, Canada
E-mail: frederic.banville@uqtr.ca

Virtual reality is defined as a way for an individual to navigate and interact both in real time and in real life with objects and with different environments all of which in 3D that has been simulated by a computer. In the last couple of years, a number of studies in psychology, primarily for the treatment of specific phobias, were done by means of virtual reality. Furthermore, researchers in the field of neuropsychology have mostly been interested in the attentional, executive and mnesic dimensions of cognitive functioning. This type of research is in emergence and the virtual environments used in the evaluation and treatment are far too few and their evaluation is ongoing. The principal objective of this study is to present the main results that were obtained from a meta-analysis on the use of virtual reality from the viewpoint of cognitive evaluation and intervention. In order to carry out this study a systematic review of literature of cognitive evaluation and intervention in neuropsychology was done using the following computerized search engines: MEDLINE, CYNAHL, COCHRANE LIBRARY, PSYCINFO, INGENTA, ERIC. 184 studies were compiled. After reading all of the summaries, 62 articles were retained and special consideration was given to studies that presented results derived from an experimentation done with a correlationnal or quasi-experimental estimate. Case studies were also used in this meta-analysis. Finally, the findings will help answer the following questions: were the cognitive treatments offered by using virtual reality efficacious? Is there a difference if the treatment is done in immersion or not? Which experimental schemas are most wildly used in research? What are the indicators of effectiveness of the treatment?

Empirical Bases for an Internet Mediated Support Group for Individuals Living with Tinnitus in Québec

Jacinthe Baribeau

Correspondence:
Jacinthe Baribeau
Université Laval
E-mail: JBaribeau2@videotron.ca

The goal of this study was to examine the nature of socially supportive communication that took place within an internet-mediated support network for individuals affected by tinnitus.. This support group list was created for individuals suffering from distressing tinnitus. Tinnitus involves the internal perception of noises and sounds that are not generated by the auditory sensory system. Preceding studies showed that out of 500

individuals affected by tinnitus, approximately 350 expressed significant distress and impact on daily activities and quality of life. Tinnitus is not presently medically treated with predictable results and, in average, lasts from several months to several years, with no scientifically demonstrable curative method. Methodology and procedures: No similar study was done on this topic in the review of literature in the province of Québec, Canada. The absence of non-internet local support groups in many regions of the province of Quebec, and the research surveying the need for such support (Baribeau et al, 2005) led to the creation of an email list where participants were offered support and answers to their questions. Out of approximately 350 individuals expressing a need for support groups, 98 provided contact by email/internet. The list of volunteers for such a group was made from contacts at conferences on tinnitus at regional locations: Québec, Montréal, Victoriaville, Bécancourt, Trois-Rivières, Informed consent was obtained with the standard procedures. Using item analysis, 100 emails were examined with reference to four themes of questions, using similar method to other similar groups on the internet (Coulson, N.S., Cyberpsychology & Behavior), 2005, Vol. 8, No. 6: 580-584) for support: such as affective, informational and factual, networking, and professional and paramedical help). Results: The analysis suggests that the primary function of this group was the communication of factual information, particularly with questions about symptoms quality, intensity, duration, prognostic factors, and medical causative variables. The second most frequently invoked theme related to the interpretation of evolution of symptoms. The 3rd category related to requests for references to medical and para-medical practitioners; The 4rth theme referred to issue of care, to ways of handling symptoms and related impact on stress tolerance, depression, anxiety, fear of aggravations. These results will provide the basis for the offering of a internet-based continuous service as part of the RQPA- Quebec grouping of resources for individuals suffering from tinnitus. As expected, the main factor discriminating participants involved by internet and participants not available on the internet was age, followed by education level. Conclusion: This initiative fostered new opportunities for individuals with tinnitus-related concerns to participate in supportive communication within a network of individuals dealing with similar issues. These results lead to the recommendation that regional contact agents attempt to provide internet access to their support group members and to interested individuals without home access to email and internet. Thanks to RQPA-Québec.

A Flexible Virtual Reality Cue-Exposure Platform for Drug Abuse Studies

Steve Baumann, Scott Fetzick, Gregg Stangl, Kyle Brauch, James Kenney, Tom Yothers, and Rachel Thompson

Correspondence:
Steve Baumann
Psychology Software Tools
Pittsburgh, PA
E-mail: steveb@pstnet.com

Background/Problem: Drug abusers suffer an abysmal record of relapse after treatment, and new treatment strategies are clearly necessary. Craving to use is strongly correlated with relapse. In combination with cognitive behavioral techniques, cue exposure has been used to treat many forms of drug abuse through graded exposure and desensitization to relevant stimuli that trigger cravings. We have developed software featuring a user interface that allows flexibility for researchers and clinicians in configuring graded, cue-exposure sessions with abusers of cigarettes, alcohol and/or crack cocaine. Method/Tools: Several environments have been created using the Source game development engine from Valve, the makers of Half-Life2. These consist of a crack house, an apartment, a bar/restaurant and an outdoor, urban street-scene that interconnects the interior environments. Models and characters were created in 3D Studio Max, and the characters animated using the Gypsy Gyro 18 motion capture system and two Cybergloves. All of the characters and many of the models are available for placement in the virtual world through a drag-and-drop interface that allows the experimenter to configure the software before a therapy session with a variety of models, characters and interactions appropriate for the individual client and their therapeutic stage. For example, initial treatment sessions for crack cocaine might have only an empty crack house, but in later sessions the crack house might contain many models of drug paraphernalia and characters smoking or dealing crack. These configurations can be saved for later editing and use with other clients. Presently, the environments and characters can be configured for any one of three drugs of abuse, so that the apartment can be populated with

appropriate paraphernalia and interactive characters for cigarette, alcohol or cocaine studies. Results: Open trials are now in progress. Preliminary results indicate that the virtual environments are effective at provoking graded cravings across a broad range of desired craving levels. The user interface is sufficiently flexible that the experimenter is capable of manipulating craving levels (on a scale of 0-10) from lowest to highest urges in a single therapeutic session. Conclusion: A flexible VR platform has been created that can be used in studies of treatment effectiveness for multiple drugs of abuse. Ongoing open trials indicate the effectiveness of the software in provoking a wide range of cravings tailored by the experimenter to the ongoing state of the client within and between individual treatment sessions. Novelty/Discussion: Previous studies have shown the utility of using VR for drug abuse, cue-exposure studies, especially for cigarette smoking (Bordnick et al., 2004; Baumann & Sayette, in press). The basic technique has been modified and extended to create a software platform with broad flexibility and utility for the treatment of multiple drugs of abuse - presently cigarettes, alcohol, and crack cocaine; and the underlying drag-and-drop architecture, featuring a library of selectable, graded, stimulus cues, can readily be extended to other drugs of abuse as well.

Virtual Reality for Teaching Street Crossing Skills to Children with Autism

Hadass Milika Ben-Chaim, Naomi Josman, Shula Friedrich, and Patrice L. (Tamar) Weiss

Correspondence:
Naomi Josman
Laboratory for Innovations in Rehabilitation Technology
Department of Occupational Therapy
University of Haifa, Mount Carmel
Haifa, Israel
E-mail: naomij@univ.haifa.ac.il

Many children with autism are not independent in their instrumental activities of daily living (IADL) including the skills needed for street crossing. This is a particularly crucial skill because it involves exposure to potentially dangerous situations, and it is an important step in the development of independence. Moreover, the difficulties that characterize people with autism cause them to be at a higher risk for getting hurt in pedestrian accidents. Most of the existing programs designed to teach these skills are presented within a classroom setting and have not been demonstrated to be effective. In contrast, virtual environments facilitate learning in a safe environment, provide opportunities for repeated learning trials, and enable a gradual increase in the complexity of tasks until they approach the conditions of real life situations. The purpose of the current study was to describe the use of a desktop virtual street crossing environment by children with autism, to examine whether they are capable of learning the skills needed to safely cross a street via this VR system, and to determine whether any skills learned via VR are transferred to a real life situation. A desktop VR street crossing environment was adapted for use by children and adolescents with autism. Twelve children took part in the study. The experimental group included six children who were diagnosed as having autism/Pervasive Developmental Disorder and who went to a school for children with autism. Three of the children (two boys and one girl) were in Grade 2 and three children (all boys) were in Grade 8. The control group included six typically developed children who were matched for grade and sex with the experimental group. The research tools included the Childhood Autism Rating Scale to determine the severity of autism. The children's performance while street crossing within the virtual environment was scored within the program. A pedestrian safety checklist, based on observation of taped video clips, was used to assess the children's functioning while they walked within a protected real sidewalk and street crossing environment before and after the VR intervention. The results demonstrated that children with autism were capable of understanding the virtual environment and of learning to use it. A significant difference between the performance of the experimental and control groups within the virtual environment was obtained on the maximum level completed during the first meeting. The experimental group showed substantial improvement in their ability to safely cross the virtual street from the beginning to the end of the intervention. Finally, half of the experimental subjects improved in their pedestrian behavior within the protected real street setting when tested at the completion of the VR intervention. These findings demonstrated that this virtual street crossing environment was eminently suitable in both its cognitive and motor demands for the target population, children and adolescents with autism. The results of this study emphasize that VR may be used as a tool for teaching skills that are

needed for street crossing because of their likelihood to be transferred to real life situations.

The Technology Acceptance Model: A Potentially Useful Tool to Understand Why Therapists Intend to Use or Not Virtual Reality

Manon Bertrand, and Stéphane Bouchard

Correspondence:
Manon Bertrand
Université du Québec en Outaouais
Canada
E-mail: manonbertrand@sympatico.ca

The Technology Acceptance Model (TAM) developed by Davis (Davis, 1989, 1993 ; Davis & Venkatesh, 1996) has been extensively validated to explain the factors involved in people's intention to use computers or softwares at the office or at home. The TAM can reliably predict the usage intentions and the actual usage of information technology. This model is based on four factors: external factors, perceived usefulness, perceived ease of use and attitude toward using the specific technology under study. Venkatesh (2000) has added four personal factors to the TAM: computer self-efficacy, perceptions of external control, computer anxiety and computer playfulness. As confirmed with structural equation modeling, all these factors impact directly the perceived ease of use dimension and on the behavioural intention to use the technology. No studies have yet been conducted on factors related to the use of virtual realty by mental health practitioners. The aim of this poster it to share with people attending to the CyberTherapy conference information about the TAM and discuss how if may apply to virtual reality. It will also describe a research project that we will launch at the Conference. Based on the TAM model and questionnaires used by Davis and Venkatesh, we developed 32 items to measure the factors potentially involved in therapists' intention to use virtual reality to treat mental disorders. As this study is still in its infancy, attendees at the CyberTherapy Conference will be welcome to participate in the study.

REFERENCES

1. Davis, F.D. (1989).   User acceptance of computer technology : a comparaison of two theorical models. *Management Science, 35,* 982-1003.

2. Davis, F. D. (1993). User acceptance of information technology : system characteristics, user perceptions and behavioural impacts. *International Journal of Man-MachineStudies, 38,* 475-487.

3. Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model : three experiments. *International Journal of Human-Computer Studies, 45,* 19-45.

4. Venkatesh, V. (2000). Determinants of perceived ease of use : integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11,* 342-365.

A Flexible Virtual Environment: The Treatment of Storm Phobia

Cristina Botella, B. Guerrero, A. García-Palacios, S. Quero, and R.M. Baños

Correspondence:
Cristina Botella
Universidad Jaume I
Castellón, Spain
E-mail: botella@psb.uji.es

Most of the virtual environments currently available in the field of psychological treatments are designed and developed to solve a specific problem, being this acrophobia, flying phobia, claustrophobia or panic disorder. Our research group has tried to develop versatile virtual reality (VR) systems that could be useful in different fields, that is, an adaptive display. In a previous study we developed a VR application called "EMMA's world" for the treatment of PTSD (Botella, García-Palacios, Baños, Guillén, Quero, Lasso de la Vega & Osma, 2005) and pathological grief (Botella, Baños, García-Palacios, Quero, Guerreo, Liaño & Perpiñá, 2005). The aim of the present work is to show the utility of that environment for the treatment of a storm phobia. The patient is a 70 year-old woman. The problem caused her a severe interference and distressing when there were storms. At those moments, unless the patient could "protect herself" completely at home (getting into a wardrobe and wearing headphones to isolate herself from the exterior world), severe panic attacks were produced. The phobia started in her childhood, getting more severe as time went by. The patient contacted the group through information published in a local newspaper about our works. The treatment was applied in two phases: a) *In vivo* exposure, which consisted of

exploding globes following a hierarchy from small to bigger size; b) Exposure to virtual environments simulating storms, rain, thunders and lightning. The intervention was composed by these two phases because the patient was not able to confront a storm, even being a virtual storm. The reason why a first exposure hierarchy of exploding globes was introduced was that the patient also feared unexpected and strong noises. Results indicated that the first treatment phase was useful so the patient could go forward to the next phase of what she called "terrible", that is, a virtual storm. However, *in vivo* exposure to the noises produced by the globes did not solve the problem at all. When the patient started to confront a virtual storm, she showed an intense anxiety and distress. Later, the anxiety was notably reduced and the positive results were generalized to real life. The patient was able to travel (something that she never did since she feared that a storm could happen and she could not protect herself) and go out of home even with bad weather. Besides, these results were maintained at one-month and one-year follow-ups. In summary, the utility of our VR adaptive display as a therapeutic tool in a case of an elderly patient (who still considers new technologies very useful) is proven.

REFERENCES

1. Botella, C., García-Palacios, A., Baños, R.M., Guillén, V., Quero, S., Lasso de la Vega, N. & Osma, J. (2005). The treatment of emotions in a virtual World. Application in a case of posttraumatic stress disorder. Presented at CyberTherapy 2005, Basel (Switzerland), June 2005
2. Botella, C. Baños, R.M., García-Palacios, A., Quero, S., Guerrero, B., Liaño, V. & Perpiñá, C. Using "traditional" strategies in a "virtual world" for the treatment of pathological grief. Presented at 5th Internacional Congreso of Cognitive Psychotherapy, Goteborg (Sweden) June 2005

VR Exposure in the Treatment of Panic Disorder and Agoraphobia: A One-Year Follow-Up

Cristina Botella, Azucena García-Palacios, Soledad Quero, Rosa M. Baños, Mariano Alcañiz, and Giuseppe Riva

Correspondence:
Cristina Botella
Universidad Jaume I
Castellon, Spain
E-mail: botella@psb.uji.es

Research status: Controlled Clinical trial. One-year follow-up data available. Background: Panic disorder, with or without agoraphobia (PDA), is one of the most prevalent mental disorders in the general population. PDA could affect patients' quality of life severely (Schmidt & Telch, 1997). The efficacy of Cognitive-Behavioral Treatment programs (CBT) for the treatment of PDA has been widely demonstrated (i.e., Barlow, 2002; Barlow, Raffa & Cohen, 2002; Gould, Otto & Pollack, 1995) However, despite these promising findings, there are still limitations on the availability of these treatments or the non-acceptance rates and difficulties in the application of some therapeutic strategies in these programs like exposure. It is important to explore new ways of delivering CBT programs in order to reach a higher number of patients. The main aim of this study is to offer data about the effectiveness of Virtual Reality Exposure (VRE) in the treatment of panic disorder and agoraphobia (PDA). Method: The study is a clinical trial with a between-subject design. Participants were randomly assigned to three experimental conditions (VRE group, IVE group, and waiting-list group (WL) and repeated measures (pre-treatment, post-treatment and one-year follow-up). The treatment programs lasted nine weekly sessions. Thirty-six patients meeting DSM-IV criteria for PDA (APA, 2000) participated in this study. Results and conclusion: Our results support the efficacy of VR exposure in the treatment of PDA. The improvement achieved using virtual exposure was superior to a waiting list condition and similar to that achieved using in vivo exposure. The therapeutic outcomes were maintained at one-year follow-up. Novelty: This is the first study showing long-term efficacy of VR exposure in the treatment of PDA.

Perceived Realism has a Significant Impact on the Feeling of Presence

Stéphane Bouchard, Stéphanie Dumoulin, Geneviève Labonté-Chartrand, Geneviève Robillard, and Patrice Renaud

Correspondence:
Stéphane Bouchard
Université du Québec en Outaouais, Canada
E-mail: stephane.bouchard@uqo.ca

Studying the impact of realism on the feeling of

presence and anxiety is becoming a popular research topic. In general, studies are suggesting that a minimal level of pictorial realism is necessary to induce the feeling of presence. Less realism may be required to induce anxiety. However, every study is focusing on objective properties of the virtual experience, such as pictorial quality, texture and shading, or adding sensory information (i.e., smell, touch). The aim this study is to experimentally manipulate perceived realism to assess its impact on the feeling of presence. The sample consists of 31 adults suffering from the specific phobia of mice randomly assigned to either an experimental or a control condition. First, all participants are immersed in a neutral / irrelevant virtual environments (virtual streets, no mouse) and rate their level of presence. Second, participants are subjected to the experimental manipulation. Participants in the experimental condition are falsely lead to believe that they will be immersed live in real time a "real" room with a "real" mouse in a cage. To create this illusion, participants first discuss in videoconference with a research assistant who is standing beside a cage containing a live mouse located in a room two floors below. The videoconference system is linked with abundant electronic cables and blinking switches to four computers. After the videoconference discussion, two cables are installed to link the four computers to the VR computer and electronic switches are turned on. Participants are then told that VR will immerse them in real time in the room they saw moments ago. In the control condition, participants watch a pre-recorded video of a discussion in videoconference with a research assistant (same duration and visual content as in the experimental condition). The videoconference system is not linked to the VR computer and control participants are told they will be immersed in a replica of the room they saw a moment ago. All participants are actually immersed in the exact same virtual environment. An I-Visor head-mounted display, an Intertrax2 motion tracker from Intersense, a Pentium IV PC and a wireless mouse are used for the VR immersions. A manipulation check confirmed that 82% of the participants in the experimental condition believed in the experimental manipulation. The mouse was rated as realistic by 81% of the participants in the experimental condition and by 77% of those in the control condition (Chi-square = .11, ns). The immersion in VR was rated as realistic by 94% of the participants in the experimental condition and by 88% of those in the control condition (Chi-square = .3, ns). A 2 times by 2 conditions repeated measure ANOVA revealed that leading people to believe they are seeing a real mouse in the virtual environment increases the feeling of presence compared to an immersion where participants are told the mouse is not real [$F(1,29)$ = 4.73, $p < .05$]. Results are discussed in the light of the potential ingredients required to suspend disbelief and foster the feeling of presence.

Immersive Virtual Reality beyond Self Help

Constantin Boytscheff, Professor, and Marilu Kanacri Sfeir

Correspondence:
Constantin Boytscheff
University of Applied Sciences
Constance, Germany
E-mail: boytscheff@fh-konstanz.de

With Immersive Virtual Reality (IVR) we can work out human development. This medium makes possible the representation of complexity. It makes someone prone to be sure of his/her own decisions. Negative developments in our present moment in the information society like high unemployment, high health costs, high criminality, etc. are obstacles for societal and individual progress. These obstacles are not the result of the material innovations of our developed societies, but of our own interpersonal abilities and attitudes (immaterial innovations) which lag behind their own greater possibilities. Technological development and the quality of interpersonal relations should be brought together on the same level. An important indicator of the positive condition of people, and therefore of society, is always their psychosocial well-being. Psychosocial and interpersonal skills are now central to our current social, economic and political moment in the information society; well-being and health will be the most important factors in the future. Our concern is the production of virtual worlds in which the possibilities of IVR offer the "user" a world of experiences and adventures, in which he/she can learn, work and relax as complementation to the real world. The goal of our work is to develop a comprehensive individual care space for each person. Our project W.O.M.B. is an example of such an application. W.O.M.B. works like a body-brain-supporter: a new IVR project as a learning system helps to create the health consciousness and well-being of a person in the sense of a salutogenesis-oriented training system. W.O.M.B. is a new way to interact, in which the "user's"

breath and movement create the size, space and shape of his/her immersive world. An emotional environment like the IVR can release deep reactions and strongly affects consciousness. Obtaining emotional support is very critical for the personal development. We realized, that many of our students feel isolated and alone with a lot of requirements and tasks to fulfil, which are coming permanently from outside. We report these experiences because they have given us a much better understanding of the phenomenon of the emotional effects of IVR worlds and have led us closer to a re-orientation of working with this IVR environment. Working with IVR is like a coaching that helps a person develops good internal management skills. It has helped the students to set concrete goals and to develop the specific skills needed to meet them. We have seen IVR as a very powerful environment for people, who tend to struggle with issues of management and self management, goal setting, behavior in a group and making something very concrete without any lost or risk. By working in some specific IVR worlds we saw how helpful it is to feel certain control over the issues, control over the own feelings, control of changes over the own belief system and behavior. People come to the point that they are able to change a lot of things which are holding them back in life. Our purpose is to use IVR as an instrument for salutogenesis.

Ankle Muscle Activation of Children with Cerebral Palsy Exercising in Virtual (VR) Versus Physical Environments

Marie Brien, Anna McCormick, Jennifer McLean, and Heidi Sveistrup

Correspondence:
Marie Brien
Ottawa Children's Treatment Centre
Ottawa, Canada
E-mail: mbrien@octc.ca

Objectives: To compare the use of a VR game environment with the use of conventional exercises to elicit specific selective movement of ankle dorsiflexion in children with cerebral palsy. To determine whether: 1)exercising in a VR environment would result in greater fun and interest than a conventional exercise program, 2) the active ankle dorsiflexion movements would be similar between approaches and 3) the ankle muscle activity would be similar between approaches. Participants: Ten children with CP (8 spastic hemiplegia, 2 spastic diplegia) and ten children without CP. The children were between the ages of 7 and 17 years old. The GMFCS levels were 4 at level 1 and 6 at level 2. Methods: Sessions (90-minutes) consisted of two conventional (A) ankle dorsiflexion exercises and two VR (B) exercises. An ABBA design was used with order counterbalanced between children. Children with CP used the affected ankle. Children without CP used their preferred ankle. Exercises included ankle dorsiflexion in chair sitting and ankle dorsiflexion in long-legged sitting. The VR system included 2 different scored game scenarios using flat screen display, camera and computer. Measurement: Visual analogue "interest" and "fun" scales were completed after each exercise series by child and parent. An electrogoniometer measured starting position, time to complete each repetition, hold time and number of repetitions for each exercise. Surface electrodes recorded bilateral gastrocnemius and tibialis anterior muscle activity during the exercises. Results: Participants with and without CP reported higher "fun" and "interest" using VR versus conventional exercises. Both groups also showed greater range of active ankle dorsiflexion, longer hold times and less repetitions in the VR environment. Greater levels of co-contraction were recorded in ipsilateral gastrocnemius and contralateral tibialis anterior during the VR exercises. Conclusion: VR environments may provide means of promoting participation and adherence to exercise through variety and enjoyment of programs used. Our data suggest improved quality of movement of ankle dorsiflexion which may be due to the goal-oriented nature of VR games. Further longitudinal research is being planned. Acknowledgements: The Ninja Flip and Coconut Shooter applications were provided by Vivid Group (www.irexonline.com). Funded in part by the Ministry of Economic Trade and Development.

Manipulating Stuttering During Virtual Job Interviews

Shelley B. Brundage, and Ken Graap

Correspondence:
Shelley B. Brundage
The George Washington University
Washington DC
E-mail: brundage@gwu.edu

Background/Problem/Research

Question: Stuttering is a "disturbance in the normal fluency and time patterning of speech," in which "the extent of the disturbance varies...and often is more severe when there is special pressure to communicate (e.g., *interviewing for a job)*" [DSM-IV, 1994; p. 63, italics added]. Situations that can exacerbate stuttering include speaking: to persons in authority, under time pressure, on the telephone, and in situations that require a specific answers. Treatment can assist stutterers to speak more fluently and to manage their stuttering. Generalization of treatment effects is essential and often challenging. Challenges include *difficulty creating realistic situations, loss of therapeutic control over the situation*, and *loss of confidentiality in real life exercises.* Virtual Reality (VR) technology has potential to alleviate many of these challenges. In this study we developed a virtual job interview (VRJI) environment, and tested its effects on speech patterns of persons who stutter. We predicted that *challenging* virtual job interviews would elicit more stuttering than *supportive* VR interviews would. Method/Tools: Twenty stuttering adults whose stuttering severity was calculated using the *Stuttering Severity Instrument-3* (SSI-3) participated. The VRJI contained a challenging interview, with the "company CEO" and who exhibited: interruptions, increased speaking rate, loss of eye contact, and increased time pressure. The supportive interview was with a "Human Resources" worker who exhibited facilitative behaviors (e.g., a slightly slowed speaking rate, eye contact, not interrupting). The content of the interview questions was the same, though the delivery varied. Each subject participated in one supportive and one challenging interview. The order of the interviews and the gender of the interviewers were counter balanced. VR equipment included a Dell PC, with an nVidia Fx5200 graphics card, a VFX-3D head-mounted display and tracker. Results: One-tailed Student's t-tests confirmed our prediction that more stuttering occurred during the challenging interview condition (t = 2.14, p = .02). We interviewed participants prior to VR as part of the SSI-3. The percentage of stuttered syllables (%SS) in both VR conditions were positively correlated with the %SS in the SSI-3 interview (for challenging: r = .49, p. = .05; for supportive: r = .652, p = .006), suggesting that the frequency of stuttering behaves in similar ways during VR and "real" interactions. Subjective comments from participants suggested that participants found the VRJI realistic, and that it induced feelings similar to those that they experience in "real world" speaking activities (e.g., "It simulated me when I'm bad. All the physical responses and reactions, eyes and mouth and tension, it was all there"). Novelty/Discussion: This is the first study to evaluate the use of VR technology with persons who stutter. Our findings are consistent with literature linking perceived stress to increases in stuttering, and suggest that VR environments can elicit stuttering in similar ways to real-world environments. VR may be a useful tool in the treatment of stuttering, and has promise as an efficient method for measuring treatment progress and generalization of treatment effects.

Selective Sensory Strategies in the Regulation of Upright Balance in Older Adults Can be Entrained Through Exposure to Sensory Conflicts

Nicoleta Bugnariu, and Joyce Fung

Correspondence:
Joyce Fung
School of P & OT, McGill University and Jewish Rehabilitation Hospital; CRIR Research Center, Montreal, Canada
E-mail: joyce.fung@mcgill.ca

BACKGROUND: Conflicting visual and somatosensory stimuli can modulate automatic postural responses in both healthy young and old adults. However, balance regulation may be more affected in older adults who rely heavily on vision. Postural imbalance may be caused not only by primary age-related sensory-motor declines but also by the inability to resolve sensory conflicts and to select pertinent sensory information. AIMS: The present study aimed to determine the effects of aging and repeated exposures on the capability of the center nervous system (CNS) to select pertinent sensory information and resolve sensory conflicts created by virtual reality. METHODS: Healthy older adults (65-75 yrs) were tested for standing balance while immersed in a virtual environment (VE) for 1 hour during which a total of 72 visual and/or surface ramp perturbations of $8°$ ($36°/s$) was randomly presented. Visual perturbations were induced by sudden movements of a VE viewed through a helmet-mounted display, and combined with or without surface perturbations presented in a direction (pitch/roll/yaw) that was either identical or opposite to the visual perturbation. Functional balance and mobility in terms of gait velocity, ability to maintain tandem stance, timed sit-to-stand and postural responses to surface perturbations without sensory conflicts were assessed before and after

VE exposures. The EMG responses of eight bilateral postural muscles, body kinematics and ground reaction forces were captured. EMG onset latencies and integrals as well as center of pressure (CoP) and centre of mass (CoM) were calculated and compared. RESULTS: When the VEs were manipulated to be discordant with the surface perturbations thus creating sensory conflicts, older adults had significantly increased EMG activation and longer latencies as compared to conditions where the perturbations were concordant and no sensory conflicts were present. Ankle and hip muscles onset latencies were prolonged by 40-60 ms in conditions of sensory conflicts. CoP and CoM excursions were sensitive to the presence of sensory conflicts. A general training effect associated with less number of steps and improved ability to maintain balance was observed in older adults as they were exposed to increasing number of perturbations with sensory conflicts. The last 10 out of 72 perturbations had significantly reduced CoP and CoM excursions and shorter ankle muscle onset latencies, as compared to the first 10 perturbations. Subjects scored higher on the ability to maintain tandem stance after repeated exposures to sensory conflicts. CONCLUSIONS: Aging affects the interaction of the somatosensory and visual systems on the ability of the CNS to resolve sensory conflicts and to maintain upright stance equilibrium. Even with a one-hour immersion in virtual environment and exposure to sensory conflicts, it is possible for the CNS to recalibrate and adapt to the changes and improve balance capability in older adults. A training program of longer durations is needed to confirm sustainable long-term effects. Preventive and rehabilitation programs targeting postural control in older adults should take into account the possible impairment of sensory organization or sensorimotor integration and include VE training under conditions of sensory conflicts.

Autonomous Eye Pattern Classification in a Virtual Environment Applied to Sexual Offenders

Sylvain Chartier, and Patrice Renaud

Correspondence:
Sylvain Chartier
Institut Philippe Pinel de Montréal
Université du Québec en Outaouais
Gatineau, Canada
E-mail : chartier.sylvain@courrier.uqam.ca

Problem: Violent behaviors like the ones resulting from sexual offenders are social and psychological distress factors. These behaviors harm in an important way the population health. There are different problems associated to the diagnostic and the measurement of threat level from violent individuals. More precisely, for the sexual deviant, phallometric measure is often used to determine their sexual preferences. From those results, it is possible to predict the risk of second offence or treatment efficiency. However, research has shown that it is possible to control sexual responses in presence of a visual or auditory sexual scene (Quinsey and Chaplin, 1988). Therefore, internal validity of phallometric measurement is reduced. A new promising tool for the study of perceptual and motor processing is the utilization of virtual environment combined with video-oculography (Renaud et al., 2003). Then, from the oculomotor pattern recording it could be possible to determine if sexual offenders fake responses by, for example, looking away or to the periphery of the visual content to reduce their penile responses. Method: Analysis of eye movement dynamics informs on the attention processing in regard to various stimuli. Since the vast quantity of simultaneous data generated and their nonlinear dynamic nature, eye patterns must be classified using non standard methods like artificial neural networks. Those models have been widely used in the context of temporal series and they can be easily implemented online (Wörgötter & Porr, 2004). Thus, from the standard measures obtained with video-oculography (e.g. eye saccade, fixation) and non standard measures (e.g. power spectrum, dimension correlation) a neural network has been trained following a supervised algorithm to classify sexual deviant from non deviant. Results: Results show that the network is able to find a function that allows the classification of sexual offenders from non offenders. Moreover, the network is able to generalize its learning to new participant and classify it accordingly. Conclusion: From the results, it is concluded that eye pattern dynamics gives enough information for a neural network classification to distinguish sexual deviant from non deviant. Novelty: By better knowing what the dynamic of oculomotor pattern is, it is then possible to improve the internal validity of current diagnostic tools as well as to develop new ones based on oculomotor responses as such. This study is thus a first step in the development of a new tool for risk assessment of second offence as well as therapy efficacy among sex offenders.

REFERENCES

1.Quinsey, V. L. & Chaplin, T.C. (1988). Preventing faking in phallometric assessments of sexual preference. In: R. A. Prentky & V.L. Quinsey (Éd.) Human Sexual Aggression: Current Perspectives. New York: New York Academy of Sciences, 49-58.

2. Renaud, P., Décarie, J., Gourd, S.-P., Paquin, L.-C., & Bouchard, S. (2003). Eye-tracking in immersive environments: A general methodology to analyze affordance-based interactions from oculomotor dynamics. CyberPsych and Behav, 6(5), 519-526.

3. Wörgötter, F. & Porr, B. (2004) Temporal sequence learning, prediction and control: A review of different models and their relation to biological mechanisms. Neural Computation, 17, 1-75.

Emotions May Not Have to Match with the Content Afforded by the Virtual Environment to Induce Presence

Geneviève Labonté-Chartrand, and Stéphane Bouchard

Correspondence:
Geneviève Labonté-Chartrand
Université du Québec en Outaouais
Québec, Canada
E-mail: chartrandgen@yahoo.fr

In previous studies, Bouchard and colleagues have shown that inducing anxiety increases the feeling of presence when phobics are immersed in virtual environments that are frightening to them. This finding might be explained by a simple increase in arousal induced by the experimental setting. On the other hand, feeling anxious in a situation that is expected to induce anxiety might suggest to phobics that they are really «there» in the situation. The aim of this study was to assess if emotions that are congruent or incongruent with what is expected from the virtual environment have an impact on presence. It was hypothesized that experimentally inducing a positive emotion in a virtual environment that is expected to induce a positive emotion be would induce more presence than when experimentally inducing a negative emotion. The sample consisted of 28 adults who had never experienced virtual reality before and who would like to visit Egypt. Following random assignment and a baseline immersion in a controlled virtual environment, two experimental moods are induced (positive or negative) and crossed over two experimental immersions in virtual reality. The detailed procedures are as follow: (a) completing pre-experiment questionnaires; (b) being immersed in a control virtual environment for five minutes; (c) completing cybersickness and presence measures; (d) being subjected to a first Velten mood-induction task (induction of either a positive or a negative mood state); (e) rating their mood; (f) being immersed for seven minutes in a virtual reality tour of the mythical temple of the Egyptian god Horus; (g) rating their feeling of presence after 3.5 minutes of immersion in the Temple of Horus; (h) after the first experimental immersion, rating their mood, feeling of presence and cybersickness; (i) completing a distraction task for five minutes; (j) being subjected to a second Velten mood-induction task; (k) completing a second experimental immersion in the virtual environment; (l) rating their feeling of presence after 3.5 minutes of immersion; and (m) post-immersion, completing mood, presence and cybersickness questionnaires. Analyses on the manipulation checks confirmed the statistically significant impact of the mood-induction task ($p < .001$). However, the repeated measures ANOVAs did not reveal any significant impact of mood on presence. Further replications are warranted, but three post-hoc hypotheses have to be ruled-out before reaching a definite conclusion on the match between participants' mood and what is afforded by the virtual environment. The impact of mood on presence might be related to the intensity of the mood, and thus a stronger manipulation may be needed. Second, it is possible that the virtual environment was not positive enough a priori to create a strong match with the positive mood and a strong mismatch with the negative mood. Third, it is also possible that the results found in previous studies apply only to people suffering from anxiety disorders.

Virtual Therapy in Patients with Depression: Preliminary Observation

Vasile Chiriță, Mircea Ilinca, Roxana Chiriță, Marinela Bîșcă, Gabriela Chele

Correspondence:
Gabriela Chele
University Hospital of Socola Iasi
University of Medicine "Gr. T. Popa"
Romania
E-mail: gabrielachele@yahoo.com

Depression disorder with anxiety is considered an important public health problem. The efficacy of cognitive-behavioral therapy (CBT) for depression has been widely demonstrated. Virtual Therapy (VT) has several advantages compared with conventional techniques. One of the essential components to treat these disorders is exposure. In VT the therapist can control the feared situations at will and with a high degree of safety for the patient, as it is easier to grade the feared situations. Another advantage is that VT is more confidential because treatment takes place in the therapist's office. It is also less time consuming as it takes place in the therapist's office. We think that VT exposure can be a useful intermediate step for those patients who refuse in vivo exposure because the idea of facing the real anxiety situations is too aversive for them. VT was specifically indicated to allow patients in recovering their planning, executing and controlling skills by implementing sequences of actions and complex behavioural patterns that are requested in everyday life. Method: In this open study we compared two types of treatment – virtual reality therapy and cognitive-behavioral therapy – for patients showing a major depression and anxiety. Two groups of patients are formed and compared: a "VT" group and a "CBT" group. The survey included 20 patients of ages 25 to 50, all received antidepressive medication. The allocation of patients to one of these two groups was done according to some constraints (more specifically the ability to use computers and virtual reality software) while ensuring of the homogeneity of the two groups in terms of significant criteria (sex and age of the patient, duration and severity of the depression estimated by the HAMD's scale, anxiety estimated by the STAI's scale, CGI-S's scale and Q-LES-Q to assess the degree of enjoyment and satisfaction experienced by subjects in various areas of daily functioning). Results show that the virtual therapy group will improve at least as much as the cognitive and behavioral therapy group, and the results for virtual therapy group show up quickly, after 2 months of treatment. Benefits in VT: more realistic assessment, reduced therapy cost, increased safety, improve quality of life. The study was conducted in the Virtual Therapy Unit of the Socola University Hospital, Iasi, Romania. This unit it is the first Centre of Virtual Therapy in Romania.

A Model for Developing and Evaluating Video Games or Other Technology-Based Solutions to Improve the Health and

Quality of Life of Young People with Cancer or Other Chronic Illnesses

Pat Christen, Ellen LaPointe, Pamela M. Kato, PhD, Veronica M. Marin-Bowling, and Steve Cole

Correspondence:
Pat Christen
HopeLab
Palo Alto, CA
E-mail: pchristen@hopelab.org

Background/Problem: A review of available research suggested that harnessing the power of video game technology to fully engage young people with cancer about their disease held promise. HopeLab consulted oncologists, epidemiologists, cell biologists, behavioral psychologists and video game producers, as well as young people with cancer themselves, to identify critical issues in using video game technology to impact health-related outcomes. We then set about developing a high quality video game and applied rigorous scientific methods to evaluate whether it would have measurable effect in kids with cancer. Method/Tools, Results : HopeLab adopted an iterative game development process to incorporate the input of young people with cancer and our scientific objectives into game design. We consulted oncologists, nurses, cell biologists and behavioral psychologists throughout the game development process to ensure that the medical terminology in the game was accurate, and that the goals of each mission represented medically valid problems. We consulted young people with cancer throughout the process to ensure that the game would meaningfully reflect their perspectives. We utilized patient interviews and questionnaires (on-line & in-person) and provider feedback on missions and cinematics, and also obtained gamer and patient feedback on game play and controls. Patients consistently emphasized that the game should be realistic *and* fun. The result was *Re-Mission*, a 20 level, 3rd person shooter video game in which players pilot a nanobot, Roxxi, through the body of fictional cancer patients to destroy cancer cells, defend against bacterial infections and grapple with often life-threatening side effects. We then conducted a 34-site, randomized controlled trial to test the effect of *Re-Mission* on adherence, cancer-related knowledge, and quality of life measures among young people with cancer. Conclusion : Study findings demonstrate a theoretically-based, data-driven intervention designed with direct patient involvement and delivered in an appealing

interactive videogame context can produce significant improvements in a variety of health-related outcomes for young people with cancer. Novelty/Discussion : Much has been made of the potential of "serious games" to effect change in a broad array of health issues. By incorporating scientific principles and the direct input of young people living with cancer into the design of a video game, and by applying a rigorous research protocol (comparable to clinical trial methodology used in testing drugs) to assess how and to what degree the game has an impact on the young people who received it, HopeLab has (1) validated the feasibility of taking a patient-centered, evidence-based approach to product development and evaluation; (2) shown that video games can successfully be designed to be fun and to improve the health and quality of life of young people with cancer. We intend to apply the insights gained from the development and study of *Re-Mission* to inform our future work in cancer as well as a variety of technology-based approaches we will pursue in the areas of obesity, sickle cell disease, major depressive order and autism to help young people grappling with these chronic illnesses.

Clinical Trial of *Re-Mission*: A Video Game for Young People With Cancer

Steve W. Cole' Pamela M. Kato, Veronica M. Marin-Bowling, Gary V. Dahl, and Brad H. Pollock

Correspondence:
Steve W. Cole
HopeLab
Palo Alto, CA, USA
E-mail: scole@hopelab.org

Background/Problem: Adolescents and young adults (AYA) have historically been under-represented in clinical trials designed to test the effect(s) of drugs and interventions for cancer. Research indicates that treatment adherence and knowledge in addition to a sense of well being (including self efficacy and quality of life) can have a positive impact on health-related outcomes for those with cancer. Video games are increasingly utilized as a means of entertainment and information dissemination to this population. Over the course of several years, HopeLab worked with game developers, oncologists, cell biologists, and AYA with cancer themselves to create a video game called *Re-Mission*. This PC-based game was developed based on empirical needs-assessment

studies and theoretical models of behavior change and consists of 20 missions inside fictional cancer patients undergoing chemotherapy, radiation, or immunotherapy. Method/Tools, Results: We conducted a multi-site, randomized clinical trial to test the effect of Re-Mission, a state-of the-art videogame intervention, on adherence, cancer-related knowledge, self-efficacy and quality of life among adolescents and young adults with cancer. Players control a nanobot that destroys tumor cells, battles bacterial infections, and manages side effects with traditional therapies. 375 male and female cancer patients aged 13-29 were enrolled at 34 medical centers in the US, Canada and Australia, and randomly assigned to receive PCs with a popular video game or the same control video game plus Re-Mission. Adherence, cancer-related knowledge and self-efficacy were assessed at baseline and at 1- and 3-months. More than 80% of patients eligible to play Re-Mission did so. Data were analyzed on an intent-to-treat basis using a 2 (Condition) x 3 (Time) repeated-measures ANOVA. Adherence was uniformly high at baseline and not significantly affected by Re-Mission. However, patients cancer-related knowledge (p=.044), self-efficacy to communicate about cancer (p=.025) and manage side effects (anxiety [p=.043], constipation [p=.007]) increased in the Re-Mission group. The overall composite score on the self-efficacy scale also increased significantly over time for the Re-Mission group (p=.021). Conclusion: These data show that a theoretically-based, data-driven intervention delivered in an appealing interactive videogame context can produce significant increases in cancer-related knowledge and self-efficacy. Novelty/Discussion: To our knowledge, this is the first multi-site, randomized clinical trial of this scale designed specifically for AYA with cancer. It is also the first use of a multi-site, randomized clinical trial of this scale designed to test the effect of a video game intervention. We believe the process by which the game was developed and tested as well as the research findings have practical application for the development and testing of other serious games and/or other technology-based approaches to helping young people with chronic illness.

3D Virtual Immersive Scenarios – Bridging the Reality Gap Between Training and Real Life Situations

Corinne Collier, Brett Stevens, Steve Hand, Gary Smith, B.M., Sheena Farrell, & Charlie Watts

Correspondence:
Corinne Collier
University of Portsmouth
Department of Creative Technologies
Portsmouth, Hampshire, UK
E-mail: corinne.collier@port.ac.uk

This research discusses Phase one of a three phase study looking at the effects of greater task realism in a Virtual Immersive Scenario using 3D stereoscopic video footage to replicate the multiple stressor stimuli of a real situation. A task is designed as having a specific goal with quantifiable components for the successful completion of an objective. In CPR it is the correct definition of task, identification of order of actions, conditional clauses on actions taken and finally critical decision making that defines it as a high human cost task. This complex algorithmic model makes CPR skill acquisition, retention and transference variable in both clinical and non-clinical training. Current training includes text book, resuscitation manikins and more recently computer-generated virtual environments and/or avatars remotely manipulated by the user via combinations of interface and haptic devices. The success of this vicarious user interaction depends on the user's ability to cognitively perceive a computer-generated environment, the degree of visual disturbance/disintegration produced by a Head Mounted Display and the correlation between surface learning in unrealistic environments and "lack of real world consequence" (Morie et al., 2002). Two High Definition (HD) camcorders were used to film reactions of a small crowd scene upon discovering an unconscious casualty. The edited and rendered footage produced a 3D stereoscopic film that back projected into a Virtual Reality room with a CAVE™ like environment producing a Virtual Immersive Scenario. A Laerdal™ Resuscitation Manikin equipped with a recording device captured participant's compression and ventilation data. Visual/analogue scales of confidence, knowledge, willingness and ability to perform CPR were collected pre study. Witmer & Singers Immersive Tendencies questionnaire (pre study), Presence questionnaire (post study) and participant basic physiological readings (pre and post study) were taken. Video footage of participant behaviour was captured during the testing procedure to compare against the participant's subjective analysis of Presence. Healthy adult participants n=20 with no prior CPR experience were randomly divided into four conditions to undertake standardized layperson CPR training and testing by a qualified resuscitation officer. Condition A - non immersive training, non immersive testing. The control condition; Condition B - immersive training, non immersive testing; Condition C - immersive training and testing; Condition D - non immersive training, immersive testing. The results of Phase one of the study revealed that in the control condition A all participants n=5 either failed to request/seek assistance before starting resuscitation n=3 or verbally requested assistance after resuscitation had started n=2. Resuscitation should never be attempted before requesting and receiving confirmation of assistance. Early indications point to enhanced skill acquisition and performance in a combination of immersive and non immersive training and testing conditions. Phase two, currently in progress and Phase three to be held in three months will test the participants in their original test condition. This data will introduce skill retention and confidence transferral data that can be compared formerly with the results of Phase one and latterly in Phase three.

Should Virtual Reality be Classified as a Mind Body Intervention?

Mandella Connors

Correspondence:
Mandella Connors
Iowa State University
Iowa
E-mail: drvrmcf@iastate.edu

A Mind Body Intervention or MBI is an intervention that "focuses on the interactions among the brain, mind, body, and behavior, and the powerful ways in which emotional, mental, social, spiritual, and behavioral factors can directly affect health," according to the National Center for Complementary and Alternative Medicine. A MBI empowers and "enhances each person's capacity for self-knowledge and self-care." Rooted in this concept are techniques such as cognitive behavioral therapy, guided imagery, hypnosis, biofeedback, meditation, and Pseudoeducation. However, Virtual Reality or VR, which is grounded in this same concept, is missing from the list. VR has been an effective treatment for some of the same diagnoses as other MBIs to include pain, phobias, stress, and posttraumatic stress disorder, and in some instances, with more conclusive results. But it has yet to be recognized by the medical community as a MBI. I believe that VR should be classified as a MBI, because it not only

encompasses all the classic characteristics of a MBI, but it yields some rather noteworthy benefits such as a) effectiveness in addressing a wide variety of diagnoses, b) the power to embody many MBIs in a single session, c) a scientific nature that tolerates testing, recording, measuring, and adjusting of variables, simultaneously, in a single setting, during a single session, using a wide spectrum of research instruments, and e) technologically convenient and advanced designs that encompasses mobile, user friendly, computer-generated realistic scenarios as part of its intervention. By classifying VR as a MBI we give those suffering from psychosomatic illnesses one of the most sophisticated, non-invasive, technological weapons available that promotes human performance by instigating the body's natural healing virtues.

Virtual Reality Rehabilitation in Chronic Stroke: Two Case Studies

J. H. Crosbie, S. Lennon, J. McNeill, and S. M. McDonough

Correspondence:
J. H. Crosbie
Health and Rehabilitation Sciences Research Institute
University of Ulster
Shore Road, Newtownabbey
Co. Antrim, Northern Ireland
E-mail: j.crosbie@ulster.ac.uk

Recovery of upper limb function is a major problem, with 30 – 66 % of stroke survivors no longer being able to use the affected arm. Rehabilitation that incorporates virtual reality (VR) may be of benefit but its effectiveness may be dependent on the extent of injury in the cortex and the resultant impairment. The aim of these two case studies was to explore the clinical profile of two participants and their user experience of the VR system. One male (Patient A, 76 years) and one female (Patient B, 60 years) participant received a single VR training session of 30-minutes duration. Both were independently mobile with right cortical damage and time since stroke was 3 and 4 years respectively. In Patient A there was no notable lesion on CT, whereas Patient B had a basal ganglia haemorrhage. Each was medically stable after a first stroke and had no significant speech deficits. User experience was assessed using the Task Specific Feedback Questionnaire (TSFQ), the Borg Scale of Perceived Exertion, the Immersive Tendencies Questionnaire (ITQ) and self reports. Motor activity and function were assessed using the Motricity Index (MI) and the Action Research Arm Test (ARAT). Table 1 presents the results from all assessment measures. Functional scores measured by the Action Research Arm Test (ARAT) were very similar. However at impairment level Patient B displayed less selective movement of the hand compared to Patient A.

Assessment measure	TSFQ	ITQ
Patient A	28	Negative
Patient B	28	Positive

Assessment measure	Borg	ARAT
Patient A	2	3
Patient B	10	4

Assessment measure	MI
Patient A	77
Patient B	62

In summary, each patient had a favourable experience when interacting with the virtual environment (VE), as indicated by the high TSFQ score. They differed in their likelihood to become immersed in a VE as assessed by the ITQ. Patient B rated the experience at the highest level of perceived exertion of 10 on the Borg scale. The greater level of impairment of hand function with this patient may account for the perceived difficulty in carrying out the virtual tasks.

Simulator Sickness and Its Technical Overview

Marcel Delahaye, Oliver Stefani, and Alex Bullinger

Correspondence:
Marcel Delahaye
COAT-Basel, Switzerland
E-mail: bua@coat-basel.com

Simulator Sickness is a traditional challenge with driving simulation and immersive Virtual Reality. The report of ill feelings associated with the use of simulation devices has been around for a long time. The common synonyms for simulator sickness are "environment sickness" or "cybersickness." Generally spoken it is an adverse reaction to immersion in a computer generated environment. Simulator sickness is related or is even a subentity of the well known motion sickness. Motion sickness occurs when the body is

subjected to acceleration of movement in different directions and under conditions where visual contact with the actual outside horizon is lost. Experiences with driving simulators indicate no correlation between motion sickness and simulator sickness (although some questionnaires exist). Both can result in an array of symptoms including: eye strain, headache, postural instability, sweating, disorientation, vertigo, pallor, nausea, and vomiting. The main theory explaining simulator sickness is the sensor conflict theory (sensory mismatch theory): the body reacts with nausea when visual and vistibular signals provide conflicting information about body's orientation (Kennedy, Hettinger, & Lillethal, 1988). In other worlds the illusory feelings of self-motion during VR exposure (called vection; Biocca, 1992) induces sickness. Other reasons for simulator sickness are flicker and flame rate of the presented programm. Also fear or anxiety can promote symptoms (airline passengers with high level of anxiety get more sick) The direction of this correlation is not quite clear at this moment as of course the ill feeling of vomiting causes fear and anxiety. Prothero et al. (1999) suggest that motion sickness arises from rest frames selected from conflicting motion cues. Rest frames are defined as "the particular reference frame (a co-ordinated system used to define positions, angular orientations and motions) which a given observer takes to be stationary". As the visual background usually provides the majority of coherent cues in the environment, it follows that the visual background should strongly influence the visual rest frame which is selected. Prothero et al. (1999) found that providing an independent background which is consistent with inertial cues reduced simulator sickness and ataxia even when the foreground cues (i.e. the VE's content-of-interest) are not in agreement with the inertial rest frame. An Independent Visual Background consisits of a grid superimposed over the out the window visual display. Regardless of how the displayed image moves during the simulation, the grid stays fixed to the earth-stationary references that help the brain maintain a solid frame reference for orientation. This helps alleviate any confusion the brain might have over what is or is not moving with respect to self-orientation. In addition, post-exposure vection ratings (i.e. "While in the VE did you get the feeling of motion?") were not affected by using an independent visual background (see-through) as opposed to an occluded background. This suggests that an independent visual background can reduce sickness symptoms without detracting from feelings of presence in VE.

REFERENCES

1. Kennedy, R.S., Hettinger, L.J., & Lilienthal, M.G. (1988). Simulator sickness. In G.H. Crampton (Ed.), Motion and Space Sickness (Ch. 15). Boca Raton, FL: CRC Press.
2. Prothero, J., Draper, M., Furness, T., Parker, D. and Wells, M. (1999). The Use of an Independent Visual Background to Reduce Simulator Side-Effects. Aviation, Space and Environmental Medicine, 70(3), 277-283.
3. Biocca, F. (1992). Will simulation sickness slow down the diffusion of virtual environment technology? Presence, 1, 334-343.

How Social Context Can Limit a Tele-informatics Application

Eamon P. Doherty, P. Sullivan, M. Fitzsimmons, C. Abline, and G. Stephenson

Correspondence:
Eamon P. Doherty
Fairleigh Dickinson University
Hackensack, New Jersey
E-mail: doherty@fdu.edu

Suhail Ali and Dr. Eamon Doherty were at Fairleigh Dickinson University and created a Multilanguage menu system for disabled people that could be used in a long term health care facility in the United States. The disabled people could call a toll free telephone number, listen to food choices for breakfast in various languages, and order a meal. There was a consensus that the elimination of paper menus taken from room to room would reduce germs. The disabled people liked that. Those with impaired speech liked the idea of push buttons to select items as opposed to trying to make him/her understood. A person with good speech did not like the food menu call in system because it reduced human interaction which was already limited for them. Another application was designed for disabled people using a civilian version of a reverse 911 system. Its purpose was to call a list of the disabled person's relatives and friends up and remind them to visit and prompt them for driving directions from various landmarks around the state. An option for suggesting a holiday gift was discussed. The disabled people who have difficulty dialing or speaking on the phone originally liked the idea of a robotic voice calling friends and family in bulk, but then changed their mind saying such a system was impersonal. Lastly we discuss an informatics system called

Chartmaxx that is used at a local hospital and allows medical personnel instant access to medical records up to twenty five years ago and has saved everyone time and money since many test results can be instantly recalled eliminating the need for performing some medical tests. It was our opinion that the social context of informatics systems was more important to disabled people for activities of daily living than to people who use it for work and have a lot of social contacts.

Using Virtual Reality to Treat Social Anxiety Disorders in Adolescents

Francine Doré, and Stéphane Bouchard

Correspondence :
Francine Doré
Université de Sherbrooke
Canada
E-mail : francine_dore@ssss.gouv.qc.ca

Social anxiety disorder (SAD) often occurs during early adolescence. It involves fears of speaking in public, being scrutinized, getting involved in informal speech and asserting oneself in more formal situations. Those affected with SAD are considerably limited in their social interactions and in their quality of life. Considering the developmental impact of social life during adolescence and low rate of spontaneous remission, it is of utmost importance that affective treatments are offered. Unfortunately, many adolescents do not seek psychotherapy for anxiety disorders. Our study focuses on the treatment of SAD with teenagers using virtual reality exposure (*in virtuo* exposure). The main objective is to document the impact of *in virtuo* exposure on measures of social anxiety and fear of public speaking. As a pilot study, we used a single case design with multiple baselines across subjects. Five adolescents from our mental health clinic received several sessions of *in virtuo* exposure. As the main outcome measure, social anxiety is assessed twice a week from the beginning of the baseline until the end of therapy. Standardized paper-and-pencil test are also administered at pre and post-treatment in order to compare our results with what is found in randomized control trials using more traditional group designs. The results show an important and significant reduction in the intensity of participant's SAD and fear of public speaking. The severity of SAD seems to be an important factor to the effect of the treatment over the other components of social anxiety. Motivation

and credibility of virtual reality with this age group are also being discussed.

Impact of Sense of Presence on Distraction in Virtual Reality

Stéphanie Dumoulin, Stéphane Bouchard, and Geneviève Robillard

Correspondence:
Stéphanie Dumoulin
Cyberpsychology Lab
University of Quebec in Outaouais
Gatineau, Québec, Canada
E-mail: tifdum@hotmail.com

Pain is now considered a complex subjective phenomenon that involves sensorial, motivational, cognitive and emotional dimensions. Recent studies have now shown that virtual reality (VR) can be used to control and reduce acute pain, probably because of it's potential for distracting attention away from the pain. But does the method used to create the virtual immersion matters? The aim of this study is to compare three types of virtual immersion systems, their impact on presence and test which one is the most efficient to distract from potentially painful stimuli. The sample is consist of 30 participants aged between 18 and 30 years old assigned randomly the three following conditions for immersions lasting four minutes each : (a) a head-mounted display (HMD) of minimum quality; (b) a high quality HMD; or (c) an immersive room (CAVE-like system). The minimum quality HMD is an I-Glass SVGA (resolution of 800 X 600, FoV: 26 degrees) and the high quality HMD is an nVisor SX (resolution of 1280 X 1024; FoV: 60 degrees). The Cave-like system is a three-wall rear projection system (10 feet X 10 feet X 100 feet walls). Head tracking for both HMD is provided by an I-Cube from Intersense. Motion tracking in the immersive room is provided by an IS-900 from Intersense. The procedure consisted on visiting of a virtual apartment. During each immersion, a background noise of 60 hertz / 80 dB was present. After each immersion, participants had to answer questions about their interest about the experience, the extent to which they were able to ignore the background noise, how involving was the VR immersion, etc. The Immersive Tendency Questionnaire and the Simulator Sickness Questionnaire were also filled prior and after the experimentation. This study is still underway and the results will be analyzed late in April.

Virtual Reality Exposure for the Treatment of Mottephobia

Douglas Eames, Hisanobu Kaiya, Eiji Yoshida, Reiko Iwasa, and Nick Chionilos

Correspondence:
Douglas Eames
Tokyo Cyber Clinic
Tokyo, Japan
E-mail: douglas@tokyocyberclinic.com

Virtual reality exposure therapy has been found to be an effective treatment for simple phobias. It is especially useful in treating phobias where in-vivo exposure is difficult to do. For example, in-vivo exposure for the fear of storms can only be conducted when the weather is bad, while in-vivo exposure for the fear of flying requires a large amount of time and money. It may also be impractical to do in-vivo exposure in a clinical environment for small animals, insects, and spiders. Keeping the feared objects in the office could be quite inconvenient. For these reasons it was hypothesized that the fear of moths, mottephobia, and the fear of butterflies are simple phobias that could be effectively treated with the use of virtual reality exposure therapy. A virtual reality environment was created for the treatment of butterfly and moth phobias. The environment is comprised of a large outdoor field with mountains in the distance. A tree is located in the middle of the field as a reference point. The user can walk around in the environment by using a game controller to move forward and backwards. Direction of view and movement is controlled by a position tracker. The number of butterflies and moths in the environment is controlled by the operator. Green, yellow, and blue butterflies are included in the environment along with grey moths. A 20 item questionnaire to asses the level of fear for butterflies and moths was created. Each item was ranked on a scale from 0-100 points, with the total score used as the measurement to monitor the treatment progress. A single patient with a fear of moths was recruited for the study. She had 19 sessions of treatment using cognitive and behavioral techniques. 10 of the sessions used virtual reality exposure therapy. During the virtual reality exposure the patient's physiological signals were monitored. In addition to the physiological data, SUD ratings were collected from the patient during the exposure. The treatment program was found to significantly reduce the patients fear so that it could no longer be classified as a phobia. The virtual environment was found to be very effective in eliciting a fear response during the initial exposure sessions. This was indicated by the SUD readings from the patient and the skin temperature data. The score from the questionnaire was also a good indicator of treatment progress. It decreased from 1670 points to 766 points over the course of the treatment. The results of this single case study have encouraged us to incorporate virtual reality exposure therapy into the treatment program for other butterfly and moth phobia patients.

Integrating Artificial Intelligence and Virtual Reality in the Diagnostic Process – Feasibility Study

Uri Feintuch, Larry Manevitz, Eugene Mednikov, Debbie Rand, Assaf Dvorkin, Rachel Kizony, Meir Shahar & Patrice L. (Tamar) Weiss

Correspondence:
Uri Feintuch
Hadassah-Hebrew University Medical Center,
Jerusalem, Israel
University of Haifa, Haifa, Israel
E-mail: urif@cc.huji.ac.il

Employing Virtual Reality (VR) technology in the field of rehabilitation facilitates the design of clinical tools, which have potential ecological validity. This property, however, may become a burden when using virtual environments (VEs) for diagnostic purposes. Whereas tests are typically standardized and rigid, contemporary sophisticated VEs encourage natural unstructured behavior of the patient. Constraining the user's behavior may reduce the added value of VR technology. The current study proposes a system which employs VR tools for conducting clinical tests, while drawing on Artificial Intelligence (AI) tools for assisting in the diagnostic process. This is done by using artificial neural networks (NN). Such networks can 'learn' different kinds of human behavior. After being introduced to several patterns of behavior, they are able to generalize and classify new cases. The goal of this study is to asses the feasibility of this system, and test whether noisy data, produced by natural behavior in VEs, will be amenable to meaningful classification of various populations. Various types of populations were asked to perform tasks in the Virtual Mall. In this task subjects are asked to shop for virtual groceries located on different shelves and aisles. The task is

fairly intuitive and involves cognitive and motor functions. We have used GestureTek's Gesture Xtreme system as the VE platform. This system is based on projection and video capture of motion, so users are not required to wear any encumbering gear. Thus, it is adequate for many types of populations including people who suffer from stroke or head injuries. These benefits also imply partial and noisy data, since there are no trackers attached to the body. We run the data through a feed-forward NN, using an algorithm of supervised learning, and then tested its ability to generalize. For example, we first provided the system with data from several subjects labeled "stroke" or "healthy"; we then introduced the system to new subjects and tested the system's ability to accurately classify them. To date, data from more than 60 subjects have been included in the analysis. Initial results suggest that the system can differentiate between the healthy subjects and those who suffered a stroke. This study shows the potential of integrating and harnessing two powerful disciplines, VR and AI. Their implementation may provide the clinician with a way to employ an ecological VE, where the patient may behave naturally. Yet this VE will provide meaningful information about the patient's status. We believe that once the NNs are taught and exposed to many types of behaviors and impairments, they may be able to distinguish between various impairments and their severity levels. This may significantly aid clinicians in performing differential diagnosis and clinical assessment. *The first three authors contributed equally and are listed alphabetically. This paper is part of the M.Sc. thesis of Eugene Mednikov at under the advisorship of Uri Feintuch and Larry Manevitz. We thank the HIACS Research Center and the Caesarea Rothschild Institute for their generous support.

## Virtual Humans Entering New Area of Applications

Michel Fleury

Correspondence :
Michel Fleury
Université du Québec à Montréal
Canada
E-mail: fleury.michel@uqam.ca

Virtual humans are at the last frontier surrounding the classical conquest of illusion. It is a big challenge to create those new entities enabling them to express convincing emotions. It is evidently an expensive challenge requiring elite Cg artist. So is it thinkable to open new territories for virtual human outside the astronomical budget of film production? It is not hard to see many potentials applications of virtual humans outside the entertainment area but the problem is the complexity of creating and animating them. Cg artist are the new artisans of the modern world. Mastering 3D is difficult. We will present an extract of a short animation –Kyra- and discus some fundamental issues in this very complex task. Is there a way out of this complexity ? We will first discuss the problem related to the creation of the virtual humans and what must be done so it is ready to talk and move. We will present the original vision of the Darwin Project developed with the support of Hexagram and then supported by a financial angel, Mr David Chamandy. We will discus how Darwin Evolver software try to give access to high end virtual humanoids to a larger group of users outside the 3D elite. Evolver is part of the solution. What about animation ? On the side of digital 3D animation real time issues and artificial intelligence are part of the solution we believes. We will discus some experiment we did with Lena using a comedian with a simple microphone, game pad and joystick to control her. We will touch some deep questions which are hard to resolved for Cg artist. What is a virtual personality? How do we capture the essence of that? There is here a natural bridge between psychology and the arts of representing virtual actors.
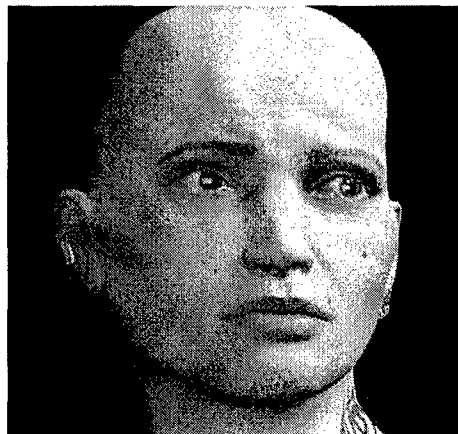
AudioMedia: Multimedia for Blind People

Héctor Flores, and Jaime Sánchez

Correspondence:
Héctor Flores
Department of Computer Science, Blanco
University of Chile
Encalada 2120, Santiago, Chile
E-mail: hflores@dcc.uchile.cl

Diverse technology devices are used to convey information to sighted users such as computers, television, internet, and multimedia. The use of these technologies relies heavily on graphical interfaces making more complex their access by users with visual disabilities. This study presents a virtual environment tool, AudioMedia, which allows users with visual disabilities to create multimedia based on audio as a mechanism for information transmission to sighted and blind users. AudioMedia is a tool that combines visual interfaces based on high contrast with auditory feedback in such a way that blind users can control the whole construction of their multimedia projects and presentations. The design of AudioMedia was based on implementation models previously developed and evaluated with blind users. Consequently the software model shows how the conceptual model that blind users want to convey is computationally represented by AudioMedia and how the interaction with the user is created by using the hardware available. Usability evaluation of AudioMedia was studied with users with visual disabilities (totally blind and residual vision) observing a high user acceptance when interacted with this new tool by highlighting the freedom and easy to use of AudioMedia. Usability evaluators studied the user interaction with the software and applied observation instruments obtaining data that confirms the feasibility of this tool for users with visual disabilities. To study the impact of this software on designing and producing multimedia we implemented a research intervention by using the Project-Based Learning methodology. Six young people ages 19-28 with different vision disabilities levels worked with the software during eight 2.5 hours sessions. Users followed three stages: 1. *Entrance*, they defined their projects and were also trained on concepts and processes concerning the project learning methodology; 2. *Project development*, users met in teams, shared ideas, and planned their projects by searching information, defined the topic, chose the multimedia to be used, and elaborated a project plan; 3. *Multimedia presentation*, users presented their project results by using AudioMedia. This process involved users with visual disabilities to exercise diverse socio-cognitive processes such as: recollection, classification and synthesis of multimedia information, team collaboration, and public final project presentation. Our initial results indicate that the use of an audio-based tool such as AudioMedia can stimulate the participation of users with visual disabilities in diverse contexts of interaction with sighted users by improving their skills to communicate, inform and present information, and thus helping them to integrate and include more fully to their society.

Does Sleep Affect Learning During a Virtual Reality Exposure Therapy for Specific Phobia?

Geneviève Forest, Éric Lord, Frédérick Michaud, and Stéphane Bouchard

Correspondence :
Geneviève Forest
Université du Québec en Outaouais
Gatineau, Canada
E-mail: genevieve.forest@uqo.ca

Evidences for a relationship between rapid eye movement (REM) sleep and memory has been found in a large number of studies over the past thirty years. These studies have been using learning tasks such as declarative (paired associated, learning stories, word recognition) and non declarative (words priming, procedural learning) memory tests. Results have shown that REM sleep deprivation impairs learning on some of these tasks. These studies also showed increased period of REM sleep following intensive learning sessions, more particularly when the material is

complex and emotionally charged (stories, films, etc.). Learning also occurs during the cognitive-behavior therapy (CBT) of phobias. Indeed, CBT involves the processing of emotionally charged information in order to learn new associations between the threatening stimuli and their consequences. In addition, the person learns how to control the anxiety elicited by the feared object. The present case study aims at verifying if exposure to the threatening stimuli, which is a task oriented towards a more emotional learning than cognitive restructuring, also solicit REM sleep mechanisms. The sleep of a man suffering from aviophobia was recorded for four consecutive nights. EEG (C3, C4, O1, O2), EMG (sub-mental) and EOG were recorded and scored according to the standard method using 20 seconds epochs. The first night was an adaptation night used to rule out sleep disorders such as sleep apnea, periodic limb movement during sleep or bruxism. The second night was the baseline night. On the third day, the subject underwent an intensive CBT using virtual reality exposure (total duration of three hours of cybertherapy). Consequently, the third night of recording was the experimental night. The fourth night was a follow up night. The subject had an additional three hours of cybertherapy on the fifth day. Clinical observations as well as questionnaires administrated before and after CBT confirm the success of the therapy. Sleep recordings showed that REM sleep significantly increase after CBT, but not the night immediately following the therapy session. Indeed, REM sleep percentages were 21.49% for the baseline night, 21.27% for the experimental night, and 31.49% for the follow up night. These results suggest first that REM sleep seem to be involved in the consolidation of psychological and emotionally charged information. Moreover, these results suggest that there may be a delay in this particular consolidation process. This is in accordance with the concept of "REM sleep windows" suggested by Smith (1985). This author suggests that REM sleep window is "a time after acquisition when there are increases in REM sleep over normal levels", and that theses windows varies "with the strain and type of learning task and the number of trials per session". More subjects are needed to validate these results.

Mental Training with Virtual Reality in Post-Stroke Rehabilitation: A Progress Report

Andrea Gaggioli, Francesca Morganti, Andrea Meneghini, Mariano Alcaniz, and Giuseppe Riva

Correspondence:
Andrea Gaggioli
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Department of Psychology
Catholic University
Milan, Italy
E-mail: andrea.gaggioli@auxologico.it

Mental practice (MP) with Motor Imagery (MI) is a training method consisting in mentally simulating a movement, with the goal of improving performance. In recent years, several authors have proposed MP with MI as a potentially valuable technique for promoting functional regain in people suffering from post-stroke hemiplegia. The benefit of mental practice would be to repetitively activate cerebral and cerebellar sensorimotor structures damaged by a stroke, thereby engaging compensatory networks to promote motor rehabilitation. However, mentally simulating a movement can be a demanding task, especially for brain-injured individuals. This article reports progress of a research project[5], which is evaluating the use of computerized technology to guide mental practice in the rehabilitation of upper-limb hemiparesis after stroke. The experimental protocol includes two phases, each during 4 weeks. During the first month of intervention, the patient undergoes three computer-enhanced mental practice sessions per week at the rehabilitation center, using a custom-made virtual reality system called "VR Mirror". The system allows to record motions of the non-affected arm, and present these visually as if performed by the affected arm. In particular, training procedure with VR Mirror consists of the following steps. First, the therapist shows the patient how to perform the exercise with the healthy arm. When the patient then performs the task, the movement is registered by tracking sensors positioned on the patient's forearm and wrist. Then, a 3D reconstruction of the movement acquired by sensors is superimposed over the (unseen) paretic limb. After watching the virtual limb on the screen, the patient is asked to mentally rehearse the movement he has just observed, taking a first-person perspective (imagery response times are collected). Last, the patient has to perform the movement with the affected arm. During physical execution, the system tracks the movement again, and measures its deviation from the movement performed with the nonparetic arm. Using this measurement, which is done in real time, the system provides the patient with audiovisual feedback describing performance on the task. The procedure described

above is repeated 5 times within each practice session, for each targeted exercise (flexion-extension of the wrist; intra-extra rotation of the forearm; flexion-extension of the elbow). At the end of the laboratory training phase, the patient used a portable display device to practice at home. The portable display stores a sequence of movies depicting these motor exercises. After viewing these movies, the patient is asked to take a first person perspective, and to imagine executing the movements with the impaired arm. This sequence is performed three times a week, for four consecutive weeks. Pretreatment and posttreatment measures include the Fugl-Meyer Assessment of Sensorimotor Impairment, and the Action Research Arm Test (ARA). Performance on the specific tasks is also evaluated through response times and sensors data.

Flow in Real and Virtual Environments

Andrea Gaggioli

Correspondence:
Andrea Gaggioli
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Department of Psychology
Catholic University
Milan, Italy
E-mail: andrea.gaggioli@auxologico.it

So far, virtual reality (VR) experience has been mainly investigated from the perspective of presence, broadly defined as the feeling of "being there" in a mediated environment. Typically, this research has been conducted in laboratory settings to assess how the manipulation of specific system variables (such as the perceptual fidelity of the displays, the ease of interaction, the length of exposure to the virtual environment and several others) affects the "feeling of reality" perceived by participants, as measured through self-report questionnaires and psycho-physiological responses. In this article, we introduce an alternative theoretical and methodological approach, which aims to compare the experience profile associated with "virtual" and "real-life" activities, focusing on its cognitive, affective and motivational components. In particular, our goal was to assess whether the use of VR is associated with *flow*, an optimal experience characterized by the perception of high environmental challenges matched with adequate personal skills, high concentration, enjoyment, engagement, loss of self-consciousness, focused attention, and intrinsic motivation. 42 students (27 females and 15 males), aged between 19-24 years ($M = 21.0$, $SD = 1.4$) volunteered to participate in the study. Quality of experience associated with real and virtual activities was assessed by means of the Experience Sampling Method, a procedure based on repeated on-line assessments of the external situation and personal states of consciousness, as real daily events and situations occur. ESM taps how people daily invest their attention and resources, what they do, what they think of, and how patterns in subjective experience relate to life conditions. Each participant received a booklet of self-report forms and an electronic pager that emitted a beeping sound at random intervals. The participants carried the questionnaires and pager during all the hours of the week they were tested, receiving five to eight signals a day during waking hours. When the pager beeped, the participants were to fill out a report. The week of observation included two VR sessions in non-consecutive days at the Psychology Laboratory. For data analysis, experiential variables were aggregated into 4 dimensions: Mood, Engagement, Confidence, and Intrinsic motivation. Flow was identified on the basis of a) perceived balance between opportunities for action (challenges) and personal skills, and b) significantly positive values of all the experiential dimensions. Results showed that VE use was a high challenging activity that participants often associated with optimal experience (22% of self-reports). Reading, TV and the use of other media used both in the context of both learning and leisure activities were associated to optimal experience in lower percentages (respectively 15%, 8% and 19% of self-reports). Implications of these findings for VR research and practice are discussed.

A Pilot Study of Enforced Collaboration during Computerized Story-Telling to Enhance Social Communication of Children with High-Functioning Autism

E. Gal, D. Goren-Bar, N. Bauminger, O. Stock, and P. L. T. Weiss

Correspondence:
E. Gal
LIRT
University of Haifa
Mount Carmel, Israel
E-mail: egal@univ.haifa.ac.il

Autism is a complex developmental disability that begins in early childhood and persists throughout adulthood affecting three crucial areas of development: communication, social interaction, and creative or imaginative play (Baron-Cohen & Bolton, 1999). Deficits in social interaction constitute a major characteristic of children with autism (Bauminger et al., 2003) and range from a lack of awareness of others (for those with the most severe social impairment) to abnormalities in peer relations (for those who are less impaired) (Volkmar et al., 1997). MERL's DiamondTouch Hardware (http://www.merl.com/projects/DiamondTouch/) is a multi-user touchable interface that detects multiple simultaneous touches by two to four users (Dietz & Leigh, 2001). Each user sits or stands on a receiver (a thin pad) such that touching the table surface activates an array of antennas embedded within its surface (capacitive touch detection). Zancanaro et al. (2003) have developed a Story-Table interface based on the Diamond Touch technology, which enforces collaboration between children while telling a story. The application is multimodal in character, providing visual stimuli, responding to touch commands, and enabling the recording of narratives. The interface has been evaluated with normative children in two trials followed by a user study which demonstrated that forced multi-user operations were a powerful means to facilitate cooperative behaviors (Cappelletti et al, 2004). We hypothesized that use of the Story-Table by children with HFA will take advantage of their interest in using computerized technologies, yet add an important dimension, namely communication and interaction with peers (Gal et al., 2005). The objective of this paper is to present the results of a pilot intervention A-B-A study using the Story-Table with four pairs of children with HFA, aged 8 to 10 years, to document its ability to facilitate cooperative (verbal and non-verbal) interactions with peers during story-telling situations. These children participate in an educational program that is adjusted to their needs in a mainstream setting. The pairs of children knew each other before taking part in the study. The children were tested prior to (pre-A) and following (post-A) the intervention (B) with a low-tech version of the Story-Table interface and with an assembly game (Discovery Toys MarbleWorks). The structured intervention consisted of 8-10 20-minute sessions which took place at their school (3-4 times per week for 3 weeks). During the intervention, the pairs of children were instructed to create and narrate a story with respect to a background picture and associated figures that they had jointly selected. All pre- and post-tests and intervention sessions were videotaped for subsequent analysis. Outcome measures included (1) a behavioral checklist which documents positive and negative social interactions as well as autistic behaviors and (2) an analysis of the language usage of all interactions and of the narratives. The results, to date, have demonstrated that the participants readily learned to use the Story-Table technology and appeared motivated to create and tell narrations. Initial examination of the pre- and post-tests and intervention sessions indicates that this technology is promising as a technique for enhancing cooperative social behaviors.

Interaction Analysis and User Based Tests: Ergonomic Issues for VR Based Therapy

Carlo Galimberti, Gloria Belloni, Matteo Cantamesse, AlbertoCattaneo, Fabiana Gatti, Maddalena Grassi, and Luca Menti

Correspondence:
Carlo Galimberti
Università Cattolica del Sacro Cuore di Milano
Milan, Italy
E-mail: carlo.galimberti@unicatt.it

This contribution is part of the Italian MIUR-FIRB-NeuroTIV project. In this study we offer the work done by Licent (Laboratory of Communicative Interaction and New Technologies) at the NeuroTIV project. Method: This study, aimed at verifying the efficacy of the VR environments in the anxiety disorders' cognitive-behavioral treatment (CBT) and defining guidelines for the design of VE, is based on the analysis of interactions between therapists and patients (8 sessions for each patient, 72 sessions) and on outpatient-based tests (12 subjects). The first level analysis, conducted with the support of Atlas.Ti 4.2 for quali-quantitative analysis, is aimed at investigating practice habits for the use of VR in the framework of therapeutic protocol, with special focus on VR scenarios and their ergonomic aspects. On the other hand, in user-based tests, outpatients are considered as 'expert users': their contribution is relevant in order to evaluate and improve the structure and the navigability of VR scenarios. The adopted perspective is intended to improve the whole interactive process, abandoning both artifact centered and user–artifact centered interaction in favour of a *'situated and context sensible' ergonomic analysis*. This approach gives evidence

of how people, in specific social situations, are able to solve complex tasks producing shared meanings and achieving their goals during interaction. The considered virtual environments were the Panic Disorders and Agoraphobia VR modules developed in the framework of the project: a metro station, a square, a mall and an elevator. Main results: Results from a preliminary analysis of data focused on ergonomic elements, in order to obtain hints on how patients use VR and what could be done to smooth the therapeutic process, could be clustered around 2 topics: "breaking points" and "narrative tips". Breaking points are elements that break down presence's experience, such as hardware issues, or software failures. Hardware issues seem to be perceived as a "personal failure": patients think they have to learn how to use hardware. To avoid this, designer could, as well as try to solve any hardware problem, implement a "sand-box" room, where patients can learn how to use input devices and become acquainted with output devices, as HMD, without being exposed to therapeutic protocol elements of VE. This room could be used to fire up an introductory sequence, fading in the VE, in order to avoid interruptions and breakdowns during the following phases of the process. Narrative tips are objects, places or in general elements that patients and therapists could use as stimulus for starting up a contextual narration of the "what, where and when" of the VE experience. Such tips are, for example, standing out avatars, or up-to-date graphic elements, as placards or signs. Further investigation is needed to explore how the VR environment level of interactivity influences the quality of the immersive experience and the role of the interaction and communication style of the therapist in VR based therapy and how this affects the VR experience mainly from the patient's, but also from the therapist's point of view.

How to Improve the VR Based Therapy Design Process with the Support of a Psychosocial Integrated Approach: Interaction Analysis and User Based Tests

Carlo Galimberti, Gloria Belloni, Matteo Cantamesse, Fabiana Gatti, Maddalena Grassi, Luca Menti

Correspondence:
Carlo Galimberti
Università Cattolica del Sacro Cuore di Milano
Milan, Italy
E-mail: carlo.galimberti@unicatt.it

The present contribution is part of the Italian MIUR-FIRB-NeuroTIV project which main objective is to prove the technical and clinical viability of using Virtual Reality Therapy in clinical psychology by means of portable and shared VR Systems. In this study we offer the work done by Licent (Laboratory of Communicative Intyeraction and New Technologies) at the NeuroTIV project. Method : The activity carried out by Licent research unit is aimed at verifying the efficacy of the VR environments in the anxiety disorders' cognitive-behavioral treatment (CBT). The study is based on the analysis of the therapist/patient interactions (8 sessions for each patient, 72 sessions on the whole) and on user-based tests (12 subjects), carried on at the end of the therapeutic cycle/protocol with the support of the Atlas. Ti 4.2 software for quali-quantitative analysis. 8 categories for the data analysis were defined on the basis of the elaboration of recorded material made by 4 independent researchers. Focus groups including therapists involved in the research were also carried out. The first level analysis is aimed at investigating how VR is used and integrated in the framework of the therapeutic protocol, with special focus on VR scenarios and their ergonomic aspects. On the other hand, in the user-based tests, outpatients are considered as 'expert users': their contribution is relevant in order to evaluate and improve the structure and the navigability of VR scenarios. The perspective adopted is intended to improve the whole interactive process, abandoning both artifact or user–artifact centered interaction in favour of a 'situated and context sensible' ergonomic analysis. This approach gives evidence of how people, in specific social situations, are able to solve complex tasks producing shared meanings and achieving their goals during interaction. The virtual environments considered were the Panic Disorders and Agoraphobia VR modules developed in the framework of the project. Main results: Data collected were analysed with reference to two different dimensions. From a strictly ergonomic point of view, main results are related to: 1) the improvement of VR training sessions for patients and their integration in the framework of the therapeutic protocol in order to avoid interruptions and breakdowns during the successive phases of the process; 2) Specific functional characteristics of the audio, video, scenarios' architecture, avatars. With reference to the sense of presence, following aspects are under investigation: 1) how the VR environment level of interactivity influences the quality of the immersive experience and final effects on the VR based therapy process; 2) the

importance of the narrative interactive experience: for example, a detailed description of the situation and of the environment made by the therapist seems to suggest the opportunity to include visual sequences in the initial and in the final phase of the navigation in order to enhance and to modulate the immersion in the VR environment while, in some cases, more generic descriptions allow patients to explore the environment and to act more spontaneously; 3) the role of the interaction style and of the communication style adopted by the therapist in VR based therapy and how this affects the VR experience mainly from the patient but also from the therapist point of view.

Presence: Head Mounted Display vs. Translucid Screen

Pedro Gamito, Diogo Morais, Jorge Oliveira, and Marisa Anastácio

Correspondence:
Pedro Gamito
Universidade Lusófona de Humanidades e Tecnologias
Lisbon, Portugal
E-mail: pedro.gamito@sapo.pt

Among others, two displays are used when exposure to virtual worlds is required: Head Mounted Display (HMD) and Translucid Screen (TS). The higher sense of immersion brought about by these two devices takes advantage over traditional media displays. In fact, both HMD and TS enable a superior sense of presence in the virtual worlds. However, the difference on the degree of presence between them is not well documented. This article presents and discusses a study that measured presence using a HMD and a TS. 69 subjects were exposed to two different neutral virtual worlds (20 minutes each world), one using a HMD and other a TS. Presence was assessed through Slater-Usoh-Steed questionnaire (1994). Significant differences (α=.05) were found between HMD and TS. In fact, results from Paired Samples T-Test (t(68)=-5.49, p=.00) revealed that presence with HMD (M=3.23; DP=.61) was significant higher than the one with TS (M=3.01; DP=.51). Cybersickness was found on 21.7% of the HMD subjects and on 27.5% of the TS subjects. On both groups, presence was significant inferior on subjects with cybersickness.

Virtual Reality and In Vivo Exposure for Fear of Flying: A Phase II Replication Study

Ken Graap, Barbara O. Rothbaum, Page Anderson, Elana Zimand, Larry Hodges, Delia Lan, and Jeff Wilson

Correspondence:
Ken Graap
Virtually Better, Inc
Decatur, GA
E-mail: graap@virtuallybetter.com

Background: Fear of flying is a prevalent problem that affects people in many ways. Like other anxiety disorders and phobias, a hallmark symptom is avoidance. Treatment generally involves exposure therapy. Exposure may be delivered via imagination, in vivo, or virtual reality (VR). This study utilized in vivo and VR based exposure with a wait list control group. Method: Participants who met DSM-IV criteria for an anxiety disorder in which flying was the primary feared stimulus were recruited from the greater Atlanta area through advertisements. Participants were randomly assigned to VR based exposure (VRE) (n = 25 completers); Standard (in vivo) exposure (STE) (n = 25 completers); or Wait List (WL) (n = 23). Data were collected at 6 and 12 months post treatment. Both treatment groups were provided with 4 sessions of anxiety management training followed by exposure either in VR or at the airport. Evaluations included willingness to take an actual flight immediately post treatment, standardized questionnaires, anxiety ratings on the test flight, self evaluations of improvement, and overall satisfaction with treatment. Results: No differences were detected between the two exposure-based treatments on relevant measures and each treatment was superior to the WL control group. Follow up evaluations indicated that participants in both treatment groups maintained therapeutic gains at follow up. Conclusions: The results of this controlled trial add evidence to that from our first trial which reported similar findings. Both trials support the use of exposure as a viable treatment modality for fear of flying. In the post 9-11-2001 flying environment, security concerns and delays in airports are the norm. The use of VR based exposure allows professionals to offer an effective behavioral treatment for flying fear in their practices. New innovations in VR and next steps in anxiety research will be discussed. Discussion: Future directions for anxiety research and the additional stimuli in the VR airplane environment will be discussed. Research Status: Completed.

Exploratory Investigations of Multimedia Human Computer Interfaces for Autism

Ouriel Grynszpan, Jean-Claude Martin, and Jacqueline Nadel

Correspondence :
Ouriel Grynszpan
LIMSI-CNRS
Orsay, France
THIM Université Paris 8
Saint-Denis, France
E-mail : ouriel@limsi.fr

Our research aims at providing design guidelines for software intended for specialized education for autism. Our study focuses on autism with average or above average IQ, referred to as high functioning. Pragmatic difficulties are attributed to people with autism: they tend to miss out context when interpreting speech. According to different authors (Russell, 1996), autism would be linked to an executive dysfunction that impacts the ability to plan actions, imagine alternative solutions and inhibit inappropriate responses. Experimental studies have emphasized the usefulness of computer education for autism. Yet, there have been few studies on the behavior of people with autism as users of a computer. We therefore performed an exploratory investigation of HCI issues that would be relevant for autism. Our experimental protocol focused on the study of two dimensions: 1) the domain of learning targeted by educative games and 2) the media and modalities used in the HCI. We contrasted two learning domains: "dialogue understanding" which seemed relevant given the pragmatic difficulties reported in autism and "spatial planning" which involves visuospatial skills considered unaltered in autism. We assumed that performances of subjects with autism would be close to those of subjects without autism in spatial planning, but that they would differ in dialogue understanding. We designed two software games for each learning domain: one for training purpose and one to evaluate subjects' skills before and after training. These games were tested with 10 teenagers diagnosed with high functioning autism according to DSM IV (APA, 1994). We tested several HCI modalities that were specific to each learning domain (e.g. text, synthesized speech, facial expressions images...). During evaluation phases, we also controlled for the impact of multimodal as compared to minimalist interfaces. The experiment comprised 13 sessions, at the rate of one session per week. We replicated the experiment with a control group of 10 children without autism. A software platform was developed to control HCI modalities and to log users' actions. Moreover, we annotated video recordings of two sessions with the subjects with autism. Contrary to initial assumptions, results lead to the conclusion that the clinical group performed poorer than the control group on spatial planning tasks, despite the asymmetric cognitive profile in favour of visuospatial skills attributed to autism. This difficulty could derive from executive functions involved in planning a solution and complying with arbitrary rules, such as orientation constraints in a graph. We also observed that HCI features enforcing the task's arbitrary rules (e.g. not allowing crossing an arrow in the wrong way) could be helpful regarding the management of executive functions. Results suggest that the multimodal interfaces tested during evaluation did not help subjects with autism more than the minimalist interfaces, whereas it was the case for the control group. Users with autism might not be able to take advantage of multimodality which could induce cognitive overload.

REFERENCES

1. American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition*. Washington D.C.
2. Russell, J. (1996). *Agency Its Role in Mental Development*. Erlbaum (UK) : Taylor&Francis.

Failure to Influence Presence by Manipulating Narrative Content

Tanya Guitard, and Stéphane Bouchard

Correspondence:
Tanya Guitard
Cyberpsychology Lab
University of Quebec
Outaouais (Gatineau, Québec, Canada)
E-mail : guitard.tanya@courrier.uqam.ca

Presence is a popular topic in virtual reality. It is a common belief that presence is related to treatment outcome, at least for the treatment of anxiety disorders. But the mechanisms linking presence, anxiety and treatment outcome remain unknown. Mantovani et al. (2004) suggested that the narrative context provided to the subject before the immersion in virtual reality has an impact on presence. But their experimental manipulation confounded the manipulation of the narrative context and the induction of emotional arousal. In order to discern the impact of the narrative and emotions induced by the context of the immersion we tried to manipulate narrative and emotions. Our hypothesis was that anxiety felt during the immersion in virtual reality would increases the feeling of presence. The study involved 30 participants, assigned randomly to one of three experimental conditions: (1) Minimal instruction (which can be summarized by: visit the Temple of Horus, in Egypt. If you see medical emergency kits let us know because some were lost during our last visit) (2) Neutral narrative (which can be summarized by: while you were visiting the Temple of Horus an accident happened to a tourist and you have to help her by finding lost medical emergency kits), and (3) Stressful narrative (which can be summarized by: while you were visiting the Temple of Horus an accident happened to the child of a tourist and you have to help. You have to find medical emergency kits before she dies. Be careful because there is a dangerous and armed man inside the Temple). Participants were immersed three times in virtual reality: once in a control environment, once in the Temple of Horus environment (the experimental immersion) and once again in the control environment. Following the immersions, participants were asked to complete different questionnaires and short measures of anxiety and presence. We found significant differences in anxiety between the conditions after randomization, but the experimental manipulation did not induce anxiety in the participants. A general impact of narratives may be reflected in the statistically significant increase in presence from the control environment to the experimental environment, but there were no differences among the three conditions. In our opinion, the failure to induce anxiety is worth reporting to the scientific community, at least as an example where narrative may not induce the expected emotions. In addition, a significant number of participants were subjected to cybersickness during the experiment. These results are discussed in the light of different factors relating to presence and the planning of further studies using different methodologies.

The Effects of Active Navigation on Object Recognition in Virtual Environments

Jinsun Hahm, Seung-Lark Lim, Kang-Hee Lee, Hyun-Taek Kim, and Jang-Han Lee

Correspondence:
Jang-Han Lee
E-mail: clipsy@cau.ac.kr

Background & Significance of the Problem: There has been growth in the interest in VEs as tools for acquiring spatial knowledge and these interaction systems appear to have significant potential as aids to human learning. In general, the visual information which is essential for learning in virtual environments can be acquired in the course of active navigation of an environment and during passive one. Evidence from some experiments generally suggests that active navigation has potential benefit for acquiring spatial knowledge while other studies show inconsistent results. In the present study, therefore, we examine the relative effectiveness of active navigation and passive navigation in the efficient acquisition of spatial knowledge by controlling for the previously mentioned limitations. Methods/Tools: 54 participants (19 males and 35 females) were randomly allocated into one of two navigation conditions (active and passive navigation). The 3D visual display was presented through HMD and participants used joysticks to navigate VEs. The VEs consisted of exploring four rooms (library, office, lounge, and conference room), each of which had 15 objects. 'Active navigation' was performed by allowing participants to self-pace and control their own navigation within a predetermined time limitation for each room. 'Passive navigation' was conducted by forced navigation of the four rooms in random order. Total navigation duration and objects for both navigations were identical. After navigation, all participants were asked to complete the recognition task with 60 old items, which had previously been shown during the navigation, and 60 new items, which had not been presented before. Recognition for objects was measured by response time and the percentage of correct, false, hit, and miss responses. Results: The active navigation group had longer overall reaction times than passive navigation group, though this difference was not significant. But the analysis revealed a significant difference between the conditions in hit and miss response

percentages for object recognition. The active navigation group made significantly more hit responses (t(52)=4.000, p= .000) and fewer miss responses (t(52)=-3.763, p= .000) than did passive condition. Conclusion: These results suggest that active navigation allows more accurate recognition of spatial objects and more efficient spatial learning than does passive navigation. Spatial encoding and the memory mechanism underlying active navigation remain to be investigated through further studies. Novelty: This study suggests that active navigation plays an important role in spatial cognition as well as provides a better explanation about the efficiency of learning in 3D-based programs.

Analysis of VR Based Head-Motion to a Virtual Avatar: Characteristic of Schizophrenia

Kiwan Han, Jeonghun Ku, Kwanguk Kim, Jinsick Park, Hyeongrea Lee, Hee Jeong Jang, In Young Kim, Jae-Jin Kim, Chang Hyung Kim, Sang-Won Nam, and Sun I. Kim

Correspondence:
Kiwan Han
Department of Biomedical Engineering
Hanyang University
Seoul, Korea
E-mail: hankiwan78@bme.hanyang.ac.kr

Schizophrenia is one of the most devastating psychiatric disorders, because it seriously affects the higher mental functions, such as thinking, feeling, and perceiving. In particular, disturbed social functioning is a common problem among individuals with schizophrenia. Clinical observations suggest that schizophrenia patients often have an impaired capacity to enter into and maintain interpersonal relationships their surroundings. Recently immersive environments have been used to investigate the psychopathic patients' cognition and behavior. Virtual Reality (VR) can offer an effective immersive environment. Some studies using VR reported social skill training for schizophrenia as well as cognitive therapy for autism. This study developed a system for measuring schizophrenia patients' behavioral characteristics in a Virtual Environment (VE) to examine their social behavior. The eye-gaze is one of the important factors considered in a social behavioral study. Therefore, this study measured the head-motion because there is a correlation between the head-motion and eye-gaze. Head Mounted Display (HMD) makes direct measurement of the eye-gaze difficult. The system was implemented in 3D Game Studio A6 as windows-based application program to present VE and a 6DOF tracker to measure the head-motion. In the VE, participants meet each avatar whilst performing 6 tasks. The participants have a conversation with the avatar after being introduced. The level of head-motion data was measured while the participants were watching the avatar during the introduction. The data was analyzed using MATLAB 7.1, and the head-motion data was sampled every 0.01sec. The head-motion data was transformed into a frequency domain using a Fourier transform. Only the data less than 1Hz was considered, because a high frequency appears to be an almost physically impossible band. In addition, the mean degree and standard deviation were determined. The result showed that there was a difference in the mean degree between the normal group and schizophrenia patients group (normal mean degree 4.24, patient mean degree 7.19). The standard deviation, normal group and schizophrenia patients group were 1.62 and 0.96, respectively (p=0.01). In addition, the schizophrenia patients group showed more movement in the low frequency domain than the normal group. In the high frequency domain, the normal group showed more movement than schizophrenia patients group. It is possible that schizophrenia patients have a more fixed eye-gaze than normal participants. This suggests that schizophrenia patients have difficulty in watching or observing other people on account their anxiety or cognition deficits.

Applications of Multimedia Technologies to Mental Health: Review

Claudia Liliana Hardy, Juan José Fábregas, and Josep María Monguet

Correspondence:
Claudia Liliana Hardy
Polytechnic University of Catalunya
Barcelona, Spain
Autonomous University of State of Mexico
Toluca, Mexico
E-mail: claudia.liliana.hardy@estudiant.upc.edu

Recently, a panel of 62 distinguished mental health professionals using Delphi methodology tried to outline how future changes will impact psychotherapy, psychologists, and patients. According to their answers, technological interventions were judged to be in the ascendancy

within the use of VR and computerized therapies. Nevertheless, this data refers only to psychotherapy, multimedia technologies offer a series of powerful and valid applications on Mental Health. The objective of this study is to quantitatively review the published literature to assess the current application possibilities of the different multimedia technologies to the mental health field, that addresses the questions: What kind of technology is used?, What is the purpose of the application? Who is the first beneficiary of the current application?. The search covered eleven literature databases (ACM Digital Library, IEEE Xplore, MEDLINE, PsycINFO, PubMed, ProQuest, Science Direct, Web of Science, Emerald, Annual Reviews, Blackwell On line) and employed 22 single search terms and concepts about computer input/output devices; human±computer interfaces; and media type and their Boolean combinations with mental health keywords. Articles not written in English were excluded. The study began with a qualitative review of 281 cited references with the following screening criteria: (1) published in an indexed journal , (2) describe the multimedia technology applied, (3) and describe the subjects involved in the experience. The areas identified to discus the results are: (i) mental health research; (ii) primary prevention, (iii) secondary prevention on mental health disorders (iv) diagnosis; (v) treatment & therapy opportunities, (vii) self-help & assessment (vi) teaching & training.

Teaching Immunology Concepts Using the Features of Computer Video Games

Kay Howell

Correspondence:
Kay Howell
Learning Federation Project Director
Federation of American Scientists
Washington, DC
E-mail: khowell@fas.org

Background/Problem: Knowledge about the operation of biological systems has exploded in recent years. Unfortunately, much of this new knowledge is inaccessible to many students, obscured by an opaque vocabulary. A recent study by the American Association for the Advancement of Science found that high school biology textbooks fail to make important biology ideas comprehensible and meaningful to students. The study found that "for many biology concepts, the textbooks ignore or obscure the most important ideas by focusing instead on technical terms and trivial details (which are easy to test)."[1] New learning strategies have the potential to dramatically improve methods of learning biology.[2] Learning sciences research suggests that learning by doing with understanding produces better transfer than mere doing alone.[3] Challenge-based simulations can provide students opportunities to receive feedback and revise their thinking, a critical part of the learning process.[4,5] Video game developers have instinctively implemented many of the recommendations of learning scientists, including highly realistic simulations of complex phenomena and progressive challenges with constant feedback regarding mastery of a subject/topic. Methods/Tools: To address the need for better approaches to teaching complex subjects such as biology, we developed a highly interactive educational game for teaching immunology that implements many of the features of current video games. The game will be used to supplement immunology taught as a part of introductory biology courses given to high school students and some freshmen college students. Our goal is to make basic immunology concepts understandable to diverse learners who will be strongly motivated to master the complexity because of the interesting, high-stakes challenges presented by the game. The central challenge of the game is to teach rules to a set of players that represent important elements of the innate immune system (e.g. macrophages and neutrophils). The project is funded by a National Science Foundation grant and involves a multi-disciplinary team of learning scientists, immunologists, computer scientists and video game designers and educators. The game will be evaluated in four high schools with approximately 225 total students during March and April 2006. This project evaluation will focus on four key questions: Does use of the instructional game improve the performance of students on tests now given by instructors in applicable courses? Does the system improve understanding in areas of immunology that are particularly difficult to master? Does the system increase student interest in science and their interest in a career in science? Does the effect of 1-3 depend significantly on sex, ethnicity, or other characteristics of the learners? Novelty/Discussion: This research project will benefit research teams working to develop biomedical simulations and groups interested in designing and testing new approaches to instruction using strategies enabled by powerful interactive simulations. The research will provide important insight regarding the motivational aspects of games and simulations and

contribute to our understanding of which features of interactive games are important for learning and why.

Changes in P300 Amplitude in Smokers in Response to Cigarette-Craving Cues

Ki-Won Jang, Jun-Seok Lee, Byung-Hwan Yang, Jang-Han Lee

Correspondence:
Jang-Han Lee
E-mail: clipsy@cau.ac.kr

Smoking has long been known to be harmful to the smoker's health. It is difficult to quit smoking, and it is thought that this is because smokers have an irresistible desire for nicotine intake. Craving can be regarded as an important mediator of continued substance use, and relapse after abstinence (Anton, Moak, & Latham, 1996; Kosten, 1992). Changes in P300 amplitude were used as an indicator of reactivity to smoking-related stimuli in smokers. P300 amplitude used to increase for smokers to be exposure smoking stimuli. P300, a component of event-related brain potentials (ERPs) elicited by smoking-related (craving), antismoking (aversive) and neutral stimuli, was investigated. P300 amplitude to antismoking stimuli, shown previously by smoking stimuli, was recorded in smokers (N = 10) and nonsmokers (N = 10). Task stimuli consisted of 10 pictorial stimuli for craving, 10 neutral pictorial stimuli, and 10 aversive pictorial stimuli. The craving stimuli were pictures of a cigarette and smoking activity. The neutral stimuli were pictures of everyday life. The aversive stimuli were posters about antismoking activity. The symbol '+' was presented on the center of the screen for 3 s at the beginning of each trial, followed by the task stimuli, which were presented for 0.5 s, with an interstimulus interval of 1.5 s. Each trial consisted of one presentation of the symbol '+', followed by 10 craving stimuli, 10 aversive stimuli, and 10 neutral stimuli. Participants were given four trials within 4.5 minutes. EEG data were recorded at F3, F4, C3, and C4. Three-way repeated measures ANOVAs were computed on the P300 amplitudes. The factors were group (smokers, nonsmokers), stimulus (craving, aversive, neutral), and electrode location (F3, F4, C3, and C4). The main effects of stimulus were significant, but the group effects did not show significant interactions with other factors. An interesting observation was the similarity between P300 waveforms for craving and aversive stimuli in smokers, relative to those for nonsmokers. These findings could indicate that the antismoking-related response is similar to the smoking-related one. By previously cigarette craving regarding the research result which it makes from virtual reality there are subjective reports or fMRI research results (Lee, J. H., et al., 2003), it will be meaningful that whether cigarette craving and in vivo procedures bring the effect from the cerebrum from ERPs.

REFERENCES

1. Anton, R. F., Moak, D. H., & Latham, P. K. (1996). The obsessive compulsive drinking scale: a new method of assessing outcome in alcoholism treatment studies. *Archives of General Psychiatry*, *53(3)*, 225-231.
2. Kosten, T. R. (1992). Can cocaine craving be a medication development outcome? Drug craving and relapse in opioid and cocaine dependence. *America journal on addictions*, *1(3)*, 230-239.
3. Lee, J. H., Ku, J. H., Kim, K. U., Kim, B. N., Kim, I. Y., Yang, B. H., et al. (2003). Experimental application of virtual reality for nicotine craving through cue exposure. *CyberPsychology and Behavior*, 6(3), 275–280.

Evaluation of Group Performance in a Mediated Environment

Leigh W. Jerome, Patricia J. Jordan, and Nancy Faraj

Correspondence:
Leigh W. Jerome
Pacific Telehealth & Technology Hui
Honolulu, HI
E-mail: JeromeL002@hawaii.rr.com

Biosensors are an enabling technology that improve our understanding of emotional and behavioral response patterns, and enhance empirical evidence for the way the mind and body work in synchrony. Individual performance has been extensively described utilizing biometric data. In addition to individual characteristics and task traits; however, groups may express unique biologic patterns or a collective flow that is indicative of group performance. Group interactions are continuously modified based on the constant sharing and streaming of mutually relevant information. A group's idea formation, leadership, affect, cohesion, flow, motivation, efficacy and problem solving change in a

continuous system of reciprocity. . The research hypothesizes that there are group patterns of physiological change that can be detected through objective assessments to reflect group dynamics and dynamic communication within groups of variant performance levels. Using a nested mixed-model design, this study aims to evaluate group performance in a collaborative gaming environment. Analyses of biometric and psychological self-report data will be used to detect group patterns that correlate with team gaming performance and other group dynamics, including cohesion, flow, and group efficacy. Thirty-nine experienced computer game players (all male) were recruited from a post-secondary institution in Hawai`i. The sample was mostly college educated (means years of education=15, SD=2.5); single (87%), in very good health (71%), and with a mean age of 25.9 (SD=6.9). Most participants identified their ethnicity as White (70%), Native Hawai`ian (10%), or Japanese (10%), with 42% reporting two or more ethnicities; 23.7% of Hispanic origin. Participants complete a series of baseline questionnaires designed to gather information about each individual's motivation, leadership style, self-efficacy, and outcome expectations. Participants were randomly divided into 10 groups of three, and each team engaged in four one-hour sessions of collaborative, multi-player computer game play (CounterStrike). Participants wore a SenseWear® armband and a LifeShirt® ambulatory monitoring system during game play for continuous collection of low-level physiological data, such as energy expenditure, heat flux, heart rate, respiration, and galvanic skin response. Follow-up questionnaires assessed individuals' perceptions of several group dynamics and cohesiveness. This presentation will provide descriptions of the project outcomes and implications related to leadership orientation, situational motivation, group efficacy, perceived cohesion, self-efficacy, and flow. Multiple regression and mediational analysis were used to explore the association between individual and group performance, physiological response patterns, and other group dynamics across time. Data will be presented to better elaborate the relationship between psychological and physiological predictors of group performance, and implications for future application of these findings will be discussed. Understanding the synchronization of group physio/psychological patterns portends development of new strategies for team composition, dynamic feedback, and communication enhancement.

Physiological and Momentary Assessment for Identifying Tobacco Use Patterns

Patricia J. Jordan, Leigh W. Jerome, and Nancy Faraj

Correspondence:
Patricia J. Jordan
Pacific Telehealth & Technology Hui
Honolulu, HI
E-mail: beatlesfan_64@hotmail.com

Cigarette smoking is the leading cause of preventable disease and death in the United States, contributing to the deaths of more than 430,000 people each year. Approximately 70% of smokers report that they want to quit, and almost 41% have made at least one quit attempt in the past year. While a number of evidence-based pharmacological and behavioral interventions have proven effective for smoking cessation, only about 4% of smokers who try to quit smoking each year succeed. Approximately 70%-80% of smokers relapse after a single quit attempt and require multiple attempts before remaining tobacco free. A new generation of applied sensor technology, though not yet in the mainstream, is emerging in support of a prevention-oriented, consumer-driven model of healthcare. Research with sensor technologies supports the utility of biosensors for the detection and prediction of arousal associated with specific behavioral events. Through real-time physiological monitoring and momentary assessment of behavioral events (e.g., smoking a cigarette), commercial sensors have the ability to capture data that can be used to create algorithms for the identification and prediction of arousal patterns associated with cravings and addiction. The primary objective of the current three-phase research is to analyze biometric and behavioral data and detect the physiological antecedents that prompt smokers to use tobacco. In Phase 1, 12 smokers were recruited from a post-secondary institution in Hawai`i. The sample averaged 32.7 years of age (SD=10.4), were college educated (mean years of education=15.8, SD=2.6), and predominantly male (67%), White (89%), and unmarried (78%). All participants reported being in good or very good health, and 63% were employed full- or part-time. Participants' smoking history will be discussed including average tobacco consumption, nicotine dependence (Fagerstrom score), number of quit attempts, and quit methods. In addition to completing baseline questionnaires about self-efficacy to quit smoking, decisional balance, and readiness to change, participants

wore non-invasive armband sensors continuously for seven days as a means of collecting low-level physiological data, such as energy expenditure, sleep/wake states, heat flux, and galvanic skin response. Participants also pressed an "event button" on the armband each time they lit a cigarette. Biometric and psychological data were analyzed during Phase 2 to generate statistical algorithms predictive of an outcome event — in this case, cigarette smoking. Development and testing of the algorithms, the methodology and analyses involved, as well as future applications of these findings will be discussed. Phase 3, which is ongoing, will test the validity and specificity of the algorithms created in Phase 2. There exist real opportunities to develop innovative treatment approaches by integrating contemporary advances in technology with our understanding of the biological substrates and behavioral mechanisms of cravings and addictions. The information gained from our research is a requisite step for the development of portable behavioral health interventions that will endow consumers with greater control over maintaining their own health. The development of new sensor technologies will tailor treatments to individual biometrics and daily routines with the delivery of personal clinical information at the most opportune moments for effective intervention.

Virtual Reality and Interactive Games to Treat Fear of Falling in Multiple Sclerosis

R. Jouvent, F. Znaidi, I. Viaud-Delmon, and O. Lyon-Caen

Correspondence :
R. Jouvent
CNRS – UPMC UMR 7593, Pavillon Clérambault, Hôpital de la Salpêtrière, Paris, France
Fédération de Neurologie, and INSERM U 546, Groupe Hospitalier and Faculté de Médecine Pitié-Salpêtrière (Paris VI), Paris
E-mail : rjouvent@ext.jussieu.fr

Patients with multiple sclerosis (MS) may experience several disorders. In particular, poor balance and motor impairments contribute to develop fear of falling that may lead to poorer quality of life. While the fear is an appropriate response to multiple sclerosis's motor symptoms, it often leads to activity restriction and needs to be addressed. This fear is both objective (due to the motor symptoms of MS) and subjective (because of the psychological component of the fear which the patient develop). In fact, because of the fear of falling, MS patients tend to function in daily life below their real physical capacities. We hypothesized that new technologies such as virtual reality and multi-media interactive exercises may act on the phobic component through the stimulation of the perception-action loop. We established a protocol to test the responsiveness to treatment with these new interactive and immersive tools. Patients recruited in the study have mild to moderate MS. The Fear of Falling Measure (FFM) was used to assess the degree of fear. The intervention consists of one session per week during 10 weeks. Patients were invited to start each session with virtual navigations and to end with performing interactive perceptive and motor exercises. During virtual navigations, patients are equipped with a head-mounted display coupled with an electromagnetic sensor system and immersed in a virtual environment in which they can move forward by pressing a mouse button. They have to turn on their own vertical axis in order to change the direction of heading in the virtual environment. The navigation in virtual environments aims to reinforce the perception of fluid walk and to increase their confidence about walking normally. Interactive exercises are practiced with Sony PlayStation® games. We use Eye Toy and the Dance Mat. With the Dance Mat, lower limbs movements have to be performed according to the task visually suggested on a large screen. With Eye Toy, upper and lower limbs movements have to be performed according to the auditory-visual context presented in the game. The visual feedback of the body of the patient, which is projected in the screen, may redress self-confidence on performing different motor movements. Initial results from this ongoing study indicate that fear of falling can be successfully reduced in MS patients. So far, the majority of patients demonstrated improvements in self-efficacy and confidence in mobility. Theoretical considerations will then be discussed.

Treating Phobia to Small Animals Using Augmented Reality

M. C. Juan, C. Botella, R. Baños, M. Alcañiz, D. Joele, and C. van der Mast

Correspondence:
M. C. Juan
MedICLab
Universidad Politécnica de Valencia

Spain
E-mail: mcarmen@dsic.upv.es

Virtual Reality and exposure in vivo have been used extensively for the treatment of several psychological problems, but Augmented Reality has not been exploited in this field. We have recently presented an Augmented Reality system for the treatment of cockroaches and spiders using visible markers [1]. With this system we treated ten patients, four with a phobia of spiders and six whit a phobia of cockroaches. We applied the AR system using "the one-session treatment" guidelines form the treatment developed by Öst, Salkovskis and Hellstroöm [2]. In all cases, the treatment significantly reduced the participants' fear facing their target animal. Before the treatment, none of them could approach spiders or cockroaches. After the treatment, all were able to kill several live spiders or cockroaches. One important step in the treatment is where the patient has to search for a possible animal hidden behind whatever object. This stimulates the anxiety of patients because they do not know behind which object is the hidden animal or if there is one or not. Using visible markers is very easy to know if animal/s is/are going to appear, because in the moment the patient sees the marker, the animal is there. We realized that the marker were visible was a negative aspect of our system and this is why we have developed an Augmented Reality system markerless. The system works in the same way as the visible marker system does, but in this case the markers are not visible. The video stream is captured using a FireWire camera (colour image). We have used DragonFly Camera. We have used the Daeyang i-Visor(DH-4400VPD) as visualization system. We have used the IR Bullet Camera (715nm IR filter) to obtain the infrared image where the invisible markers are detected. We have used the IR invisible Ink Writing Pen – 840 nm Peak to draw the invisible markers. The infrared and colour cameras are situated in known positions, so the transformation matrix from the position of the infrared camera to the position of the colour camera is easy to obtain. Both cameras capture the image of the real world. The infrared image is analyzed to identify the position and orientation of the marker. Later, using the above-mentioned transformation matrix, the real position where the virtual objects have to appear over the colour image is obtained. The cockroach/spider appears over the invisible marker in the colour image. In this way, we know the position where the animals have to appear, but the user can not see it. Now we are testing if the sense of presence and reality judgment in normal users (without fear) is the same using the visible and the invisible marker system.

REFERENCES

1. Juan, M.C., Alcañiz, M., Monserrat, C., Botella, C., Baños, R., Guerrero, B., Using Augmented Reality to treat phobias, IEEE Computer Graphics and Applications, Vol. Nov-Dic, pp.31-37, 2005
2. Öst, L., Salkovskis, P., & Hellstroöm, K., "One-session therapist directed exposure vs. self-exposure in the treatment of spider phobia", Behavior Therapy, 22, pp. 407-422, 1991

An Augmented Reality Book for Storing Past and Future Events

M. C. Juan, D. Perez, and M. Alcañiz

Correspondence:
M. C. Juan
MedICLab
Universidad Politécnica de Valencia
Spain
E-mail: mcarmen@dsic.upv.es

The use of Augmented Reality to develop applications for entertainment and education has been exploited extensively. In this paper we present an Augmented Reality book for remembering past events and to plan future ones. We think it is possible to use this system to have a memory book from past events and to think about future plans. The user can include not only photographs but also objects and videos. Our system runs in a PC AMD Athlon with 1 Gb Ram and under Microsoft Windows XP. The video stream is captured using a USB camera. We have used Logitech QickCam Pro 4000. We have used 5DT HMD (5DT Inc., 800 H x 600 V, High 40° FOV) as visualization system. The system has been developed using Brainstorm eStudio. Braintorm eStudio is commercial software (www.brainstorm.es). Brainstorm eStudio is an Advanced, Multiplatform Real Time 3D Graphics presentation tool. Brainstorm eStudio can be defined as an interface that the programmer can use to create 3D complex visualizations without using OpenGL, only using tool options. We have included ARToolKit into Brainstorm eStudio as a plugin writing in C++. So, in this way we have included AR options into a 3D graphics presentation tool with the advantages that this presents. The registration is achieved using markers. The elements that are recognised using markers are: the

type of elements (option space) and the elements (database space) to be included into the book, the selector, the drain and the book. Option space and database space have 4 markers. We have used 4 markers because the user can cover till 3 markers and the system will recognise the other marker. If the system recognises one marker, it has enough information to proceed. If the system had one marker and if the user covered it, the system would not be able to recognise it and it would not work properly. The book has another marker to indicate the page of the book. The memory book works as a photograph album. In a photograph album, the user chooses a photograph and puts it in the desired place of the selected page. In the memory book is nearly the same. The user utilizes a selector to choose the elements and he also puts them over a page of the book. The user can choose among videos, objects or images. These elements appear over a page with 4 markers (option space). Once the user has chosen the type of element he wants, he/she selects the desired element. These elements appear over a page with 4 markers (database space). The user can remove an element from the book. He/She puts the selector over it and he drags it over the drain.

Efficacy of Sensory Integration Treatment Based on VR-Tangible Interaction for Children with Autistic Spectrum Disorder

Ko-Eun Jung, Hyun-Jhin Lee, Young-Sik Lee, and Jang-Han Lee

Correspondence:
Jang-Han Lee
E-mail: clipsy@cau.ac.kr

Background & Significance of the Problem: Children on the autistic spectrum disorder have difficulties in integrating for motor and sensory experiences. So it may be important to address in therapeutic interventions for children with autistic spectrum disorders. There are some advantages of sensory integration therapy. It is possible that unstrained therapy in role play situation and can induce social skill training by holding intimacy with friends. However it has low efficiency in place, duration of treatment and in cost effect. Virtual reality technology is an exciting tool for allowing children with autism to practice behaviors in role-play situations, while providing a safe environment for rule learning and repetition of tasks (Parsons & Mitchell, 2002). However, some ethical and technical concerns surround the use of fully immersive virtual reality technology (i.e. the use of head-mounted displays [HMDs]). HMDs can be extremely expensive and people may experience 'cybersickness'. Moreover, HMDs place some limitations on the child's interaction with another person. Methods/Tools: Our treatment system is composed of three programs. The first is 'sensory integration treatment'. With this scenario, children with autism experience vestibular, proprioceptive, and somatosensory activities, such as swinging, spinning, and rotating. Second is 'social skill training'. It is consist of social skills training program such as eye gaze. Third scenario is a measuring program for coordination ability. This involves breaking virtual balloons with a real stick, which measures the visuomotor coordination. Our VR–tangible interaction system consists of a Pentium IV PC, a projector, a screen (200 × 150 cm), an infrared reflector, and a digital camera and tangible devices. Twelve autistic children (mean age = 6) and twenty normal comparisons (mean age= 5.6) were participated twice per week, total of 10 sessions in this study. First of all, basic data about participants were collected for clinical test of this system. Next, we gathered experimental data while all participants experience the program. Therapist and assistants were interviewed after all of sessions. Results: Clinical test of this system well completed and data were gathered but still in data analysis. Therefore, to demonstrate efficacy of VR – tangible interaction system on this abstract is not available. We will analyze the effect of this system for autistic children. And we will also compare the performances of normal comparison groups and autistic groups in the visuomotor coordination program and the social skills training program. Novelty: This study suggests that VR tangible interaction system has possibility about clinical approach for autistic children.

REFERENCES

1. Ayres, J. (1972). Improving academic scores through sensory integration. *Journal of Learning Disabilities, 5,* 338-343.
2. Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research, 46(5),* 430-443.

Development of VR System to Train Assertiveness Social Skill for Psychiatric Patients and a Clinical Pilot Test

Kwanguk Kim, Kiwan Han, Hee Jeong Jang, Junyoung Park, Jeonghun Ku, Chan Hyung Kim, Jae-Jin Kim, In Young Kim, and Sun I. Kim

Correspondence:
Kwanguk Kim
Department of Biomedical Engineering
Hanyang University
Seoul, Korea
E-mail: Kwang6@bme.hanyang.ac.kr

Background/Problem: In a general sense, social skills are all the behaviors that help us to communicate our emotions and needs accurately as well as allow us to achieve our interpersonal goals. Social interactions can be broken down into a three-stage process requiring a different set of skills at each stage. Indeed, good communication requires accurate social perception (receiving skills), cognitive planning ability (processing skills) and an effective behavioral response (sending skills). Social skill training tools for receiving skills and processing skills were previously developed based on virtual reality (VR) techniques. In this study, VR program, which is called an assertiveness skills training program, was developed for sending social skills. Overall, a training program has been developed for the three-stage process for developing socials skills. Method/Tools: A HMD-based VR system was developed to make assertiveness training more realistic. The narrative-based contents were constructed by a psychiatrist and social worker that was derived from daily-occurring assertiveness situations in the home, friends and in job relationships. The contents can be divided into "Positive assertiveness training" and "Negative assertiveness training". Moreover, it also can be divided into "family relationships", "friend relationships" and "job relationships". In total, 12 narrative-based VR assertiveness training modules were developed. The subjects consisted of 15 schizophrenic patients (6 males and 9 females) and 15 controls (7males and 8 females). This study measured the VR data, questionnaire data, and symptom data. The VR data included whether there was reinforcement or failure, the length of the expression time, the reaction time and the percentage of those watching the avatar (while listening to the avatar, and while communicating with the avatar). Questionnaire data included emotional arousal, valence, assertiveness scale, self-efficacy scale, presence etc. The symptom data was measured using the PANSS (Positive and Negative Syndrome Scales). Results/Conclusion: The VR parameter can measure the quantitative aspect of assertiveness skills. According to the analyzed results, the schizophrenia subjects did not perform as well as the normal subjects in terms of the percentage of those watching the avatar while listening to the avatar (control 59.53%, patient 36.55%) and in the percentage of those watching the avatar while communicating with the avatar (control 68.25%, patient 47.22%). The number of reinforcements or failures in the schizophrenia and the control groups was 2.60 and 1.33 per subject, respectively. Indeed, the schizophrenia subjects required almost double the number of reinforcements. However, there were similar expression and reaction times. According to the results, schizophrenia subjects did not perform as well on the assertiveness test as the normal subjects. In addition, the VR program induced sufficient emotional arousal (2.88 ± 1.07) but the emotional valence was appropriate according to the emotional contents (positive: 2.48 ± 0.95, negative: -1.63 ± 1.13). Novelty/Discussion: A VR three-stage assertiveness social-skills-training program was developed. This program is different from the social phobia program because it includes an understanding of social situations and allows the subject to make decisions based on their feelings.

Investigation of Social Problem Solving Ability in Schizophrenia Using Virtual Reality

Jaehun Kim, Kwanguk Kim, Kiwan Han, Hee Jeong Jang, Junyoung Park, Jeonghun Ku, Chan Hyung Kim, Jae-Jin Kim, In Young Kim, and Sun I. Kim

Correspondence:
Kwanguk Kim
Department of Biomedical Engineering
Hanyang University
Seoul, Korea
E-mail: Kwang6@bme.hanyang.ac.kr

Background/Problem: Patients with schizophrenia usually lack the social skills necessary for daily encounters with others, and have an inability to communicate effectively with people, an inability to confirm and express their feelings, and a difficulty in understanding interpersonal boundaries. They sometimes solve their problems in an unsuitable manner or they may have few solutions. In this study, a Virtual Reality system was developed to measure the social problem solving ability according to the state of illness of the schizophrenia patients. Method/Tools: A project-

based VR system was developed because schizophrenia patients feel a great deal of anxiety when wearing a Head-mounted display. Narrative-based contents were constructed to assist schizophrenia patients achieve the appropriate goal in being able to assess their social problem solving ability. A survey was carried out on 50 normal people to select 8 complicate social problems among the many daily-occurring social problems and to determine their difficulty. The virtual environment and virtual avatar matched with 8 complicated situations were constructed using 3D-MAX and were converted for rendering in an A6 engine. The behavioral database, which consisted of 15 avatars, approximately 40 apparels, around 70 actions and 6 facial expressions, was constructed to make a flexible and dynamic avatar. In addition, eye-blinking and lip-synching was roughly implemented to make the virtual avatar appear more realistic. The VR system was designed to give the users the information required in problem solving because the aim was to measure the pure social problem solving ability excluding the user's cognitive aspects such as memory. After having VR experience in each content, a Q&A panel asking questions about the complicated situation appeared and user could select their own solution about a given social problem using an 8-button joystick. The reaction time for responding to the Q&A panel and problem solution in the given social VR situation was extracted from the proposed VR system and used to assess the subject's social problem ability. After experiencing in each session, the schizophrenia patients answered the following questions: computer experience scale, immersive tendencies questionnaire, virtual reality questionnaire, social problem solving index, positive and negative syndrome scale, and the KWIS. Results/Conclusion: According to results, schizophrenia subject's selections showed a larger distribution than the normal subjects. In addition, the schizophrenia subjects did not perform as well on the VR social problem solving ability score as the normal subjects (difference 20.56 point). In particular, the normal and schizophrenia subject's mean score was 45.11 point and 24.95 point, respectively. In addition, correlation analysis revealed the VR social problem solving tool to have partial correlation with the classical social problem solving tool (Social Problem Solving Inventory). Novelty/Discussion: This study attempted to produce a more realistic and dynamic situation using a VR medium, which could be difficult to construct using other media such as text, pictures or video. However additional research into the usability and validation of the proposed VR system will be needed.

A Short Feedback Questionnaire (SFQ) to Enhance Client-Centered Participation In Virtual Environments

Rachel Kizony, Noomi Katz, Debbie Rand, and Patrice L. (Tamar) Weiss

Correspondence:
Rachel Kizony
Department of Occupational Therapy
University of Haifa
Haifa, Israel
E-mail: rachelk@zahav.net.il

Over the past two decades clinicians who work in rehabilitation have adopted a "client-centered" approach which, among other elements, emphasizes the important role that client feedback plays in the intervention process. This feedback enables clinicians to help clients achieve a better match between their abilities, and the intervention tools used to improve their functional ability. In recent years, virtual reality (VR) technologies have begun to be used in rehabilitation due to their well-known assets (e.g., Rizzo & Kim, 2005). Client feedback during the VR-based rehabilitation process is even more important than during conventional therapy due to the additional complexity of the setting and its potential impact on the client (e.g., encumbrance, side effects). Indeed, there are still factors whose importance to VR-based rehabilitation is still in doubt (e.g., level of "presence"). Several presence questionnaires have been developed. One of the most frequently used is Witmer and Singer's (1998) 19-item questionnaire that is divided into four subscales: involved/control, natural, interface quality and resolution. Due to its length, this questionnaire is less suitable for use within the constraints of clinical intervention, especially when multiple virtual environments are used or with clients who suffer from cognitive deficits. Other questionnaires are typically either too long or focus mainly on the sense of presence and realism. The purpose of this presentation is to: (1) present the Short Feedback Questionnaire (SFQ) developed for research and clinical purposes based on Witmer and Singer's (1998) Presence Questionnaire (PQ) and (2) provide psychometric data from studies with patients and control subjects after experiencing a variety of virtual environments run with different VR systems (GestureTek's Gesture

Xtreme (GX) VR, Sony's PlayStation II EyeToy, a virtual street crossing desktop VR system and the STISIM desktop Driving Simulator). The subjects included healthy participants (n=134), participants who had a Spinal Cord Injury (n=18) and participants who had a stroke (n= 43), all divided into groups according to type of virtual environment. The SFQ consists of eight items graded on a 5-point scale. The first six items assess the participant's (1) feeling of enjoyment, (2) sense of being in the environment, (3) feeling of success, (4) feeling of control, (5) realism of the environment and (6) whether the feedback was understandable. The seventh item queried the participants' discomfort and the eighth item queried their perceived difficulty of the task. The SFQ has been found to be suitable for use in different virtual environments and with various clinical populations. Initial results showed that internal consistency reliability of the SFQ ranged between α=.70 to α=.81 for different virtual environments. The concurrent validity of the presence part of the SFQ with the PQ showed significant moderate to high correlations (p<.005) ranging from r=.55 to r=.74 for the different virtual environments. The SFQ appears to be a reliable and valid tool for obtaining user's responses to virtual environments for both research and clinical purposes. These data play an important role in matching VR protocols to clients' therapeutic needs. The implications of the results will be discussed.

Performance Analysis in a VR-Based Assessment of Cognitive Planning

Evelyne Klinger, Alain Grumbach, Isabelle Chemin, Sophie Lebreton, and Rose-Marie Marié

Correspondence :
Evelyne Klinger
UPRES EA 3917
Caen, France
E-mail: evelyne.klinger@wanadoo.fr

Research status: Completed Case-Control study. Cognitive planning deficits affect patients with brain damage and interfere with their capacity to manage everyday life activities. Owing to the dramatic need of detection and to the lack of ecological validity of the traditional psychometric tests, therapists are looking for more appropriate evaluation tools. In an earlier study, we reported a VR-based assessment of cognitive planning, built on the model of scripts and in the purpose of precise performance evaluation. We designed a Virtual Supermarket in which participants can carry out a task close to daily activities: a test of shopping list. The virtual system allows us a further analysis of the participant's performance thanks to various data recorded during the assessment session. We are now reporting the results of a study carried out in the context of Parkinson's disease. The study is based on a case-control design where the case condition is Parkinson's disease (PD). Thirteen patients with PD and eleven age-matched healthy volunteers, meeting inclusion criteria, constituted our convenience sample. The participants got familiarized with the Virtual Supermarket and the task thanks to two preliminary sessions. Then, without any time limitation, they were engaged in the assessment session, during which various measures were recorded (e.g. positions, actions). The patients were also submitted to the traditional psychometric evaluation of executive functions. The virtual system allows the therapist or the participant to review the performance from an upper point of view. We analysed the performance in the Virtual Supermarket according to three categories: (a) semantic knowledge related to the task, e.g. the number of good actions; (b) information processing speed; and (c) temporal and spatial organization. The results showed a lack of difference in the semantic knowledge related to the task between the patients and the controls. However, specific impairment was observed in patients in the sequential unfolding of the task. An analysis of reaction times suggested the expected alteration of information processing speed in patients. Moreover, the performance in the virtual supermarket revealed a significant alteration of the temporal and spatial organization of the patients. Finally, the participants appreciated the visual review of their path in the Virtual Supermarket, which helped them to better understand their real life behavior. This study shows the usefulness of our VR-based tool in the evaluation of cognitive planning. Thanks to various measures of the virtual performance, it allows us to detect and specify an alteration of cognitive planning. The path review is useful for both the patient and the therapist. It seems that the virtual system becomes the medium of a new indirect relationship between the patient and the therapist. This analysis of the virtual performance in three categories represents a new step in the use of our collected data. It leads to the characterization of the performance alteration in the designed task of shopping list, and so to an objective assessment of cognitive planning deficits.

Smokers' Attentional Bias to Smoking-Related Cues in Eye Movement

Soo-min Kwak, Duk L. Na, GHo Kim, and Jang-Han Lee

Correspondence:
Jang-Han Lee
E-mail: clipsy@cau.ac.kr

Background/Problem: Smokers have attentional biases toward smoking-related cues, and such cues elicit craving [1]. Smokers also feel anxious during nicotine deprivation, and anxiety may exacerbate attentional biases toward aversive cues [2]. Therefore, deprived smokers will show attentional bias to smoking-related and aversive cues. To identify this attentional bias, we monitored participants' eye movement. Methods/Tools: We examined the attentional bias of smokers (N=14) and a control group of nonsmokers (N=16) towards smoking-related and aversive cues. Using an eye-tracking device, we measured eye movement when smoking-related, aversive, and control cues were presented simultaneously. We analyzed the number of initial fixations, and gaze duration, to identify the attentional bias. Results: Smokers initially fixated their gaze on aversive cues. A 2X3 repeated measures ANOVA (group and picture type) showed a significant main effect of picture type. And, they maintained their gaze longer on smoking-related cues, in comparison to the control group. Conclusion: These results suggest that smokers gazed at smoking-related pictures longer than nonsmokers did, but there was no difference in initial fixation. Gaze duration could therefore be a sensitive measurement tool for identifying attentional bias. Novelty: Present study suggests that gaze duration in eye movement could be a sensitive tool for ascertaining attentional bias. Based on this result, we can confirm more precise and object characteristics of craving in virtual reality when virtual stimuli are presenting. As well when HMD and eye-tracker are combined, it will be more ecologically valuable to certificate the role of attentional bias and craving.

REFERENCES

1. Di Chiara, G. (2000). Role of dopamine in the behavioural actions of nicotine related to addiction. European Journal of Pharmacology, 393: 295-314.

2. Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. Behaviour Research and Therapy, 36: 809–848.

Application of Virtual Reality-Cue Exposure Therapy for Reducing Alcohol Craving

Hyoseok Kwon, Sungwon Roh, Joonho Choi, Byung-Hwan Yang, and Jang-Han Lee

Correspondence:
Jang-Han Lee
E-mail: clipsy@cau.ac.kr

Background and Significance of the Problem: During abstinence from alcohol, craving is elicited by the cues and contexts previously associated with alcohol, which contribute to relapse. To prevent the craving and relapse experienced by alcoholics, cue-exposure therapy (CET) has been used to extinguish the association between alcohol and alcohol-related cues and contexts. Methods/Tools: This study applied CET, using a virtual reality (VR) system, to eight members of an Alcoholics Anonymous group, in eight sessions. Cues and contexts most likely to elicit an urge to drink were selected through a preliminary survey in order to compose VR-CET scenarios: a glass, bottle, food, and a bar were judged to be the most tempting for people in alcohol dependence and abstinence. Using these cues and contexts, a Japanese-style pub and a western bar were created. Each session was administered for 30 minutes by a psychiatrist and included an introduction, immersion, VR navigation, interviews about feelings, and self-report questionnaires about cravings. The eight sessions consisted of initial and closing sessions, and person-, object-, and situation-focused sessions. Results: A reduction in cue-elicited craving after VR-CET was reported. A mean score of 15.75 (SD = 10.91) on the Alcohol Urge Questionnaire [1] in the first session decreased to 11.57 (SD = 6.88) in the final session. Novelty: This study suggests that using virtual reality can enhance the efficacy of CET so as to promote craving for alcohol and then to desensitize conditioned reactivity to alcohol.

REFERENCE

1. Krahn, D. D. , & Staehler, B. A. (1995). Development and initial validation of a measure of

drinking urges in abstinent alcoholics. Alcoholism: Clinical and Experimental Research, 19, 600-606.

The Relation Between Anxiety and Feeling of Presence During VR Immersion

Marie-Renée Laframboise, Stéphane Bouchard, Serge Larouche, Geneviève Robillard, and Patrice Renaud

Correspondence :
Marie-Renée Laframboise
Université du Québec en Outaouais
E-mail : lafm09@uqo.ca

Using virtual reality (VR) with people suffering from specific phobia is becoming an evidence-based and efficient form of exposure treatment. Traditional exposure is characterized by an increase in anxiety when the feared stimulus is presented, followed by a progressive reduction over the course of the exposure exercise. This is often called the "habituation curve", or the "anxiety curve". It is also thought that the subjective feeling of presence in the virtual environment is an important ingredient in making VR exposure work. However, it is not known if the feeling of presence remains stable within and between sessions. The stability of the feeling of presence is especially important since Robillard, Bouchard, Fournier and Renaud reported in 2003 that anxiety and presence correlate significantly when phobics are immersed in virtual reality (VR). How does this relationship hold over time, especially if anxiety fluctuates within sessions and decreases between sessions? The goal of this study is to assess changes in anxiety and presence while measured within therapy sessions as well as between therapy sessions, when people suffering from fear of flying receive VR-based exposure therapy. Our hypotheses are that anxiety will show the traditional habituation curves found during exposure therapy: anxiety will decrease within sessions and between sessions. Given the lack of previous data about presence, no specific hypotheses are suggested for within and between sessions. We also expect anxiety and presence measured within and between sessions to correlate significantly. The sample consists of 22 adults, 15 female and 7 male, diagnosed with flight phobia according to the Structured Clinical Interview for DSM-IV. Our analyses are based on data collected during the first four sessions virtual exposure therapy. Each of these immersion lasted up to 60 minutes (only the first 30 minutes are analyzed).

Every five minutes during the immersions, therapists asked participants to rate on a 0 to 100 scales their level of anxiety ("how anxious do you feel?") and feeling of presence ("how much do feel you are really there in the virtual environment?"). A first set of repeated measures ANOVAs is used to compare levels of anxiety and presence within each of the four exposure sessions. A second set of repeated measures ANOVAs is applied on the first five minutes of immersion from each session. A correlation between anxiety and presence is calculated for each session as well. As expected, the results show that anxiety decreases significantly within sessions [F values range from 3.59 to 7.25, all $p < .01$] and between sessions [F= 3.98, $p < 05$]. The feeling of presence increases significantly within the first session [F=2.4, $p < 05$], marginally within the second session [F=2.26, $p = .056$] and remains stable over the last two sessions [F=1.83 and 1.21, ns]. The feeling of presence doesn't change significantly between sessions [F=.3, ns]. Finally, anxiety and presence correlate significantly [r=.41, $p < .025$]. Our results show that the relationship between anxiety and presence is more complex than anticipated by many researchers. Presence can remain high even if anxiety is getting lower from one therapy session to the other. Other implications are discussed as well.

Manipulating Optic Flow Modifies Walking Trajectory in Persons with Stroke

Anouk Lamontagne, Joyce Fung, Bradford J. McFadyen, and Jocelyn Faubert

Correspondence:
Anouk Lamontagne
School of Physical and Occupational Therapy
McGill University & Jewish Rehabilitation Hospital
CRIR Research Centre
Montreal,Canada
E-mail: anouk.lamontagne@mcgill.ca

BACKGROUND: Optic flow (OF) is a predictable pattern of visual motion projected at the moving eye during self-motion. By providing information on the speed and direction of self-motion, OF may contribute to the central nervous system (CNS) control of locomotion. We have previously shown that manipulating OF speed has been shown to influence gait speed in healthy subjects. After a stroke, walking speed is usually markedly reduced, due to a hemiparesis and possibly altered sensorimotor integration. Whether OF speed is perceived adequately and can be manipulated to

enhance walking speed after stroke is not known. AIMS:The main objective of this study was to compare the changes in walking speed in response to different speeds of OF in persons with stroke (patients) vs. healthy controls (CTLs). It was hypothesized that a modulation of walking speed in response to OFs of changing speed would be present in the patients, but to a lesser extent than in the CTLs. METHODS: Patients (n=9) and CTLs (n=9) were evaluated while walking on a self-paced treadmill while viewing, in a helmet-mounted-display (Kaiser), virtual scenes controlled by Caren-2 (Motek) and Tarsus real-time engine (Vicon) systems. In the first paradigm that was tested, subjects walked at comfortable speed for 5 minutes in a virtual corridor. OF speed was varied sinusoidally (0.017Hz) from zero to 2 times the subjects' comfortable gait speed. In the second paradigm, subjects walked in a 10m virtual corridor at comfortable speed with a matching OF speed (control trials). For the test trials, OF speeds ranging from 0.25 to 2 times the subjects' initial comfortable gait speed were randomly presented. Subjects were instructed to walk the 10m distance within the same time as in the control trials. RESULTS: In the first paradigm, cross-correlation analyses revealed that gait speed was modulated out-of-phase with respect to optic flow speed, the strength of this modulation being weaker in the patients (r= -.35±.10) than in the CTLs (r= -.42±.20). Walking speed responses lagged behind the changes in OF speed by an average of 4.3s and 6.4s, respectively, in patients and CTLs. In the second paradigm, linear regressions also revealed a negative relationship between walking speed and OF speed, so that subjects walked faster when exposed to slower OFs. Similar gait speed vs. OF speed slopes were observed between patients (-.17±.19, R^2=.04 to .95) and controls (-.17±.15, R^2=.01 to .73). CONCLUSIONS: Persons with stroke present with an altered modulation of walking speed in response to continually changing OF speeds. However, the fact that patients could still use OF speed and voluntarily modify their walking speed accordingly suggests that manipulation of OF speed through virtual reality technology could be used to promote faster walking speeds after stroke.

Virtual Reality Distraction for Children Receiving Minor Medical Procedures

Belinda Lange, Marie Williams, Ian Fulton, and Meredith Craigie

Correspondence:
Belinda Lange
University of South Australia
Adelaide, Australia
E-mail: Belinda.Lange@postgrads.unisa.edu.au

Distraction strategies aim to divert a patient's attention away from a painful or anxiety producing situation and focus that attention onto another task. Virtual reality (VR) has been demonstrated to provide effective distraction during medical procedures associated with high levels of pain and/or anxiety (wound care/physiotherapy for burns patients, post-operative physiotherapy, dental procedures). Less is known about the usefulness of VR distraction for minor medical procedures where pain may be relative low but anxiety and distress high. Distraction interventions in the form of listening to music, blowing bubbles, playing with interactive toys, reading interactive or musical story books and watching movies have been used for children undergoing venipuncture (blood sampling, intravenous catheter insertion), with variable results. The aim of this study was to determine of VR was more effective in reducing pain and distress in children undergoing minor procedures compared to watching an animated movie. Children attending a Pediatric Emergency Department, requiring venipuncture or wound care procedures were randomly allocated (block randomization) to receive VR or animated movie distraction. Children were asked to provide self reported pain intensity (Colored Analogue Scale) and affect (Facial Affective Scale) scores pre, post and maximum during the procedure. Parents and staff were also asked to provide scores for their perception of the child's pain and anxiety (Visual Analogue Scales) at these time points. Parents were asked to score their own anxiety (Visual Analogue Scale). Children's distress behaviors were scored during the procedure (Brief Behavioral Distress Scale) and children were monitored for any adverse effects (Malaise Scale). Parents and staff were asked to comment on the effectiveness of the intervention (Visual Analogue Scale) and children completed a presence and enjoyment questionnaire post procedure. Eighty eight subjects (51 males, 37 females, mean age 11.3±2.9) were recruited, with 44 children in the VR and movie intervention groups. Using Mixed Modeling Analysis, no significant difference was found between interventions for children's self-reported pain and anxiety or parent's perception of children's pain and staff's perception of the child's pain and anxiety. Parent's perception of their child's anxiety was significantly higher (p=0.02)

when children were using the VR compared to watching the animated movie, however, children using VR displayed significantly lower behavioral distress (p<0.001). Children using VR had significantly higher scores for level of enjoyment, interest/involvement and presence, than children watching the animated movie (p<0.001). Virtual reality was perceived by both staff and parents to provide more effective distraction (p<0.0001). The results indicate that VR is at least as effective as and significantly more enjoyable than watching an animated movie. Although VR is a novel distraction technique for patients, parents and staff, further research should focus on the development of more age appropriate and interactive virtual environments. A cost-benefit analysis is required in order to determine if VR will be a beneficial and cost effective distraction tool for use during minor medical procedures in the Pediatric Emergency Department. *This research was supported by a Channel 7 Children's Research Foundation Grant.*

The Impact of Perceived Attitude of Virtual Agents on Beliefs and Physical Reactions of Social Phobics Immersed in Virtual Reality

Hélène Lassignardie, Marie-Renée Laframboise, Julie-Ève Arseneault, and Stéphane Bouchard

Correspondence :
Hélène Lassignardie
Université Paris 8 France
E-mail : lassignardie@voila.fr

Pertaub and Slater have already shown that the behaviour of virtual agents can induce anxiety in people suffering from the fear of public speaking. The goal of this study is to test if changing the narrative context surrounding the immersion (positive vs negative virtual agents) without changing the behaviour of the virtual agents will have an impact on social phobics' anxiety (subjective and objective), beliefs and feeling of presence. Our hypothesis is that simply presenting virtual agents in a negative manner (arrogant, superior, judgemental and unfriendly) will induce anxiety, activate negative beliefs about oneself and increase the feeling of presence, compared to presenting the virtual agents in a positive manner (warm, interested, friendly and nice). The sample consists in 20 adults diagnosed with social phobia according to the *Structured Clinical Interview for DSM-IV*. Participants are randomly assigned to two either the Negative or the Positive virtual agents.

Note that the virtual agents are exactly the same in both conditions and behave identically. Both groups are immersed in the same virtual classroom and are invited to give a talk for 20 minutes where they discuss their phobia, their personal difficulties, their physical reactions when anxious and have to answer questions from a virtual agent. During this task, participants' heart rate is measure using a Procomp+ system. Post-immersion, they filled-in some questionnaires related to social anxiety and sense of presence: Fear of Negative Evaluation (Watson & Friend, 1969), Social Anxiety Thoughts (Hartman, 1984), Liebowitz Social Anxiety Scale, 1987), State-Trait Anxiety (Spielberger, 1983) & Presence Questionnaire (Witmer & Singer, 1998). Participants also receive 15 weekly sessions of cognitive-behavior therapy in groups of four or five. All exposure exercises are conducted *in vivo* (no immersions in virtual reality). Post-treatment, participants perform the same experimental task as at pre-treatment. This portion of the study is still underway. Repeated measure ANOVAs will be used to compare differences between conditions at pre-treatment and assess the impact of therapy on patients' reactions to the virtual audience. We expect our results to show that the behaviour of virtual agents is not the only factor that can induce anxiety and presence. Clinicians can, and probably should, manipulate how the patient perceives the virtual agents in order to induce different level of fear when using virtual reality in the treatment of social phobia. We also expect participants' reactions to change after therapy, showing that using a virtual audience could be used to measure treatment outcome.

Speculations on the Construction of an Interactive Environment to Assess Sexual Interest and Coping Skills in Sexual Offenders

D. Richard Laws, and Carmen L.Z. Gress

Correspondence:
D. Richard Laws
Pacific Psychological Assessment Corporation
Victoria, BC
E-mail: drlaws@telus.net

This is basically a video version of the *Situational Competency Test* that was developed in the 1980s to assess coping skills in treated sexual offenders. Video game technology provides an as yet unexploited medium for the construction of an interactive environment for this purpose that would be unlike anything currently on the market. What

we envision is situation resembling a city street or park through which the subject is required to move. As he progresses he is confronted by situations and persons who would pose a high risk for the commission of sexual offenses. The situations could be areas where a sexual offense could be easily committed and, depending upon the cues present in that situation, he must make a choice on what to do next. The virtual persons that confront him (children or adults) might offer provocative suggestions to which he must respond. The models then respond in kind to whatever he says or does. Each of these junctures could be considered choice points where a number of options are available to the subject. The situations and virtual persons contain an array of responses to whatever the subject says and/or does. Our expectation is that it would be possible to score the quality of the subject's behaviour at each of the choice points, thus yielding an evaluation of his sexual interest or his ability to deal with high risk situations. Several video game examples will be presented to illustrate the type of environments we have in mind.

Differences in Brain Connectivity in Relation to the "Feeling of Presence" in Schizophrenia during a VR Experience

Hyeongrae Lee, Jeonghun Ku, So young Kim, Kwanguk Kim, In Young Kim, Kiwan Hahn, Jinsick Park, Kang Jun Yoon, Sang-Won Nam, Chan Hyung Kim, Jae-Jin Kim, and Sun I. Kim

Correspondence:
In Young Kim
Department of Biomedical Engineering
Hanyang University
Seoul, Korea
E-mail: iykim@hanyang.ac.kr

Presence is often thought of as a sense of 'being there' in the virtual environment (VE), and it is one of the most important factors in estimating a VE. Although the VE might have same contents, each user's experiences and perceptions can be different. These differences can influence not only the presence score but also the brain activity in perceiving information. Many studies have examined presence, but there is no report on the direct correlation between presence and the brain activity. The aim of this study was to determine the brain region influenced by the feeling of presence during a VR experience by performing covariance analysis of the brain activity related to inference and the subjective presence score. The connection between these areas was investigated using correlation analysis. The VR experience block had an avatar telling either an ambiguous or clear story about something it just experienced. The subjects were asked to watch and listen to the story for 30 seconds, infer why the avatar told that story for 20 seconds and respond to an O/X question for 10 seconds. For the fMRI experiment, the 12 ambiguous tasks and 12 clear tasks were arranged randomly. Fifteen normal right-handed healthy subjects and thirteen right-handed schizophrenia patients were recruited. The fMRI conducted with 1.5T machine (GE Medical System). After the fMRI experiment, subjects were asked to complete a presence questionnaire developed by Bob G. Witmer. The mean presence score was 107.86 (SD=15.51, range=80~132) for the normal subjects and 102.69 (SD=18.71, range=79~142) for the schizophrenia. The fMRI data analysis results revealed several brain areas to be related to the presence score. A positive correlation is shown in the right lingual gyrus, right cuneus, left lingual gyrus, right fusiform gyrus, left inferior temporal gyrus, anterior cingulate and right posterior cingulate of normal subjects. However, there was no brain area related to the presence score in the schizophrenia. Correlation analysis revealed two different circuits in the normal group. One circuit involved the left lingual gyrus, right lingual gyrus, right cuneus, left inferior temporal gyrus and right fusiform gyrus, and the other involved the right lingual gyrus, right cuneus, left inferior temporal gyrus and anterior cingulate. The former might be a circuit for perceiving information, and the latter might be a circuit for monitoring and integrating information. But, in the schizophrenia group, there was no correlation between the anterior cingulate and the other areas except for the left inferior temporal gyrus in the circuit for monitoring and integrating information. This might be because subjects with schizophrenia are less able to integrate or resolve ambiguous information. This study revealed that the brain activity during a VR experience can influence the subjective feeling of presence in a VE, and this is the first study to investigate the correlation between the presence scores obtained and the brain activities and their different connections in subjects with schizophrenia.

Sociosexual Uses of Internet Among French-Speaking Gays from Québec: Results from a Quantitative Research

Joseph J.Lévy, Kim Engler, Louis-Robert Frigault, and Alain Léobon

Correspondence:
Joseph J.Lévy
Department of sexology
UQÀM
E-mail: levy.joseph_josy@uqam.ca

Objectives : Unknown before the middle of the 1980's, the mediatization of sexuality through Internet has been accompanied by the development of numerous studies, particularly among gay populations. By providing new forms of sociability, Internet has contributed to changes in their sexual practices, strategies of communication, patterns of socialization and encounters. The study of sociosexual uses of Internet in Québec is still in its infancy and we will present some results of a recent quantitative research. Methodology : Following a qualitative study among gay men from Montréal and Québec, an online questionnaire was developed with 62 questions organized in 5 sections (socio-demographic information; social, romantic and sexual uses of Internet ; encounters with other users ; psychological and sexual impacts of Internet use, health and well-being). Between February 2003 and October 2004, 932 French-speaking gay men from Québec, aged 18 years and more, have answered a self-administered and anonymous questionnaire. Results : Data dealing with sexual activities online during the six months preceding the study show the following tendencies: 39,5% of participants have often or very often viewed pictures with sexual content ; 30,8% have often or very often had masturbatory activities online and 28,4% have often or very often exchanged messages with sexual explicit vocabulary. Other sexual activities online are less frequent : sexual ads (often or very often: 14,7%) ; webcam use (often or very often: 13,6%) ; romantic ads (often or very often: 12,7%) ; reading or publication of sexual stories (often or very often: 10,9%) ; transmitting nude pictures (often or very often: 10,4%), buying sexual material (often or very often: 2,3%), viewing direct sexual performances (often or very often: 1,6%). Apart of sexual activities online, 74,2% of participants have encountered men offline mainly for sexual purposes. As to impacts of Internet on their sexual life, 50% and more agree that the use of Internet has contributed to develop their sexual experiences, to ameliorate the expression of their sexual desires, to encourage them to have a more active sexual life, to accept their sexuality and their sexual orientation. Conclusions : Despite the many sexual possibilities linked to Internet, this technology is mainly used for sexual encounters, viewing of sexual material and masturbation online while other activities are less frequent. Furthermore, the use of Internet seems to contribute to a better sexual life. Comparisons with a heterosexual population could help to better understand variations in sociosexual uses of Internet.

Virtual Patient/Clinician Platform for Tele-Rehabilitation Application and Case Study

Leslie S. Liu, Roger Zimmermann, and Margaret McLaughlin

Correspondence:
Leslie S. Liu
Integrated Media Systems Center
University of Southern California
E-mail: lleslie@usc.edu

Healthcare is one of the fastest growing sectors of the economy and providing cost-effective healthcare service to an aging population with a declining number of hospitals is a formidable challenge. Through recent technological advances it is now possible to migrate some of the services from centralized locations into the home. We describe a prototype architecture that we built to support novel, pervasive and easily deployable information technology applications in healthcare segment where outpatient treatment can be a cost-effective alternative. Our proposed architecture is conceived as a flexible platform that allows application builders to rapidly design, create and deploy applications that require the transmission of delay-sensitive media streams such as audio, video, and haptic data. As an initial example we applied our framework to tele-rehabilitation where a therapist remotely monitors the exercise regimen and progress of a patient who, for example, previously suffered from a stroke. We have designed a virtual patient/clinician interactive platform called ACTIVE+ based on our innovative audio streaming protocol [9, 10]. The new ACTIVE+ platform was devised to distinguish among different characteristics (e.g., bandwidth and processing requirements) of different streaming data and handle them accordingly. The ACTIVE+ architecture dynamically maintains and optimizes a peer-to-peer overlay streaming network so that time-sensitive data, e.g., a remote voice stream representing verbal instructions given to a patient by a clinician during rehabilitation, can

be delivered in a timely fashion. We are excited by ACTIVE+'s capability to provide a general and flexible platform that presents a universal interface to its applications such that multiple media channels can be allocated, each with potentially different characteristics. We are using neuro-rehabilitation as our application case study to investigate the effectiveness of the ACTIVE+ approach. We have designed an exercise environment which can be host to a progressive set of training tasks from precise fine motor movements to reaching movements that involve full arm and shoulder activity. We are leveraging our earlier work that makes use of the PHANToM haptic device, which is a small, desk-grounded robot that can simulate the sense of touch on a virtual object through force feedback. By using the ACTIVE+ platform, the therapist can remotely monitor both the actions and progress of the patient and, if necessary, provide the needed assistance through the voice channel. The metadata stream that contains the haptic information and user feedback are stored and analyzed later. We conducted a preliminary trial of our ACTIVE+ prototype starting in 2005 and a subset of the results were reported in McLaughlin et al. (2006). As a work in progress, our prototype received a positive feedback with average user rating of 4.5 on a scale of 1 to 7. Our proposed virtual patient/clinician application is the first of its kind that is using a peer-to-peer based streaming network. Its main benefits are that no expensive, centralized infrastructure is required and the whole system is easy to deploy and scalable. Our innovative work shows that it is becoming feasible and cost-effective to utilize this type of heterogeneous network to conduct certain healthcare tasks remotely.

VR Tools for Development and Training of Advanced Prosthetics

Blair Lock

Correspondence:
Blair Lock
Rehabilitation Institute of Chicago
Neural Engineering Center for Artificial Limbs
University of New Brunswick
Institute of Biomedical Engineering
E-mail: b-lock@northwestern.edu

The Revolutionizing Prosthetics 2009 and Revolutionizing Prosthetics 2007 programs are part of a large scale and high profile effort currently underway in conjunction with the United States Defense Advanced Research Projects Agency. This ambitious endeavor seeks to revolutionize the field of upper-extremity prosthetics within the next few years by facilitating the collaboration of expertise and experience throughout the field. Each aspect of the project, from new surgical techniques to electromyography (EMG) signal processing to prosthetic fitting/fabrication and training, is being investigated, fine-tuned, and advanced. By project end, we will be anxious to produce what past decades of fragmented prosthetic research and development has strived to accomplish. One of the principal components of this advanced prosthetics research is the creation and use of a large scale virtual reality/virtual environment system to be developed in parallel with all other aspects of the project. Virtual environments involving human upper-extremity movement are anything but new and are found in widespread use from gaming and animation to many scientific and clinical applications. For limb-deficient individuals, virtual reality lends itself naturally to their prosthetic fitting and training as an adequate virtual system can provide them with physiologically appropriate visual feedback that is essential in their mastery of control paradigm. Again, this is not a new concept and many researchers involved with virtual environments will be aware of groups and institutions implementing uses in the field of prosthetics. The advanced prosthetics program has called on many of these groups to come together and implement a complete virtual environment to accompany many of the other prescribed aspects. Described in this discussion is the virtual reality contribution being made to the advanced prosthetics effort by the Rehabilitation Institute of Chicago and the University of New Brunswick. The joint effort involves a small number of dedicated people and supports many of the major building blocks of the advanced prosthetic effort, including: advanced signal processing that includes EMG pattern classification; and tools for prosthetic training and evaluation. It will be demonstrated where and how the virtual system endeavors will lend to different aspects of the advanced prosthetics programs. We shall illustrate some of the past research and work done by these two groups, show the current progress, and describe the existing systems. Additionally, we will demonstrate some virtual environment performances by our unique limb-deficient patients (those who have benefited from targeted nerve reinnervation surgeries) and we will define what lies ahead for virtual environments in the advanced prosthetics programs.

Virtual Reality Treatment for Agoraphobia: A Mexican Case Study

Georgina Cárdenas-López, Sandra Muñoz, Maribel Gonzalez, and Carmen Ramos

Correspondence:
Georgina Cárdenas-López
Universidad Nacional Autónoma de México
E-mail: mgcl@servidor.unam.mx

The mental health services, as well as other fields, are benefiting from vigorous advances of information and communication technologies. Beginning several years ago, innovative applications of treatment systems based on virtual reality technologies have been published in literature pertaining to the field of psychology. The literature on the field, describes the results derived to these systems are promising on the treatment of posttraumatic stress, anxiety and fears, obsessive compulsive disorders and non suicidal depression among others. For this, it is doubtful that new angles will continue to emerge to fortify these systems, making them simpler and counting with more varied applications to different mental health problems. Upon the scarce research and technological development in the field of Psychology in Mexico, it is important to count with the possibility to carry out actions that generate the necessary knowledge for the empirical validation of treatment protocols that incorporate new virtual reality technologies to the psychological rehabilitation. In particular in our country, the research on the field is almost inexistent and its applications are incipient. That's why the development and assessment for the practice training programs and the possibility of granting attention at the same time to the mental health professional community using innovative therapeutic modalities, it's fundamental as well as the technological development. This current project in collaboration with the IXTLI Virtual Reality Visualization Observatory with the Virtual Teaching Laboratory of the School of Psychology of the National Autonomous University of Mexico is developing virtual reality scenarios for agoraphobia exposure treatment, testing their cultural and social contextualization (markets, Sunday's gathering places, etc.) and their therapeutic effectiveness. This poster will describe the data obtained by the assessment of presence level in this VR Mexican scenarios and the evaluation for the psychological services effectiveness provided this via addressed to agoraphobic patients. For its appraisal several indicators will allow to prove the effectiveness of the present proposal, the planned assessments include the treatment effectiveness, the therapeutic alliance, the user satisfaction related to the treatment and the chosen milieu. The service demanding, the incidence of the risk behavior and the therapist' reports will be general indicators. The opportunity that psychologists can count with empirical evidence of this innovative therapeutic modality using virtual reality will strength their formation and the incipient application in Mexico, allows to provide to the mental health professional with specialized knowledge that fortify his or her competence level and modernizing as a professional on these new models granted services.

The Use of EEG-Based Inverse Models for both BCI Design and 3D Visualization of Brain Activity in VR

F. Lotte, M. Congedo, A. Lécuyer, C. Arrouët, F. Lamarche, J.-E. Marvie, and B. Arnaldi

Correspondence:
F. Lotte
IRISA-INSA National Institute of Applied Sciences
Rennes, France
E-mail: flotte@irisa.fr

Brain activity study, visualization and identification are very active theoretical and practical research topics, especially in the fields of NeuroFeedback (NF) and Brain-Computer Interfaces (BCI). The most common way of measuring the brain activity is ElectroEncephaloGraphy (EEG), which provides only scalp measurements. In order to overcome this limitation we have proposed the use of inverse models for both brain activity visualization and BCI design. Inverse models are methods that can reconstruct the activity in the whole brain volume, using only measurements from the scalp. Therefore a more physiologically meaningful information can be obtained from EEG such as the activity in Regions Of Interest (ROI) within the brain. We have developed a platform that enables a subject to visualize, on-line and in real-time, his/her own brain activity in a 3D immersive virtual environment. Thanks to the LORETA inverse model [Pascual-Marqui94], the subject could focus his/her attention on the activity in any part of his/her brain, hence providing an interesting NF.

We have also conceived a BCI based on the sLORETA inverse model [Pascual-Marqui02]. The aim of a BCI is to identify specific "brain patterns" and translate them into a command for an electronic device such as a wheel chair or a hand prosthesis. We have worked on the data set IV of the "BCI competition 2003". The goal of the competition was to compare the accuracy of identification algorithms for BCI. For data set IV, we had to identify left or right finger movements intention, only thanks to EEG signals. Using the activity of two ROIs as features, Common Spatial Pattern (CSP) as a spatial filter, and a simple linear classifier, we have obtained the same accuracy as the winner of the competition. This proves the suitability and efficiency of inverse models for BCI design.

The Butler Project: A Cognitive and Emotional Tele-Assistance System for Elderly

J. A. Lozano, M. Alcañiz, C. Botella[2] D. Castilla, M. C. Juan, N. Lasso de la Vega, G. Llorca, A. García-Palacios, S. Quero, and R. Baños

Correspondence:
J. A. Lozano
Medical Image Computing Laboratory
Polytechnic University
Valencia, Spain
E-mail: jlozano@dsic.upv.es

The ageing of the population is increasing dramatically in industrialized countries. The number of elderly people increased seven times in the XX century. Therefore, it is understandable the growing interest in subjects related with this age group. The goal of this interest is not only to increase the life time, but also the quality of life of the elderly. Because of this, several changes in the concept of ageing are being addressed. There is and emphasis in considering ageing from three different perspectives: Biological, psychological, and social. Elderly is considered now as another phase in the life term, a phase with many positive aspects that can be lived satisfactorily. New technologies can assist in improving quality of life in our elderly. This is the main objective of the Butler Project, concretely the development and the clinical validation of a system based on a number of tele-assistance tools. This system is designed to conduct early diagnosis, intervention, and continuous follow-up of the physical, cognitive, and emotional state of elderly people. This system is aimed to improve quality of life and prevent social isolation by promoting social support. The technological solutions used in the Butler system are based in the several advantages offered by telecommunication and Virtual Reality techniques. In order to offer the elderly a support tool, the system includes virtual environments that offer audiovisual stimuli designed to induce positive emotional states (joy and relax) and to learn useful techniques in order to reduce negative emotional states (relaxation, mindfulness, etc.). Moreover, it also includes e-mail, chat, and videoconference applications designed to help them to keep existing social relationships (children, grandchildren, friends, etc.) or to provide new social relationships with other users. Finally, an Internet application provides the user the possibility of creating an individual memory space with several audiovisual stimuli related with their own life that even can be shared with other users, creating in this way a collective memory space. On the other hand, in order to offer the psychologist an early detection and diagnosis tool, the system includes an Internet application that screens the user's general state. Then, depending of the assessment, the Butler system assists the user: it offers some of the mentioned tools, or it advices to perform a certain activity to improve a negative mood; or even if the system detects a severe emotional problem it can warn other people (family members, medical staff, etc.) about it. The Butler system has been designed to be used in both geriatric hospitals and the user's home. Our team has finished the design of the Butler system and we are about to conduct a clinical trial to validate its use. The aim of this presentation is to describe in detail the technical and clinical features of the Butler system.

A Photographer's View of Presence

J. Harvey Magee

Correspondence:
J. Harvey Magee
University of Maryland Medical Center
Telemedicine and Advanced Technology Research Center (TATRC)
E-mail: magee@tatrc.org

This abstract is offered not as a scientific presentation but as a way of broadening our perspective of behavioral therapy. I suggest that an understanding of the components of presence observed in non-clinical settings may be useful to broaden an understanding of the components of

presence observed in clinical settings, both those that are augmented by Virtual Reality (VR) technologies and even those that are not. I intend to support this idea by sharing information and illustrations about the power of photography in non-clinical settings. Via the medium of photography, one can enter another's world, observe it, capture it, recall it, and give that moment to the photographic subject as a reminder. I will identify several important technical and non-technical elements that contribute to a positive photographic outcome, a "great shot", if you will. In the interest of time, I will develop, and then illustrate, only three or four. Several technical factors that determine a photographic "exposure" are length of exposure to light (time setting, normally measured in fractions of a second), amount of light exposed at a given time (a lens' aperture "opening", measured in F-stops), and the sensitivity of a camera's sensor or of the film used (measured as an ISO setting). Several non-technical elements (issues of judgment) are composition, focus, photographer's cognitive understanding, psychomotor skill and judgment, even a photographer's "presence" in the scene being photographed. I suggest that a clinical outcome is determined in part by these same elements. A clinical encounter has a "time setting" (appointment duration). A clinical encounter will reveal varying amounts and levels information revealed during that encounter, e.g., "light exposed". A therapist may demonstrate varying levels of capability or proficiency based on his / her training, skill, and experience. My hope is that the audience will receive insights from this non-clinical look and be encouraged in their quest to become yet more effective as professionals delivering care to patients in need. My plan is to capture and share some moments from CyberTherapy 11 and to share them as a tribute to the growing field of Virtual Reality (VR)-augmented behavioral therapy.

Impact of Immersion, Narrative Context and Affective Connotation on Subjective Sense of Presence, Physiological Arousal and Vocal Acoustic Parameters in Virtual Reality

Fabrizia Mantovani, Francesca Morganti Alessandra Preziosa, Daniela Villani, Samantha Capideville, and Giuseppe Riva

Correspondence:
Fabrizia Mantovani
CESCOM - Centre for Research in Communication Science
University of Milan
Bicocca, Milan, Italy
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: fabrizia.mantovani@unimib.it

Research carried out in recent years by an the interdisciplinary community of psychologists, computer scientists, engineers, philosophers and HCI scholars has substantially contributed to better defining the concept of sense of presence and to identifying factors which might influence it. Understanding how to enhance the sense of "being there" of a user when immersed in a virtual environment can be in fact very valuable in order to improve the design of VR applications in many domains, from healthcare to training applications, from entertainment to product design. At the moment, although there is no one single theory of presence that all researchers in the field agree upon, general consensus is emerging on the idea that "sense of presence" should be conceived as a complex construct, potentially influenced by both technological features and psychological processes [1]. A research question that is attracting growing attention concerns the relationship between sense of presence and emotion. Moreover, the challenge is on developing multimodal measurement protocols used for the study of presence and related phenomena, broadening analyses from purely self-report measures to physiological and behavioral measures. The present study was carried out as part of the EMMA project ("Engaging Media for Mental Health"-IST-2001-39192), a project funded by the European Commission with two main goals: from a theoretical and basic research point of view, the study of the relationship between presence and emotions; from an application point of view, the design and development of presence-enhanced "mood devices" for clinical and non-clinical populations. Main objective of the present research is to investigate the influence of immersion, narrative and affective connotation on subjective sense of presence, physiological arousal and vocal acoustic parameters in a virtual reality experience. 40 undergraduate students, aged 21 to 25, took part into the study. Experimental design consisted of a 2x2x3 mixed design, including two between-subjects variables (Variable 1: immersive vs not-immersive condition; Variable 2: presence vs absence of narrative context) and one within-subjects variable (Variable 3: affective connotation – neutral vs anxious vs relaxing- of the virtual environment). Dependent variables were sense of

presence, measured through ITC-SOPI questionnaire and UCL scale; emotional experience measured through Positive and Negative Affect Scale (PANAS), State Trait Anxiety Inventory (STAI) and Visual Analogue Scale (VAS); psycho-physiological parameters (heart rate, GSR, respiration, EMG, peripheral temperature); and vocal acoustic parameters (fundamental frequency and voice intensity, rhythm and Long Term Average Spectrum). Results from the study showed that affective connotation plays an important role in influencing sense of presence in the VR experience. In particular, anxious and relax environments differed significantly from the neutral environment, eliciting significantly higher levels of Spatial Presence environments ($F_{2,74}$=8.74, p<.001), Engagement ($F_{2,74}$=10.23, p<.001), and Ecological Validity ($F_{2,74}$=7.34, p<.001). Narrative context also showed to play a role in enhancing sense of presence. Physiological and vocal acoustic measures were correlated with the level of emotional involvement and were influenced by the affective connotation of the environment.

MYSELF Project: Exploring the Role of Affective Computing in Enhancing Web-Based Training

Fabrizia Mantovani, Luigi Anolli, Massimo Balestra, Piet Kommers, Odile Robotti, Anne-Dominique Salamin, and Joachim Wetterling

Correspondence:
Fabrizia Mantovani
CESCOM - Centre for Research in Communication Science
University of Milan
Bicocca, Milan, Italy
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: fabrizia.mantovani@unimib.it

Affective computing is an interdisciplinary research domain usually defined as "computing that relates to, arises from, or deliberately influences emotion" (Picard, 1997). Being able for a computer system to express and recognize emotions while interacting with the user might be a crucial feature, with important applications in many domains, such as e-learning, e-health, entertainment, etc. As far as educational and training applications are specifically concerned, there is a growing recognition that emotions and affect play an important role in learning. The continuous monitoring of learners'/trainees' motivational and emotional state and subsequent tuning of learning process is therefore becoming an important issue in web-based training applications, which could be interestingly addressed by exploiting affective computing potential. This paper presents the work carried out in the MYSELF project-"*Multimodal elearning System based on Simulations, Role-Playing, Automatic Coaching and Voice Recognition interaction for Affective Profiling*"- (www.myself-proj.it). The project was funded by the European Commission and involves 14 partners from 6 different EU countries. Main goal of Myself is the development of a web-based platform with affective computing capabilities for individual and collaborative e-learning simulations. The focus of these simulations is on training social and relational skills in different professional contexts (health-care, banking, commerce, etc.). As far as affective computing features are specifically concerned, three main issues are at the moment investigated. First of all, the *design and implementation of a 3D virtual tutor provided with emotional expressive synthesis abilities*. Research on human-like agents and Embodied Conversational Agents showed that anthropomorphism is not a benefit in itself, unless it is coupled with adequate expressive, conversational and interactive abilities. We designed the tutor LINDA (Learning INtelligent Dynamic Agent), a 3D model developed with Poser 5 and animated with specific attention ito the multimodality and time synchrony of emotional expression. We are currently testing the effectiveness of Linda's emotional expressiveness and its implications for impression formation in the user throughout the learning experience. Second issue under investigation is a *multimodal emotional recognition system* able to provide to the platform information about the emotional and motivational state of the user; much work has been now carried out in the affective computing domain to perform the detection and inference of emotional state from physiological correlates, facial expressions, vocal-non-verbal features (such as F0, intensity, etc.), verbal speech content, questionnaires/self-report measures and the detection of behavioural events (e.g. mouse-clicking). We built a multimodal database as a basis for training and testing algorithms and decision systems. This system will be coupled by a cognitive architecture modelling affect allowing to consistently personalize the learning path according to the user's affective profile and to provide coherent feedback to changes of motivational and affective states of the

user during the training experience. Finally, the project aims at the development of *3D interactive simulations and targeted exercises to improve emotional management* in interpersonal relationships, with specific focus on emotional expression, recognition and management. Emotional competence is mainly learnt through experience throughout our life and plays a central role in our personal and professional lives; therefore, the use of interactive simulations can provide a controlled experiential setting to foster its training.

Multicomponential VR-Enhanced Treatment of Emotional Overeating in Obese Subjects: A Controlled Clinical Trial

Gian Mauro Manzoni, Gian Luca Cesa, Daniela Villani, Gianluca Castelnuovo Enrico Molinari, and Giuseppe Riva

Correspondence:
Gian Mauro Manzoni
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: gm.manzoni@auxologico.it

Emotional overeating is a dysfunctional eating behaviour that affect many obese subjects. It consists in eating an unusually and large amount of food in response to negative as well as positive emotions. Clinical observations as well as laboratory studies have showed that over-weighted and obese subjects tend to eat more food in response to emotions than normal-weighted subjects and tend to eat in response to emotions even when normal-weighted subjects don't. Even if we cannot sustain that emotional overeating is implicated in the aetiology of obesity, we can say with certainty that in many cases it contributes to its maintenance and increase. In order to clinically approach this dysfunctional behaviour, we developed a new VR-enhanced therapeutic protocol that consists in both pc-based and mobile sessions. It incorporates different clinical components, from progressive muscular relaxation and deep breathing exercises to cognitive-behavioural ABC technique, through some elements of the emotion-focused therapy like developing emotion awareness and inducing good feelings. It is composed by six pc-based and therapist-based sessions, two for each of the three weeks the treatment lasts, and two mobile phases

between each couple of sessions. During four of the six pc-based sessions, subjects are immersed in a virtual environment in which they experience relaxation by applying different relaxation techniques, listening to different therapeutic narratives. In the two mobile phases, subjects continue relaxation exercises individually and daily through the support of a mobile phone playing a relaxing video with a relaxing narrative. The goal of this study is to evaluate the efficacy of this procedure in targeting emotional overeating by helping obese subjects to cope and manage the emotions in response to which emotional eating occurs. The primary outcome we expect is the reduction of the behaviour's frequency and we will plan a follow-up in order to detect it after the hospitalization time. The secondary outcome we expect is the improvement of the subjects' perceived self-efficacy in coping the dysfunctional behaviour. The tertiary outcomes we expect are improvements in state emotional dimensions during each session. Self-report and physiological measures will be used. Three experimental groups will allow to evaluate the effect of the VR-enhanced protocol in comparison with a similar procedure not supported by VR and mobile technology and with a waiting list. This study is going to start and the results will be ready in spring, therefore preliminary outcomes will be presented during the conference.

VR-Enhanced Treatment of Anxiety in Obese Subjects: A Follow-Up Study on Trait-Anxiety, Psychological Symptomatology and Generalized Self-Efficacy

Gian Mauro Manzoni, Gian Luca Cesa, Daniela Villani, Gianluca Castelnuovo, Enrico Molinari, and Giuseppe Riva

Correspondence:
Gian Mauro Manzoni
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: gm.manzoni@auxologico.it

This study is the follow-up part of another one presented last year at Cybertherapy 2005 in Basilea. VR, combined with different relaxation techniques, was used to enhance relaxation in a sample of obese in-patients by visually presenting key images for facilitating the process and enabling participants to practice, and hence master, relaxation techniques in a more realistic context.

To accomplish this goal, the Relaxation Island was used, a Virtual tropical island in which participants experience relaxation by applying different relaxation techniques, listening to different therapeutic narratives, within a specific protocol that is composed by two sessions, each implemented on two following days. Three phases composed each session: the first was based on immersive navigation, the second on imagination and the third on immersive navigation again. The techniques aimed to reduce anxiety linked to active negative thinking through progressive muscular relaxation of Jacobson and depth breathing exercises. The aim of this 3 months follow-up study is to explore the long term effects on trait-anxiety, psychological symptomatology and generalized self-efficacy of the treatment described above and implemented during hospitalization. Like in the previous study, to test the hypothesized long term enhancing effect of the specific protocol, we compared three conditions: VR treatment; an usually video exposure, a new age DVD with relaxing narratives - where participants watched a video and had the freedom to imagine any sensory element required - and a control condition. The questionnaires considered were the Trait version of *State-Trait Anxiety Inventory (STAI)*, to measure the level of trait-anxiety, the *Symptoms Check-List (SCL-90)*, to measure general psychological symptomatology, and the *Generalized self-Efficacy Scale*, to measure the level of general perceived self-efficacy. We received follow-up data from 28 subjects and 26 didn't answer (54 in-patients participated in the previous study). Baseline comparisons didn't show any significant statistical difference between responders and non responders. Non parametric analysis were used to test within groups (time) and between groups (experimental conditions) differences. Data show no follow-up change in trait-anxiety in any condition. On the contrary, data show a significant reduction in the SCL-90 Anxiety for the VR group and a significant reduction of the generalized self-efficacy for the comparison group and for the control group, with no change for the VR group. These results follow those obtained in the previous study where the treatment showed to be efficacious in improving relaxation and in reducing anxiety in the short term. Follow-up data strengthen the previous outcome showing a long term efficacy in reducing anxiety.

Implicit Learning of an Embedded Regularity in Older Adults Using an SRT Task in a Virtual Reality Medium

Rose Martini, Lisa Aquilino, Simone Buissé, Anabelle Dumais, Valérie Pion, Ebony St. Rose, Heidi Sveistrup, and Diane Ste-Marie

Correspondence:
Rose Martini
School of Rehabilitation Sciences
University of Ottawa
Ottawa, Canada
E-mail: rose.martini@uottawa.ca

Implicit learning tasks are used to investigate incidental learning where learning is not fully consciously accessible (Seger, 1994). Implicit learning of embedded regularities (i.e., a regularly occurring predictive pattern) has traditionally employed serial reaction time (SRT) tasks involving simple movement responses, such as a finger key press in response to a visual stimulus. This is a limitation of the research in this field as such tasks are not reflective of the kind of complex processing required for most daily activities (Shea, Wulf, Whitacre, & Park, 2001). This study used a gross motor reaching task in a virtual reality environment to investigate implicit learning of an embedded regularity in older adults (60-80 years). Participants were asked to reach with their preferred hand to contact virtual balls as quickly as possible as they appeared at four far quadrants of a television monitor within a virtual environment. All groups performed five blocks of 84 acquisition trials and one retention trial block. Within each block, an embedded regularity appeared four times intermixed with random trials. Learning is inferred by faster response times for the repeated sequences (the embedded regularity), as compared to the random sequences (Curran, 2001). Indeed, data analyzed to date demonstrate that participants performed significantly faster across blocks $F (4, 7) = 18.279$, $p < .001$ for both repeated and random sequences and significantly faster on the repeated sequence as compared to the random sequence $F (1, 10) = 27.689$, $p < 0.001$). This trend appears to continue at retention. Oddly, this significant difference is found as of the first block of trials. Possible learning within this first block will be explored further. To determine whether learning of the repeated pattern was explicit (consciously accessible) or implicit (unconscious), verbal reports were obtained through progressive questioning, visual recognition of sequences, and an adapted method of opposition. Verbal reports data indicate that several participants suspected the presence of a pattern; however, no significant differences were obtained between the recognition of the two types

of sequences presented. This finding is similar to Meulemans, Van der Linden, and Perruchet (1998) who, using the same sequence in a finger key press task, did not find that their adults (18-27 years) or children (6 and 10 years) acquired explicit knowledge of the repeating sequence. The novelty in this study stems from the use of the virtual reality modality for the SRT task. The advantages and disadvantages experienced in the use of the virtual reality medium for the exploration of implicit learning of embedded regularities will be discussed.

REFERENCES

1. Curran, T. (2001). Implicit learning revealed by the method of opposition. *Trends in Cognitive Sciences, 5,* 503-504.
2. Meulemans, T., Van der Linden, M. & Perruchet, P. (1998). Implicit sequence learning in children. *Journal of Experimental Child Psychology, 69,* 199-221.
3. Seger, C. A. (1994). Implicit learning. *Psychological Bulleting, 115,* 163-196.
Shea, C. H., Wulf, G. Whitacre, C. A., & Park, J. (2001). Surfing the implicit wave. *The Quarterly Journal of Experimental Psychology, 54,* 841-862.

Middle School Student Aggressions and the Use of Motion Captures

Simon Meistininkas, Robert Chamot, and Sharon Tettegah

Correspondence:
Simon Meistininkas
University of Illinois
Urbana-Champaign
E-mail: Max621@gmail.com

This research explored the use of middle school aggressive behaviours captured using Motion Analysis's motion capture technology in a studio. The raw motion capture data containing 3D translational and rotational information of over 20 joints was stored in HTR format using Motion Analysis's software. The raw HTR data was imported into Maya 7.0 as keyframed animation data using a custom MEL script. The animation data was edited using Maya's animation tools to remove bad data points and smooth the animation. A simple scene was constructed as a background for the animations. Finally, the animation was applied to a skeleton, which in turn controlled the animation of a low polygon "stick figure." The animations were rendered as high-resolution (1280x1024) movie clips. Two versions of the animations were created: one containing just the skeletal animation, e.g. bones and joints, and another containing an animated low polygon "stick figure" model of a person. The skeletal animations were rendered using Maya's PlayBlast feature. The "stick figure" animations were rendered as single frames in Maya and then compressed into AVI video format using VirtualDub. We sought to identify whether children could discern the difference between physical aggression and non-aggressive behaviors in both skeletal and stick figure representations using ten common physical aggressive behaviours displayed within an immersive C.A.V.E. (Cave Automatic Virtual environment). Findings and future implications of such work are presented.

Predicting Treatment Outcome for Arachnophobia's Virtual Reality Therapy Through Measures of Fear

David Michaliszyn André Marchand, Marc-Oliver Martel, and Mélissa Gaucher

Correspondence:
David Michaliszyn
University of Québec
Montreal, Canada
E-mail: michaliszyn.david@courrier.uqam.ca

The mechanisms underlying the efficiency of Virtual Reality are still being explored. The aim of this study is to identify variables that may help predict treatment outcome. This study is based on pre-test/post-test with waiting list control group. 15 participants have been treated for fear of spiders, aged 18 to 50 years old. Structured interviews (SCID-I) were performed, questionnaires were administered (*Spider Beliefs Questionnaire*, Arntz, 1993, *Fear of Spider Questionnaire,* Szymanski et al., 1995), as well as a behavioural avoidance test in order to assess the presence of a fear of spiders. In order to obtain efficient exposure, virtual environments must evoke anxiety for participants. We hypothesise that higher levels of fear should favor a positive treatment outcome. Work in progress.

Virtual Reality in the Treatment of Combat-Related PTSD with Warfighters

Sarah D. Miyahira, Hunter G. Hoffman, and Raymond A. Folen

Correspondence:
Sarah D. Miyahira
Pacific Telehealth & Technology Hui
VA Pacific Islands Health Care System
Honolulu, Hawaii
E-mail: sarah.miyahira@med.va.gov

Background/Problem: Continuing exposure to potential death or serious injury places military personnel deployed to combat theaters at high risk for developing post-traumatic stress disorder (PTSD). For some, the symptoms of PTSD are transient and recovery occurs naturally. Others, however, fail to recover and would greatly benefit from treatment. Timely and effective treatment of PTSD can leverage combat readiness by improving the probability of warfighters returning to duty, and may also prevent the long-term deleterious effects of the disorder that have been experienced by thousands of veterans from earlier conflicts.[1] Cognitive-behavioral therapy (CBT) has been successfully applied to treat PTSD in civilians and veterans.[2] Recent studies suggest that immersive virtual reality (VR) applications may offer a potent augmentation to CBT for treating PTSD.[3,4] Building on the promising outcomes of the VR research to date, this study investigates the usefulness of VR in a CBT exposure treatment of PTSD in U.S. warfighters returning from combat zones in Iraq. Methods and Tools: The project is a randomized controlled clinical trial using a between group pre-post experimental design that includes both intent-to-treat analyses and analyses of subjects who complete treatment. The treatment utilizes a CBT with graded VR exposure (VRE) protocol that integrates a virtual environment that was developed for the study to treat combat-related PTSD. The experimental group will undergo biweekly sessions of VRE for 5 weeks, and the control group will receive structured minimal attention (MA) for 8 weeks. After 8 weeks of minimal attention, the MA group will begin VRE. Outcome measures include several psychological self-report questionnaires, a PTSD clinical interview, and self-reported ratings of quality of life. Follow-up assessments will be conducted at 6 and 12 months post-treatment. During the treatment sessions, biofeedback will be used to obtain physiologic data such as blood pressure, skin conductance, and heart rate. Results: The first year of this project was focused on developing the computer-based VR environment and system, standardizing the treatment procedures, and training the therapists. Data collection is scheduled to begin during this second year of the study. Conclusions: Although it is premature to discuss study outcomes at this time, valuable lessons learned about the development of computer-based VR applications for psychotherapeutic interventions can be considered. Multiple issues were confronted, including the selection of development tools, design of the environment, sensory experiences, and intellectual property. Novelty/Discussion: Few, if any, randomized controlled clinical trials of PTSD treatment have been conducted with active duty personnel, and even fewer have focused on PTSD resulting from combat exposure. Immersive VR technology can enhance a person's memory retrieval of traumatic events with visual, auditory, and other sensory experiences that will, in turn, activate the emotional engagement during therapy found to be related to recovery from PTSD.[5,6] This study will be one of the first to examine the utilization of VR technology in a randomized controlled treatment trial of warfighters with PTSD.

Immersive Panoramic Video: An Alternative VR Environment

Sarah D. Miyahira, Raymond A. Folen, and Stanley M. Saiki, Jr.

Correspondence:
Sarah D. Miyahira
Pacific Telehealth & Technology Hui
VA Pacific Islands Health Care System
Honolulu, Hawaii
E-mail: sarah.miyahira@med.va.gov

Currently, the primary medium for virtual reality (VR) applications in healthcare is computer graphics (CG)-based. These environments are typically very costly, time-intensive to create (average $100,000), and take one year from concept to final application. Compared to commercial video games, these VR environments have simple graphics and limited interactive capability. While VR developers are capitalizing on gaming software and engines to decrease the development time and expenses, distribution and platform compatibility issues continue to be problematic. Immersive panoramic video is emerging as an alternative. Camera systems ranging in costs from $20,000-$140,000 can produce 360° videos that are user-friendly, and can create a VR application within a few days or

weeks. The video environment presents a more authentic representation of the 'real world' that is graphically more accurate than the CG environment. While interactivity is a limitation with video environments, new capabilities are emerging to provide branching functionality in response to the user. Distribution costs and platform compatibility concerns are also significantly less than those associated with CG applications. However, controlled studies are needed that 1) assess the immersiveness of the video VR environment; 2) assess the psychophysiologic effects of panoramic video; 3) compare panoramic video displayed through a head-mounted display (HMD) with a flat-screen display; and, 4) compare immersive video environments to similar CG VR environments. The Pacific Telehealth and Technology Hui's Virtual Reality in Behavioral Health research program is actively investigating the first three questions. Methods: The first study examines the use of video stimulus cues for anger provocation by exposing subjects to the same stimulus content viewed either on a flat-screen or as panoramic images viewed through a HMD. Self-report and physiologic measures taken pre-post, and during exposure are compared between the two groups. Psychometric measures include anger, self-esteem, and presence questionnaires. Physiologic measures include heart rate, blood pressure, skin conductance, peripheral skin temperature, and respiration. The second study uses a counterbalanced design to evaluate the use and utility of panoramic and flat-screen stimulus cues for inducing nicotine craving in individuals who are heavy smokers. Participant responses to panoramic VR cues presented through an HMD are compared to flat-screen images of the same video content. Self-reported nicotine craving and physiological data similar to the first study are used to assess reactivity to the stimulus cues. Results and Conclusions: As these studies are in progress, no results or conclusions can be offered at this time. However, informal responses to the immersive panoramic video experience compared to the flat-screen display have been more favorable. Preliminary results, examples of the panoramic video, and future plans to compare immersive VR and CG environments will be presented. Novelty/Discussion: The immersive panoramic video is an exciting new technology that may provide an alternative to CG virtual environments in the treatment of behavioral health conditions. However, there is a dearth of published research about the healthcare applications of this technology, and a lack of controlled studies about its efficacy in behavioral

health treatment approaches. Our studies are among the first research to address these issues.

The Virtual Classroom: An Ecological Version of the Continuous Performance Task

Geneviève Moreau, Marie-Claude Guay, and Albert Rizzo

Correspondence:
Geneviève Moreau
University of Quebec
Montreal, Canada
E-mail: moreau_genevieve@hotmail.com

The Virtual Reality (VR) Classroom is a computer-based program using a head mounted display tracking device and VR reality glasses. The VR Classroom is a continuous performance task designed to test attention in school-aged children. The child is immersed in a three dimensional classroom environment. A continuous performance task is presented on the chalkboard at the front of the class. During the assessment, visual and auditory distracters are presented. Just like the Conners' Continuous Performance Test (CPT), the VR Classroom records reaction times, commission errors, and omission errors. While the child performs the task, a head tracking device monitors head movements, documenting the number of times the child turns away from the CPT task. The precise times when errors occur are recorded, allowing association of errors with specific distracters. The Classroom was developed at the University of Southern California. The child assessed is presented with a standard continuous performance task by presenting letters on a chalkboard at the front of the class. The task last 6 minutes and data are divided in three equal block periods. Instructions are given by the virtual teacher and the child is given a practice time to familiarise with the virtual environment. The Classroom presents the advantage of being more representative of the child's performance in real life settings compared to traditional neuropsychological tests used in diagnosing ADHD. To perform well, the child must sustain attention on the task and avoid distraction by the various visual and auditory stimuli occurring in the classroom. The objectives of this pilot study are : 1) To determine if the cognitive profile of the child with ADHD outlined by the traditional CPT corresponds to the one outlined by the VR Classroom (ecological CPT); 2) To compare performance on the VR Classroom to a standard

neuropsychological battery (Delis Kaplan Executive Functioning System (DKEFS) Stroop and Tower subtests, CPT, d2 Test of Attention, Achenbach System of Empirically Based Assessment) and observations through an academic task on the following variables: impulsivity, sustained attention, reaction time, variability of the reaction time and problem planning and resolution. 20 French speaking Canadian children aged between 8 and 12 diagnosed with ADHD (combined subtype) are currently assessed in a Montreal hospital-based ADHD clinic using a standardised neuropsychological battery and the VR Classroom. Children are assessed without medication. Results are to be given at the conference. If the objectives are met, a full-scaled quasi-experimental study will be conducted in the fall of 2006 to compare performance of children with and without ADHD.

Virtual Reality Contexts for the Situated Assessment of Spatial Neglect

Francesca Morganti, Andrea Gaggioli , Maria Luisa Rusconi, Anna Cantagallo, Elisabetta Mondin, and Giuseppe Riva

Correspondence:
Francesca Morganti
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milano, Italy
E-mail: francesca.morganti@auxologico.it

The main characteristic of virtual reality (VR) dwells in carrying spatial information in an analogical mode preserving most of space-time dimensions and interaction modalities that humans usually have in natural contexts. According to this, the spatial nature of virtual environments revealed an advantageous opportunity for the evaluation of residual perceptual abilities and motor-explorative behaviours in patients with cognitive impairment. In particular, it has been suggested that VR can be effectively used to evaluate how cognitive impaired users, such as patients affected by visuo- spatial neglect, are able to explore and memorize the environment in which they are able to interact. Neglect patients present difficulties in attending to stimuli placed in the contralesional space (typically the left hemispace). Several kinds of task can be used to assess and to modulate neglect behaviour. These tasks should address the whole range of cognitive domains in which the disorder could be manifested (perception and mental representation, personal/extrapersonal space, navigation abilities). Since standard evaluation of neglect syndrome is mainly carried out using paper-based tests within the laboratory, the assessment of patient's behaviour impairments in everyday contexts tends to be overlooked. Drawing on these premises, we introduced a VR-situated approach for the evaluation of neglect patient's perceptive, memory and explorative residual abilities in coping with daily contexts. We designed two virtual environments: a small-scale, closed environment within which neglect patients could position objects and navigate; and a large-scale, open one, which patients explored freely. The main goal of the first virtual environment provided is to evaluate patients' ability in memorizing, recognizing, and replacing objects within all the field of vision. The main aim of the second one is to evaluate patients' exploration strategies and to analyze their description of context they are engaged with. We tested the environments in four brain-damaged patients. They were requested to immersively explore the environments in order to memorize, replace and recognize familiar objects. Patients included in the study were previously evaluated with "paper and pencil" neuropsychological assessment which revealed respectively a neglect syndrome, an overcome neglect, a right brain damage without neglect and frontal brain injury (with slight attentional neglect). Results showed that, compared with standard evaluation (that is mainly grounded on the detection and recognition of motionless target objects) patients' interaction with virtual environments (in which target objects are situated in a dynamical scene) exhibited peculiar explorative behaviours, such as perseverations and /or right-side navigation tendencies, that could be addressed to their specific cognitive impairments. In addition, from a methodological point of view, the introduction of a VR-based assessment allowed to deliver the complexity of stimulus challenges of naturalistic settings, as well as to monitor them in order to identify what constitute patients' main troubles in managing daily activities.

A Virtual Reality-Extended Neuropsychological Protocol for Route and Survey Spatial Knowledge Assessment

Francesca Morganti, Andrea Gaggioli, Lorenzo Strambi, and Giuseppe Riva

Correspondence:

Francesca Morganti
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milano, Italy
E-mail: francesca.morganti@auxologico.it

Spatial cognition research has emphasized the evolutional advantage of this ability in human beings and animals. The same research has furthermore, given evidence of, in all forms of knowledge acquisition (the direct exploration of the environment, the use of simulations of a graphical or verbal nature, the interaction in simulated 3D environment) spatial knowledge can be represented in a cognitive map which can be of the route or survey type. The first consists of representations essentially organised in limited paths through the sequential connection of turns and/or salient points in the space. Survey maps, on the other hand, are representations in which relationships between various points of the environment can be inferred through the reasoning process. The capability of learning spatial relationships in a large scale environment, and of organising them in route and/or survey type, is influenced by a series of characteristics of the specific environment, capable of assuming a role functional with the activities an agent performs, or is going to perform, inside it. In spite of the agreement in considering as essential for spatial cognition organization the kind of environment in which an agent moves, the aims he proposes for himself in the exploration and the kind of interaction he is able to have in his movement and in modifying parts of it, classical evaluation of spatial functions is generally based on "paper and pencil" tests that dodge to assess the ability of being spatially oriented in navigating within a complex environment. For this purpose we propose a matched spatial cognition evaluation protocol in which perceptive, memory and attentional functions (that combined each other are considered the hub for spatial orientation ability) will be evaluated with standardized neuropsychological tests and we upgrade introducing a more situated computer based tools for the assessment of spatial orientation during the interaction with complex environments. Due to their pronounced route and survey intrinsic characteristics we developed two virtual reality tools based on WISC-R Maze subtest and Road Map Test modifying them according to interactive evaluation purposes. VR-Maze consists of 8 mazes, with regular structure and without landmarks, that were provided to subjects according with an increasing complexity order. This test allow us to evaluate human ability of finding the best route to achieve a target goal while immersed in an empty environment. VR-Road Map Test is a complex large scale environment, in which the experimenter can eliminate, add, or modify landmarks and target objects. These features may be used to evaluate the ability in creating relationships between various points of the environment and in inferring, through the reasoning process, a high level spatial organization knowledge. By providing the possibility to track user's spatial behaviours, a virtual reality-based evaluation allows an effective and objective record of all the experimental variables. It also avoids the intervention of the experimenter that may interfere with the actions of the agent-explorer. The integration of these virtual environments with traditional evaluation methods, may provide an interesting alternative to paper and pencil-based approaches, thereby contributing to improve the study of spatial cognition.

Task Fatigue and Driving Performance: How Important is Length of Simulation?

Jonathan Nhan, and Henry J. Moller

Correspondence:
Henry J. Moller
University of Toronto
University Health Network
Department of Psychiatry
E-mail: henry.moller@uhn.on.ca

While a wide array of simulation paradigms are used to infer internal state through performance measurement, surprisingly little research has focused on the factors of fatigue and simulation length to optimize performance and take into account fluctuations in task immersion. Sustained performance for extended periods of time invariably causes fatigue in the person performing a routine task. To assess the effect of fatigue on driving, the York Driving Simulator was used to measure performance in 10 healthy control subjects and 10 sleep disorder patients (Epworth Sleepiness Scale score >10) on a standardized monotonous 60-minute simulated driving session. Subjects were asked to repeatedly rate themselves on the 7-point Stanford Sleepiness Scale (SSS) every two minutes throughout the duration of the drive to assess the driver's subjective awareness of his or her own fatigue. Measured simulation performance variables included standard deviation of road position (SDRP), i.e. tendency to "weave", speed, speed

deviation (SPDEV), and reaction time (RT). All performance data and SSS ratings were grouped in 10-minute blocks and paired t-test calculations were performed in order to determine variation over time in subjective state and performance. Occurrence of off-road incidents (CRASHES) was also recorded for each 10-minute epoch. SSS ratings increased in a curvilinear fashion over the course of the drive, but with respect to objective simulator measures, significant deterioration in driving performance was noted only for variables involving speed modulation. SPDEV was observed to increase over the 60-minute session, suggesting that a subject's ability to monitor and maintain a speed close to the posted speed limit over time (i.e. task vigilance) decreases in parallel to fatigue and sleepiness with prolonged simulator sessions. In particular, those subjects with sleep disturbance showed a notable decrement between the first and last epoch of the drive (p=. 049*). In comparing mean speed (p<. 001) and SPDEV (p=. 042) for the first and last half of the drive, highly significant differences were also noted. While CRASHES cannot be considered a continuously recorded variable, and represent simulator events with a rare overall base rate, there was a significant trend towards increased collisions (83% of total crashes) occurring once the simulation duration had exceeded 30 minutes, implying a possible role for task fatigue. Other measures of performance recorded by the driving simulator (i.e. SDRP, RT) did not show a significant change over time, even though subjective fatigue increased. This finding has implications for "real-world" as well as simulated driving. In the case of driving, the increased speed deviation observed may be a phenomenon transferred over from driving in the real world, namely increased speed as sleepiness increases to reach the destination quicker, or an attempt for increased perceptual self stimulation to combat fatigue. For simulations incorporating elements of task immersion, the relationship shown here between subjective sleepiness and some (but not all) performance variables suggests that fatigue can differentially affect performance depending on simulation length and the specific variables measured. Being aware of task fatigue appears relevant for design of any simulator protocol to obtain more valid results.

Combined Use of Virtual Reality, Video-Oculography and Vaginal Photoplethysmography in Assessing Women's Sexual Preferences

Pascale de Courville Nicol, Marie-Pierre Bonin, Patrice Renaud, and Stéphane Bouchard

Correspondence :
Pascale de Courville Nicol
Laboratoire de Cyberpsychologie de l'Université du Québec en Outaouais
E-mail: pascaledecn@gmail.com

With the advance of new technologies, classical methods already in use in psychology and sexology are complemented by the addition of new techniques that seem to be filling certain gaps. The simple measure of the feminine sexual response with vaginal photoplethysmography consists in the insertion in the vagina of a probe measuring the blood volume of that region. Light emitted by the probe is reflected by the blood vessels in the tissue, and this measure indicates the level of arousal. This method has proved its efficiency on certain aspects, but can be improved on others, including the stimuli presented to prompt sexual response with women. Most stimuli currently used are pictures, video or audio tapes. Virtual reality stimuli would improve the efficiency and the realism of the method by adding interactive and emotional dimensions to the sexual stimuli. Also, adding an eye-tracking system directly in the head-mounted display makes it possible to put perceptive and cognitive processes in parallel with the genitally measured sexual excitement (Renaud et al., 2003, 2004). Immersive video-oculography allows to precisely analyze the visual dynamics in relation with geometry and signification of the virtual objects simulating sexual characteristics. Currently used with the penile plethysmography on male participants, including a sexually deviant sample, this sexual preferences evaluation method is being validated with a female sample at the Cyberpsychology Laboratory of Université du Québec en Outaouais. Instrumentation, general method and preliminary results will be presented in this communication.

Attention Rehabilitation With the Virtual Classroom for a 6-Year-Old Boy With Attention Deficit Disorder

Pierre Nolin, Frédéric Banville, Albert A. Rizzo, Marie-Ève Nadeau, Marie-France Gobeil, Marylène Brouillard, and Stéphane Bouchard

Correspondence:

Pierre Nolin
University of Quebec
Trois-Rivieres, Canada
E-mail: Pierre.Nolin@uqtr.ca

Virtual reality (VR) provides a three-dimensional computer representation of a real world through which a person can navigate and interact with objects to carry out specific tasks. One novel application of VR technology is in rehabilitation for children with attention deficit disorder. Attention deficit disorder is a diagnosis applied to children who consistently display certain characteristic behaviours over a period of time. The most common core features include: distractibility (poor sustained attention to tasks) and impulsivity (impaired impulse control and delay of gratification). The objective of the present paper was to determine whether, by using the Virtual Classroom, a child who had attention deficit disorder could improve his attention capacities. The Virtual classroom simulation was originally developed as a controlled stimulus environment in which attention processes could be systematically assessed in children with attention-deficit/hyperactivity disorder. The scenario consists of a standard rectangular classroom environment containing student desks, a teacher's desk, a virtual teacher, a blackboard, a large window looking out onto a playground with buildings, vehicles, and people, and a pair of doorways on each end of the wall opposite the window through which activity occurs. A 6 year old boy with attention disorder completed a 5 weeks of training with 2-3 hour individual sessions. The child had to complete many 6 minutes condition during each session. The child was instructed to view a series of letters presented on the blackboard and to hit the response button only after he viewed the letter "X" preceded by an "A". Visual and auditory distractions were included during the session. Outcome was assessed with specific and non specific attention tests requiring attention (Auditory Attention and Response Set, Day & Night Stroop) and an ecological test of attention (TEA-Ch). This assessment was performed twice before and after the rehabilitation programme. Analysis is ongoing. Full results will be reported. The results of the study will contribute to an understanding of factors which determine significantly the progress of the child using virtual reality. The results will also highlight interventions which could improve outcome for this kind of children and will indicate if the Virtual Classroom may improve sustained attention and inhibition capacity.

Virtual Reality in the Treatment of Pathological Gambling

Azucena García-Palacios, N. Lasso de la Vega, C. Botella, R.M. Baños, and S. Quero

Correspondence:
Azucena García-Palacios
Universidad Jaume I
Castellón. Spain
E-mail: azucena@psb.uji.es

Background: Addictions are among the most prevalent mental disorders. Pathological gambling is a behavioural addiction consisting in a loss of control over gambling that lead to important psychological and social problems. One of the most effective treatments for this disorder is cognitive-behavioral therapy, including cue exposure and cognitive restructuring. Virtual Reality (VR) technology could be a valuable tool for applying cue exposure in the treatment of pathological gambling. VR presents some advantages: There is an absolute control over all the events that may occur and the consequences of those events. Also, the treatment takes place at the therapist's office. This allows approaching and practicing in different contexts without leaving the office, and offers the patient the security of being able to work with those risky situations without being in contact with the substance or the addictive situation. In summary, VR could be a helpful tool to improve the application of cognitive-behavioral programs and therefore to increase the number of people who can benefit from the treatment. Our research group has designed a VR program for the treatment of pathological gambling. The aim of this work is to present preliminary data of the clinical efficacy of this program. Method: Four individuals suffering pathological gambling participated in this study. They were referred from an Addictive Behavior Unit. They were assessed and they went through a multicomponent cognitive-behavioral program for pathological gambling, including VR environments (casino, bingo, bar with slot machines) to conduct cue exposure, and VR environments to conduct cognitive therapy. The treatment consists of eight weekly sessions. Results and conclusion: In progress. We have completed the treatment of two patients and we are treating two more. The results so far indicate that VR is useful for the treatment of pathological gambling. The VR scenarios evocated the impulse to gamble in our participants. The comparisons from pre- to post-test showed that the VR treatment program was effective for the treatment

of pathological gambling. Novelty: This is the first study showing preliminary efficacy data of the utility of VR therapy for the treatment of pathological gambling.

Use of Virtual Reality to Reduce Claustrophobia During MRI Scans

Azucena Garcia-Palacios, Hunter Hoffman, Todd Richards, and Sam Sharar

Correspondence:
Azucena García-Palacios
Universidad Jaume I
Castellón. Spain
E-mail: azucena@psb.uji.es

Research status: Pilot clinical efficacy study. In progress. Background: Magnetic Resonance Imaging (MRI) is a valuable diagnostic procedure. The patient is placed in a cylinder remaining immobile for an average of 50 minutes. Although MRI scans are very costly, premature termination and "no shows" are common (around 20%). Between 25 and 37% of people going through this procedure reported moderate to severe claustrophobic fear (McIsaac, Thordarson, Shafan, Rachman & Poole, 1998). The essential feature of Claustrophobia is fear and avoidance related to enclosed spaces. It includes fear of suffocation and fear of restriction (Rachman, 1997). These fears could be easily evoked during a MRI procedure. It is important to explore the possibility of reducing claustrophobic fear during MRI scans. Virtual Reality (VR) distraction has proven to be effective in the treatment of acute pain during fMRI scans (Hoffman, Richards et al, 2004). The multiple sensory quality of VR makes this technique a powerful distracter. VR distraction could also be used to draw attention away from such a claustrophobic situation as a MRI scan. The aim of this work is to show pilot data about the utility of VR to reduce claustrophobic fear during MRI scans. Method: Ten individuals suffering claustrophobia participated in this study. After a clinical interview, filling out the Claustrophobia Questionnaire (CLQ, Radomsky, Rachman, Thordarson, McIsaac, & Teachman, 2001), and going through a Behavioral Avoidance Test in a mock scanner, the participants were randomly assigned to two experimental conditions. In one condition, the subjects underwent a mock MRI scan during 15 minutes while they listened to music (no visual distraction). In the other condition participants underwent a mock MRI scan while

shooting snowballs at snowmen, penguins, igloos and robots in SnowWorld, a VR environment. Fear and avoidance ratings were given before, during, and after the MRI scan procedure. Results and conclusion: In progress. We predict that patients will feel less claustrophobic in SnowWorld than in music only, and we predict that the more present patients feel in SnowWorld, the more reduction in fear they will report. Novelty: This is the first study exploring the utility of VR distraction for reducing fear via distraction in a common claustrophobic situation, undergoing a MRI scan. If VR is effective we will be able to reduce the percentage of "no shows" or premature terminations involved in this costly but valuable diagnostic procedure.

REFERENCES

1. Hoffman HG, Richards TL, Coda B, Bills AR, Blough D, Richards AL, & Sharar SR. (2004). Modulation of thermal pain-related brain activity with virtual reality: evidence from fMRI. Neuroreport. Jun, 7 (15), 1245-1248.
2. McIsaac, H. K., Thordarson, D. S., Shafran, R., Rachman, S. y Poole, G. (1998). Claustrophobia and the Magnetic Resonance Imaging Procedure. *Journal of Behavioral Medicine, 21*, 255-268.
3. Rachman, S. J. (1997). Claustrophobia. En G.C.L. Davey, (ed.). *Phobias. A Handbook of Theory, Research and Treatment* (pp. 163-182). Chichester: Wiley.
4. Radomsky, A. S., Rachman, S., Thordarson, D. S., McIsaac, H. K., y Teachman, B. A. (2001). The Claustrophobia Questionnaire. *Journal of Anxiety Disorders, 15*, 287-297.

Ocular Movement Dynamics, Emotional States and Presence as Modulated by 3D Sounds Propagated from Virtual Objects

Jonathan Paquette, Patrice Renaud, Christian Villemaire, Jean Décarie, Guillaume Albert, and Stéphane Bouchard

Correspondence :
Jonathan Paquette
E-mail: zero_absolu_20@hotmail.com

Virtual sound environments have a significant impact on perceptual and cognitive processing, emotional and presence state (Justus & Bharucha, 2002; Västfjäll, Larsson & Kleiner, 2002; Juslin & Sloboda, 2001). Since Yarbus (1967) we know that oculomotor behaviors are not only influenced by

low level (bottom-up) processes but also by high-level processes (top-down) of the cognitive functioning. We do know that sounds, and especially their level of complexity, influence oculomotor behaviors (Boucher, Lee, Cohen, & Hughes, 2004; Krukowski, Begault, Wenzel, & Stone, 2001; Mondor, Terrio, & Hurlburt, 2000; San Martini and al., 1994; Mudd, Conway, & Schindler, 1990). However a complete model of the link between eye movement dynamics, emotional states and presence feeling led by virtual sound stimuli remains to be developed. Participants (N=12) were isolated from surrounding noises and visual stimulations. Recording of their oculomotor responses were made using an eye-tracking device combined into a HMD also providing sound through earphones. They were instructed to locate and scrutinize 3D sounds. Visual search paths as well as emotional states and subjective presence were recorded (Witmer and Singer, 1998; Zuckerman, 1960).Two independent variables were studied. First, four types of sound stimuli were presented in a 3D spatialized sound fashion: white noise, pink noise, pure sounds and fractal sounds. Second, sound sources were either presented in a static fashion or in movement, i.e. following a random path.

Therefore, this study developed a MR compatible Augmented Reality (AR) system, which could present a virtual image in the real world using by camera in real-time. This system was composed of a PC, a MR compatible HMD, and a camera shielded by an aluminum case. The MR compatible camera was mounted on the upper and front side of the head coil so that the camera could capture an image in the same view of the subject. Therefore, it captures a real image, and transfers this image to a PC in order to merge it with the virtual image. The superimposed image is then shown on a HMD. For a preliminary fMRI study, a virtual fire was used as the virtual stimuli and superimposed on the subject's left hand image. The virtual fire was presented to the subject's left hand for 20 seconds and removed for another 20 seconds. The on and off sequence was repeated three times. Two healthy right-handed subjects were recruited. The fMRI scan was performed using a 1.5T GE machine. The analysis of the fMRI data revealed the activations that were located contra-laterally. In particular, activations in the right primary and secondly somato sensory areas were observed. This could mean that the virtual stimuli on a real body can influence the brain activity. The AR system has the potential to be used for many other neuroscience studies.

Development of MR Compatible AR System to Provide Virtual Stimuli on the Real Hand and its Pilot Study

Jinsick Park, Jeonghun Ku, Kwanguk Kim, Kiwan Han, Hyeongrae Lee, Hee Jeong Jang, In Young Kim, Chan Hyung Kim, Jae-Jin Kim, Kang Jun Yoon, Sang-won Nam, and Sun I. Kim

Correspondence:
In Young Kim
Department of Biomedical Engineering
Hanyang University
Seoul, Korea
E-mail: iykim@bme.hanyang.ac.kr

Functional Magnetic Resonance Imaging (fMRI) is the most frequently used method in many neuroscience studies. However, those studies have limitations in that the stimuli are far from the events of a real environment. Therefore, Virtual Reality (VR) technology, which can present a realistic stimulus and be used during fMRI scanning, has been developed. Even though VR could give a three-dimensional and ecologically valid environment to the subjects, it could not provide the events experienced in the real world.

Comprehension by the General Population of Questionnaires Measuring the Feeling of Presence

Marie-Josée Patry, and Stéphane Bouchard

Correspondence :
Stéphane Bouchard
Université du Québec en Outaouais
E-mail : stephane.bouchard@uqo.ca

Several studies have shown the importance of the illusion of presence in virtual reality. This concept, which can be summarized as the subjective feeling of "being there" in a virtual environment, is thought to exert a strong influence on treatment effectiveness and on the experience of the user immersed in a virtual environment. Thus, it is important to develop good instruments to assess the feeling of presence. Unfortunately, not all instruments currently available have strong psychometric qualities, the most fundamental being that items are clear and well understood. Many of these questionnaires were validated with university students or highly educated professionals being trained using VR. It is possible

that the wording of items that is used in these instruments is too complex to be easily understood by the general population. The aim of this project was to determine the extent to which people in the general population understand the meaning of the items from frequently used measures of presence. Our hypothesis was that many items would not be well understood. In order not to exhaust the participants, the number of items tested had to be restricted. The items from the following measures were selected: all 28 items from the Presence Questionnaire, the 8 items of the Kim and Biocca Self-Reported Telepresence Scale, the 4 items of the presence subscale of the Reality Judgment and Presence Questionnaire, and 7 new items. A first set of 2 control items were drawn from the Beck Depression Inventory. This well validated measure was developed to be used with clinical samples drawn from the general population. A second set of 2 control items was developed in order to be objectively difficult to understand (e.g., phrases with triple negatives or that do not make sense). The sample consisted of 50 adults recruited during the weekend in a downtown shopping mall in the city of Gatineau. Participants sat on a chair, wearing a VFX-3D head mounted display, and completed a five minutes virtual flight using the software created by VirtuallyBetter for the treatment of aviophobia. After the immersion, they rated on a 0 to 10 scale how well they understood the meaning of each item. Data were analyzed using descriptive statistics and ANOVAs were performed to compare ratings of the presence items to those of the control items that were "easy to understand" and "difficult to understand". Most items were less clear than the "easy to understand" controls but clearer than the "difficult to understand" controls. As much as 72.22 % of the items were significantly less clear than the "easy to understand" controls. For each questionnaire, many items were also considered easy to understand. The impact of these findings on the measurement of the feeling of presence are discussed.

Safe Sex Attitude Measurement and Intervention in an Immersive VR Context

David B. Portnoy

Correspondence:
David B. Portnoy
University of Connecticut
E-mail: david.portnoy@uconn.edu

Background: A major problem in measuring sexual risk behavior is that self-report cannot always capture an accurate record of behavior and lab studies are often too contrived to obtain generalizble results (Loomis, Blascovich, & Beall, 1999). Accurately measuring and intervening with risky behaviors is of the utmost importance to public health; VR allows efficient and accurate measurement of such behaviors. It also provides a unique and effective tool in which the training and practice of health-risk reduction techniques can take place in controlled settings as has been done for training for surgery (Seymour et al., 2002) and for firefighters (Satava, 1995). Other studies have shown that psychological states in a virtual environment (VE) are similar to those in the real world (e.g.,Vincelli & Riva, 2000). The present study, currently in progress, capitalizes on the immersive nature of VR to allow for the measurement and intervention of safe sex attitudes and behaviors. Many researchers have turned to using measures of implicit, or unconscious, attitudes as the best predictor of spontaneous behavior in sensitive domains such as racism (Dovidio et al., 1997). This translates into the embodied attitudes and movements of participants in a VE. For intervention, the VR setting allow participants to safely attempt strategies for safer sex with their partner that could be personally harmful or embarrassing in the real world. Method: This study examines how simple approach-avoid attitudinal measures assessed both in the VE and on self-report measures predict safe sex behaviors. The VE for the study includes a bedroom and a bathroom in a virtual house with one user driven avatar and one computer driven agent in the appropriate gender. The VE was designed using Vizard; users interact with the VE on a head mounted display, joystick and keyboard. In that environment users control an avatar and also interact with computer agent. The main experimental tasks consist of interacting with safe sex-related items such as condoms as well as negotiating safer sex with the agent. Attitude and emotion measures are taken during the interaction with the VE as well as after the user completed the experimental tasks; distance to the object in the VE is recorded as an indirect measure of attitudes. Results: Initial pilot testing of the VE (n=19) has shown that users' responses were positive on presence and realism (4.2 and 5.0 out of 7, respectively). Ratings of the avatars indicated that participants found them moderately attractive (*M*=5.1), realistic (*M*=4.5), and expressive (*M*=4.5). Attitudinal measures indicated participants had positive attitudes toward both the VE (70 out of

100) and the avatars. Users had no problems navigating the VE, even those with minimal computer experience. Conclusion: This work extends previous research on implicit attitudes as predictors of safe sex behavior (Marsh et al., 2001), as well as the use of VR to provide a safe training environment for difficult behaviors. Future directions of this work include using the VE to condition attitudes through repeated exposures of safe sex and positive outcomes in a variety of circumstances.

Optic Flow in a Virtual Environment: Sustained Influence on Speed of Locomotion

Wendy A. Powell, Steve Hand, Brett Stevens, and Maureen Simmonds

Correspondence:
Wendy A. Powell
Department of Creative Technologies
Portsmouth University
UK
E-mail: wendy.powell@port.ac.uk

Generalised psychomotor slowing and persistent slowing of movements are frequent consequences of injury, illness, pain and ageing. Slow movements are also associated with the fear of falling. This adds to the physical burden because slow movements are relatively inefficient both in terms of time taken and energy requirement. Slow walking speeds also give rise to an inability to function effectively in the community. In recent years, rehabilitation approaches have targeted movement speed. However, an ongoing challenge with any rehabilitation approach is the need to engage and motivate patients to actively participate in their rehabilitation. Studies have shown that improvement in movement patterns and efficiency can occur with an increase in walking speed. Moreover, regular ambulation on a treadmill at speeds higher than normal overground walking speed can produce significant improvements not only in walking speed and walking capacity but also in overall physical performance (e.g. timed sit-to-stand tasks). Virtual Reality as a tool of rehabilitation can help engage patients, decrease pain and also improve movement. For example, optic flow (i.e. the expansion of an image on the retina) within a virtual environment can influence an individuals perception of movement and thus their actual movement. The sustainability of this phenomenon is not clear. The objective of this preliminary study

was to investigate whether a simple virtual environment could be used to sustain the modulating effect of optic flow on walking speed. Nine subjects, 5 male and 4 female aged between 33 and 57 (mean age 45.6) participated in this experiment. An animated Virtual Environment simulating a moving walkway was created in 3D Studio Max and rendered into a stereoscopic movie using Virtalis StereoWorks. The movie was projected (moving towards the subjects) onto a 5 meter wide screen in front of a self-paced treadmill. The movie was projected at three different speed conditions (0.75m/s, 1.5m/s (average walking speed) and 3.0m/s) in counterbalanced order. Participants walked on the self-paced treadmill and were instructed to maintain 'comfortable walking speed' throughout the 5 minute duration of each speed condition. A significant difference was found between the walking speeds of the subjects at different animation speeds (Two way Anova $p<0.01$), with lower animation speed associated with faster walking speeds and vice versa. This modulating effect was sustained for the duration of each 5-minute test, which suggests that it does have potential for use in rehabilitation and training. This preliminary study used healthy subjects, and further work is proposed to investigate the extent of this modulating effect on different patient groups.

Managing Exam Stress: The Use of Mobile Phones for Enhancing Emotion Regulation

Alessandra Preziosa, Daniela Villani, Alessandra Grassi, and Giuseppe Riva

Correspondence:
Alessandra Preziosa
Department of Pre-Clinic Science
LITA VIALBA
University of Milan, Italy
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: a.preziosa@auxologico.it

Exam anxiety is referred to students' emotional reaction to perform an exam and it may interfere with the student's ability to be successful at the university. Exam anxiety involves physical, emotional and cognitive components. All these components may be taken into account for managing and reducing exam stress. A critical issue in exam stress is learning how to regulate one's own emotion. According to Emotion Focused Therapy the emotional regulation process requires

the subject to become aware of his/her own emotions. Learning to regulate emotions means to listen to one's own physical sensations and level of arousal, to symbolize emotions and to anticipate the effects of reactions, in order to act more adaptively. Meichenbaum and Cameron proposed Stress Inoculation Training, a clinical protocol for training coping skills in stressful situations. It consists of three main phases: the first one is focused on acquiring cognitive relaxation competences on physical and psychological reactions; the second phase is based on learning coping strategies; finally the third phase exposes progressively the subject (in vivo and also in imagination) to stressful situations (in a controlled setting) in order to practice the previous acquired relaxation techniques. Starting from this background in the present study authors defined a protocol based on Stress Inoculation Training to support students in managing exam stress. The main aim of this research is to investigate the effectiveness of the clinical protocol applied to the exam stress management. More in details, authors evaluate the role played by the use of video contents (additionally to only audio contents) and of mobile devices (as compared to desktop pc) for enhancing the exam stress management. To support the training we developed both audio and video contents: audio contents consist of a narrative voice that guides the subject in the visualization process, in physical reactions recognition and in coping abilities development; video contents consist of realistic presentation of both a stressful situation (exam) and of a relaxing environment. 30 University students (Faculty of Psychology) that have to perform exam in the following week will be assessed. The protocol is composed by six sessions: session 1 and 2 are based on psycho-physiological reactions to an exam event; session 3 and 4 are based on psycho-physiological reactions and on coping strategies; session 5 and 6 present the stressful situation (exam) in order to evaluate the acquired competencies. Participants will be randomly assigned to one of the following conditions: 1. Audio + video on pc desktop; 2. Audio + video on mobile devices (mobile phones) ; 3. Audio on pc desktop; 4. Audio on mobile devices (mp3 devices). A condition with participants who do not receive any treatment will be also included.The procedure will be the same for all conditions (except the "no treatment group"): participants will be asked to have one session per day for six days before the exam's date and at the same time of the day (preferentially in the evening, when they have finished to study). Each participant will be

administered the following questionnaires: the STAI (*State Trait Anxiety Inventory*); the PANAS (*Positive and Negative Affects Schedule*); the COPE (Coping Orientation to Problems Experience); the Generalized SELF-EFFICACY scale (Jerusalem, Schwarzer, 1981). The research is in progress. Final results will be presented at the 2006 Cybertherapy Conference.

Monitoring Daily Life Using Mobile Phones: The Experience Sampling Method.

Alessandra Preziosa, Marta Bassi, Daniela Villani, Andrea Gaggioli, and Giuseppe Riva

Correspondence:
Alessandra Preziosa
Department of Pre-Clinic Science
LITA VIALBA
University of Milan, Italy
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Milan, Italy
E-mail: a.preziosa@auxologico.it

Research studies oriented to enhance knowledge about social, psychological, and physiological processes within everyday situations can greatly benefit from the contribution of Ecological Momentary Assessment (EMA) instruments, which repeatedly examine ongoing experiences through self-reports. Among them, Experience Sampling Method (ESM), developed at the University of Chicago in 1976, has been successfully applied in both psychological and medical areas. The main purpose of ESM is to examine the human beings' internal experiences (thoughts, feelings), and their contingent behaviours and context , catching the complexity of daily life. For a given time span, usually one week, participants carry an electronic device emitting acoustic signals 6-8 times a day during waking hours. At signal's receipt, participants are asked to fill out a questionnaire sheet, reporting on their current activities, location, social context, associated subjective experience, in terms of motivational, affect and cognitive components. Through this procedure, ESM overcomes some of the disadvantages of standard approaches because it does not rely on retrospective recall or data reconstruction, but rather involves on-line access and accurate reporting of information. ESM has been extensively validated in different cultures and contexts. Starting from the original format characterized by paper

questionnaire supported by signalling equipment, the ESM was thoroughly implemented on electronic devices (PDA) that bring in one all the necessary instruments for the assessment. Further ESM was assessed on the web, and using voice recorders. Each type of data collection has several advantages but also some limits. In this study, we propose mobile phones as a valid alternative technology to palmtop and hand-held computers, promoting ubiquitous and mobile computing applications [5]. In this mobile version, we followed the original ESM protocol. An acoustic signal reminds participants to fill in a standard ESM questionnaire 6-8 times per day for one week. Respondents are asked to fill out the questions using the phone's keyboard. The study assesses the usability of the ESM implementation on mobile phones. The sample is composed by 20 general population subjects, 10 males and 10 females. All respondents are tested in two sessions: one with a version of the ESM based on paper & pencil, and one with a version of the ESM implemented on 6680 Nokia mobile phones (display resolution:176x220). The order of presentation is randomized, with one group of participants starting with the paper and pencil version, and the other one with the mobile phone version. The sample is also administered the Questionnaire for User Interface Satisfaction (Italian version), and takes part in a structured interview to discuss the features of both approaches, as well as to appraise their user's satisfaction. The research is in progress. Final results will be presented at the Cybertherapy 2006 conference.

A Randomized Controlled Study of Virtual Reality Exposure Therapy and Cognitive -Behaviour Therapy in Panic Disorder with Agoraphobia

C. B. Pull, J. Cottraux, A. Berthoz, R. Jouvent, M. Zaoui, A. Pelissolo, M. C. Pull-Erpelding, L. Wouters, G. Aguayo, V. Genouilhac, A. Duinat, F. Znaidi, C. De Mey Guillard, P. Panagiotaki , F. Fanget, I. Viaud-Delmon, E. Mollard E, and F. Gueyffier F

Correspondence :
C. B. Pull
Centre Hospitalier de Luxembourg
Luxembourg
E-mail : Pull.charles@chl.lu

Panic disorder with agoraphobia is a frequent and disabling disorder occurring in up to 4% of the general population. Treatment modalities include medication (with selective serotonine reuptake inhibitors or benzodiazepines) and cognitive-behavioral therapy (CBT). A major component of CBT for panic disorder with agoraphobia is progressive and sustained exposure to situations that individuals with the disorder are afraid of. Traditionally, exposure therapy consists in confronting feared stimuli first "in imagination" and then in the real world. Virtual reality exposure therapy or VRET is an exposure "in virtuo" that may be conceptualized as an exposure in between imagination and reality. Reviews on the use of Virtual Reality Therapy (VRT) in panic disorder with or without agoraphobia can be found in a recent book by Wiederhold and Wiederhold (2005) and in a recent paper by Pull (2005). The study presented here is an ongoing investigation involving the Collège de France and three university hospitals (in Luxembourg, Lyon and Paris). It is a randomized controlled trial comparing the efficacy of traditional CBT, VRET, and a waiting list in patients meeting DSM-IV criteria for panic disorder with agoraphobia. Patients taking psychotropic medication other than valeriane are excluded, as are patients having a score of 17 or above on the Hamilton Depression Rating Scale. Patients who are eligible for the trial receive a two-page information leaflet and sign an informed consent form. Patients in the waiting list are randomized to either of the two active treatments at the end of three months. Follow-up is one year from the date of entry. CBT and VRET are given in 12 sessions of 90 minutes duration. Both types of treatment are provided by the same clinicians who are experienced therapists. CBT includes respiratory control, cognitive restructuring, exposure in imagination to anxiety provoking scenes and interoceptive exposure to anxiety-related physical sensations, and homework involving exposure to real-life situations. VRET includes exposure to 12 virtual environments (taking a subway, walking in a tunnel, taking an elevator, shopping in a supermarket, driving a car on a lonely country road, travelling by plane, entering a movie theatre, driving a car in a city, driving a car in a tunnel, travelling by bus, walking in a crowd, being caught in a sensorial conflict provoking a feeling of derealisation). Virtual environments were created at the Collège de France. VR environments are presented using a head mounted display and tracking head movement (Kaiser Pro view 60 ™). Participants are guided through the VR environments by the therapists. Treatment techniques and guidelines for each CBT or VRET session are described in

detailed manuals. Patients are assessed using a number of rating scales, behavioural tests, and neuro-psychological instruments. The main outcome criterion is a decrease of 50 % decrease of the baseline agoraphobia score on the Fear Questionnaire. By the end of 2005, 90 patients had been included in the project. The design of the study, the methodology upon which it is based, the assessment instruments, the technical and methodological difficulties encountered in the trial, as well as first results will be presented at the conference.

Differences in Presence and Reality Judgement Using Different Display Devices in a Clinical Population

Soledad Quero, R.M. Baños, C. Botella, S. Salvador, A. García-Palacios, and C. Perpiñá

Correspondence:
Soledad Quero
Universidad Jaume I.
Castellon, Spain
E-mail: squero@psb.uji.es

Most authors researching on virtual reality (VR) field agree to consider presence as a multi-component construct determined by two general categories of variables: media characteristics and user characteristics (e.g., Barfield, Zelter, Sheridan, & Slater, 1995). Nevertheless, as we have pointed out in previuos studies (e.g., Baños, Botella, Alcañiz, Liaño, Guerrero, & Rey, 2004), in the user-environment binomial a central role has been given to the media and most of efforts have been devoted for the porpouse of increasingly generate sophisticated technologies to augment the sense of presence. From this approach the role of variables like immersion, interaction and perceptual realism in the sense of presence have been overemphasized leading even, some times, to erroneously define presence as a direct function of immersion (Schubert, Friedmann, & Regenbrecht, 2001). However, it has been stated that the sense of presence is a subjective experience in which the person's characteristics have something to do. In fact, many authors relevant in the field (Biocca, 1997; Schubert, Friedmann & Regenbrecht, 2001) consider that a person feels present in a environment when his/her cognitive processes lead to a mental representation of a space, where the person locates him/herself. Therefore, not only media form characteristics but also users characteristics and

media content characteristics should be taken into account. As for media content, previous studies (e.g., Emmelkamp, Bruynzeel, Drost, & van der Mast, 2001) have proven that VR therapy is effective for clinical (mental health) participants by using a relatively cheap hardware and software on stand-alone computers currently in the market. Also several works carried out by our group (e.g., Baños et al., 2004; Baños, Quero, Salvador & Botella, 2005) showed that in clinical populations the user characteristics and the media content seems to play a central role in the sense of presence rather than the formal contents. All these studies support the impact that emotions and clinically significant environments that are relevant to the person have on presence and the reality atribution of users. Therefore, this work examines the differences in sense of presence and reality judgement made by a clinical population suffering from different anxiety disorders. The sample (N=114) included several specific phobias and panic disorder with or without agoraphobia. Three different conditions were used: (1) Immersive virtual reality using a head-mounted display (HMD); (2) Desktop virtual reality using a PC monitor; and (3) videos of different audiences that simulate social situations (e.g., a tribunal, a classroom) using a PC monitor. In order to measure sense of presence and reality judgement, the 7-factor Presence and Reality Judgment Questionnaire (Baños et al., 2005) was used. Results indicate that there are no statistically significant differences in "emotional involvement" and "reality judgement and presence", finding differences in the factors regarding interaction, quality of the software, software easiness and satisfaction with the experience.

The VMall as an Intervention Tool for Stroke Rehabilitation

Debbie Rand, Noomi Katz, and Patrice L. (Tamar) Weiss

Correspondence:
Debbie Rand
Department of Occupational Therapy
University of Haifa
Haifa, Israel
E-mail: drand@univ.haifa.ac.il

Virtual environments have been used with stroke patients as a mean of therapy to decrease motor (e.g., Broeren, et al., 2004) and cognitive impairments (e.g., Brooks, & Rose, 2003; Katz, et

ál., 2005). Other environments (e.g., Gourlay, et al., 2000) have been used to enhance participation in activities of daily living (ADL) These environments typically support therapy aimed at improving various abilities (motor or cognitive or meta-cognitive) or daily activities rather than incorporating functionally relevant tasks that require the individual to contend simultaneously with abilities in all three areas. The objective of this paper is to present the results of an initial intervention study which examined the effectiveness of a virtual supermarket (VMall) for the assessment and treatment of motor and executive function deficits following stroke. Seven participants, aged 53-73 years, participated in the study. Five were at a sub-acute stage of rehabilitation (5-9 months post-stroke) and two were at a more chronic stage (27 and 96 months post-stroke). All were relatively independent in Basic ADL but were generally dependant in Instrumental ADL. Three patients had a motor deficit only and four patients had a primary deficit in executive functions (with a mild – moderate motor deficit of their affected upper extremity). The VMall is a virtual large supermarket programmed as an application within GestureTek's Gesture Xtreme (GX) video-capture VR system. The performance of the shopping task provides multiple opportunities to make decisions, plan strategies and multitask, and the various functions (e.g., buying groceries) are activated by using upper extremity movements, mainly of the affected side. Outcome measures included the time to perform and number of mistakes made during a 4-item shopping task within the VMall, a test of executive functioning, the Multiple Errands Task (MET) in the VMall and a real shopping mall, and three assessments of motor functioning including the Fugl-Meyer Motor Assessment, the Wolf Motor Function Test and an ADL questionnaire regarding the number of tasks performed using both hands. A series of single intervention case studies (using an A-B-A design) was used to assess the effectiveness of treatment using the VMall. The intervention phase consisted of 10 sessions over a period of three weeks using both the VMall and other GX game applications. Participants were tested two weeks before and immediately prior to the intervention and immediately following the intervention as well as two weeks post-intervention. The number of mistakes made while performing the MET in both the VMall and a real shopping mall decreased following the intervention for the patients who suffered from executive functions deficit. Participants who suffered primarily from a motor deficit showed improvement in their motor ability and for two of the three subjects there was functional improvement in the affected upper extremity and an increase in the number of daily life tasks performed using both hands. The VMall appears to provide motivating, meaningful and ecologically valid tasks suitable for stroke intervention aimed at both active movement of the weak upper extremity and the use of executive functions.

An Analog Study of Simulation Trauma Severity: Sensitivity of 'Bus-World' for VR Exposure Therapy

Ayelet Reisberg, Patrice L. (Tamar) Weiss, Azucena Garcia-Palacios, Hunter Hoffman, Eli Somer, and Naomi Josman

Correspondence:
Ayelet Reisberg
Laboratory for Innovations in Rehabilitation Technology
Department of Occupational Therapy
University of Haifa
Mount Carmel, Haifa 31905 Israel
E-mail: ayreis@zahav.net.il

Terrorism evokes a fundamental sense of helplessness. It is estimated that for every physical injury during a terrorist attack, between 10 and 13 people suffer emotional trauma. Typical reactions to terrorism include a wide range of emotional (e.g., shock, fear, anger, depression) and physical (e.g., headache, nausea, sleeplessness) reactions known as 'acute stress reactions'. One out of every four victims does not recover naturally, and may develop an Acute Stress Disorder, eventually resulting in a full-blown Post-traumatic Stress Disorder (PTSD). Cognitive-behavioral therapy involving exposure therapy is an effective treatment for this disorder (Cahill & Foa, 2004). In recent years, Virtual Reality (VR) has been successfully implemented in the treatment of PTSD to conduct exposure to the trauma memories (Hodges, et al., 1999; Difede & Hoffman, 2002). VR treatment enables the exploitation of patients' imagery ability, supplemented by potent visual and auditory computer-simulated stimuli. The sensory-rich virtual environment generates an evocative therapeutic experience which may intensify their personal emotional involvement, even for patients who are reluctant to recreate their traumatic experiences. We developed BusWorld, a simulation of a terrorist suicide bus bombing attack in Israel designed to provide VR-based exposure

therapy to people suffering from PTSD (Josman, Garcia-Palacios, Reisberg, Somer,Weiss, & Hoffman (in press), Josman, Somer, Reisberg, Weiss, Garcia-Palacios, & Hoffman, (in press).The severity of trauma provided by the simulation has been graded from Stage 1 (views of a public bus stop with the usual urban din of voices and sounds) through to Stage 12 (view of the bus exploding, flames, bus and body parts strewn all over, real voices of people screaming and emergency vehicle sirens). The objective of this paper is to present the results of an analog study that investigated the physiological and subjective reactions of healthy individuals to this virtual environment in order to evaluate its ability to provide exposure to successively more severe levels of trauma. Thirty volunteers aged 23 to 63 years, without a history of past or present PTSD were tested. The participants were exposed for 90 s to each of four graded stages of Bus-World (Stages 1, 2, 5, and 12). Immediately following each exposure, heart rate was measured and the participants were asked to rate their Subjective Units of Discomfort (SUDs) and to complete the Short Feedback Questionnaire, an abbreviated version of Witmer & Singer's (1998) Presence Questionnaire. All of the outcome measures differed significantly with respect to the severity of simulated trauma. In some cases (e.g., heart-rate) the differences were small from a functional point of view. In other cases (e.g., SUDs, presence) the differences were large and correlated positively with the severity of the simulated trauma; both anxiety and presence increased with the severity of exposure. The results of this analog study have verified the ability of BusWorld to provide graded exposure to trauma for use in VR-based exposure therapy for individuals suffering from PTSD due to suicide bus bombing. The discussion will focus on the importance of conducting analog research as a first step for studies with PTSD clients.

Morphing Sexual Characters: Unlimited Generation

Patrice Renaud, Jean Proulx, Joanne-Lucine Rouleau, John Bradford, Paul Fedoroff, and Stéphane Bouchard

Correspondence:
Patrice Renaud
Université du Québec en Outaouais
Institut Philippe-Pinel de Montréal
Hexagram: Institut de recherche/création en arts et technologies médiatiques
E-mail: patrice.renaud@uqo.ca

A series of realistic, interactive and virtual 3D characters depicting different age brackets, racial types and secondary sexual features will be presented. These characters and their emotional expressions are produced from a generic morphing principle. By resorting to this principle, it is possible to create characters adapted to very specific research and clinical needs such as those of sexual preference assessment. This research is done in collaboration with Darwin dimensions.

User-Centered Design Driven Development of a VR Therapy Application for Iraq War Combat-Related Post Traumatic Stress Disorder

Albert "Skip" Rizzo, Ken Graap, Jarrell Pair, Joseph Nunn, Matthew Liewer, Anton Treskunov, Michael Roy, JoAnn Difede, and Barbara Rothbaum

Correspondence:
Albert "Skip" Rizzo
University of Southern California
E-mail: arizzo@usc.edu

In 1997, researchers at Georgia Tech released the first version of the Virtual Vietnam VR scenario for use as a graduated exposure therapy treatment for PTSD in Vietnam veterans. This occurred over 20 years following the end of the Vietnam War. During that interval, in spite of valiant efforts to apply traditional psychotherapeutic approaches to PTSD, the progression of the disorder in some veterans severely impaired their functional abilities and quality of life. Prior to the availability of VR therapy applications, the existing standard of care for PTSD was *imaginal* exposure therapy. Such treatment typically involves the graded and repeated imaginal reliving of the traumatic event within the therapeutic setting. This approach is believed to provide a low-threat context where the patient can begin to therapeutically process the emotions that are relevant to the traumatic event as well as de-condition the learning cycle of the disorder via a habituation/extinction process. While the efficacy of imaginal exposure has been established in multiple studies with diverse trauma populations, many patients are unwilling or unable to effectively visualize the traumatic event. Virtual Reality offers the ability to systematically deliver relevant stimuli to clients in order to address this problem. We have initiated a project that is

creating an immersive virtual environment system for the treatment of Iraq War military personnel diagnosed with combat-related PTSD. Thus far we have created a series of virtual scenarios designed to represent relevant contexts (two city types and a desert road convoy) required for this treatment to be conducted in VR. That is the easy part. The real challenge exists in building a *platform* that gives a clinician, who may have no programming knowledge, the capacity to control the stimulus environment in both *real time* and *offline* between sessions. For real time delivery of stimuli, we have created a "wizard of oz" type clinical interface that lets a clinician or researcher easily introduce visual, auditory, tactile, olfactory and thermal stimuli while the client is in the environment. This interface allows the therapist to gradually introduce and control "trigger" stimuli in the environment in real time as is required to foster the anxiety modulation needed for therapeutic habituation. A more complex offline environment editing interface has also been developed which allows a clinician to substantially modify the activity and look of the environment between clinical sessions. In our view, these interfaces are essential elements for providing state of the art VR exposure in a sound and ethical manner, as opposed to a "one-size-fits-all" approach. User-Centered tests are currently underway at the Naval Medical Center–San Diego, Camp Pendelton and within an Army Combat Stress Control Team in Iraq. This feedback with non-diagnosed personnel is providing information on content and usability that is feeding our iterative design process. A clinical trial version of the platform built from this process will be tested with PTSD-diagnosed personnel beginning in April 2006 and data from the user centered design trials and from initial observations from the clinical trial will be presented at CyberTherapy.

Using Virtual Reality for Cue Exposure in Treatment for Crack Cocaine Addiction: An Open Trial and Manual Development

M. Zachary Rosenthal, Stephen B. Baumann, and Thomas R. Lynch

Correspondence:
M. Zachary Rosenthal
Duke University Medical Center
E-mail: rosen025@mc.duke.edu

Despite experimental findings supporting the use of cues to induce and extinguish cocaine cravings, treatments using cue exposure for cocaine addiction have not demonstrated efficacy. One particular problem related to cue exposure treatment is reliably re-creating conditioned responding and extinguishing cravings to a variety of conditioned stimuli. Consistent with the mission of Stage 1 behavioral treatment development research (Rounsaville, Carroll, & Onken, 2001), the aims of this project are to develop and manualize a virtual reality (VR) based cue exposure intervention for use as an adjunctive treatment in substance abuse counseling. During Stage 1a, the VR technology will be developed and refined using two small open clinical trials (N = 20). At the conclusion of Stage 1a, a treatment manual detailing the rationale and parameters of the VR technology will be completed. Next, a Stage 1b pilot randomized clinical trial (N = 40) will be conducted in order to determine the acceptability and feasibility of this treatment to patients and therapists, and to obtain treatment outcome effect size estimates. This study is currently in Stage 1a. The VR simulation has been refined iteratively using focus groups and open trials. Several environments have been created using the Source game development engine from Valve, the makers of Half-Life2. These consist of a crack house, an apartment, a bar/restaurant and an outdoor, urban street-scene that interconnects the interior environments. All of the characters and many of the models are available for placement in the virtual world through a drag-and-drop interface that allows the experimenter to configure the software before a therapy session with a variety of models, characters and interactions appropriate for the individual client at their stage of therapy. For example, initial treatment sessions for crack cocaine might have only an empty crack house, but in later sessions the crack house might contain many models of drug paraphernalia and characters smoking or dealing crack. These configurations can be saved for later editing and use with other clients. Thus, the VR platform is flexible and can be individually tailored to maximize treatment response. In the first 4 weeks of data collection, we have enrolled 7 participants who meet full diagnostic criteria for cocaine dependence. Self-report and psychophysiological measures of craving are being obtained as participants undergo 10-12 VR sessions as an adjunct to weekly drug counseling. The initial data suggest that (a) the VR environments are capable of eliciting cravings to use cocaine in all participants, (b) there are individual differences in the intensity of cocaine-related cues needed to induce craving, and (c) repeated exposure leads to habituation to cues that initially induced high cravings. The treatment

manual is being written contemporaneously, and by June we expect to have completed one open trial and have begun a second open trial. For this poster, the first wave of clinical data (e.g., craving) will be presented, along with an overview of the process, VR platform, and feedback from participants.

Randomized Controlled Trial of CBT with Virtual Reality Exposure Therapy for PTSD

Michael J. Roy, Wendy Law, Ivy Patt, JoAnn Difede, Albert Rizzo, Kenneth Graap, and Barbara Rothbaum

Correspondence:
Michael J. Roy
Uniformed Services University of the Health Sciences
Bethesda, MD
E-mail: mroy@usuhs.mil

We describe a study for which we are currently securing funding and IRB approval. Background: Posttraumatic stress disorder (PTSD) is a common reaction to traumatic events ranging from war to personal assaults. A recent study identified PTSD in nearly 13% of U.S. Army veterans returning from Operation Iraqi Freedom, echoing our findings in U.S. Desert Storm veterans. Untreated or undertreated PTSD is linked to higher rates of depression and other psychological conditions, poorer physical health, missed work, impaired function at work and home, and higher healthcare costs: in 1998 in the U.S. alone, PTSD and related anxiety disorders were estimated to cost $63 billion. PTSD is relatively resistant to therapy, with even first-line treatments failing half the time. Cognitive behavioral therapy (CBT) with exposure therapy is the preferred non-pharmacologic therapy, but traditional exposure therapy requires that the patient recount their trauma repeatedly to their therapist (imaginal exposure), which is often inherently difficult, as avoidance of reminders of the trauma is a cardinal feature of PTSD. Virtual reality (VR) can overcome this obstacle, enabling therapist-guided exposure to progressively more intense trauma-associated stimuli. VR exposure therapy (VRET) has shown efficacy for other anxiety disorders, particularly phobias. Some of our co-investigators documented improvement in an open trial of Vietnam War veterans with PTSD. More recently another co-investigator documented significant improvement in World Trade Center workers after 9/11/01, with CBT/VRET compared to waitlist controls. The "Virtual Iraq" environment is the most realistic and sophisticated yet applied to PTSD treatment, adapted from the Microsoft® X-box game Full Spectrum Warrior. It is being used in an open trial of PTSD at the Naval Medical Center San Diego, but it is critical to make blinded comparisons in controlled studies. Objective: To compare the efficacy of 12 weeks of CBT/VRET vs. supportive psychotherapy in conjunction with a relaxation virtual environment, with blinded outcome measures. We hope that this design will serve two purposes: first, to establish a feasible control for CBT/VRET, and second, to give us an initial measure of the efficacy of CBT/VRET. Ultimately, we hope to conduct a trial of CBT/VRET vs. pharmacotherapy in a 2X2 design to assess whether combination therapy is more effective than either alone. Methods: Combat veterans will be screened for PTSD at Walter Reed Army Medical Center, Washington, DC and National Naval Medical Center, Bethesda, MD. Twenty-six who provide informed consent and meet eligibility criteria will be randomized to CBT/VR sertraline or supportive psychotherapy/relaxation VR. An experienced psychotherapist will conduct therapy for both arms, for 12 weekly sessions. A blinded, independent investigator will assess response to therapy, with the gold standard Clinician-Administered PTSD Scale (CAPS) used to compare change from baseline for each arm as well as direct comparisons between the two arms.

Evaluating the Interaction of Blind Learners with Audio-Based Virtual Environments

Jaime Sánchez, and Mauricio Zúñiga

Correspondence:
Jaime Sánchez
University of Chile, Department of Computer Science, Santiago, Chile
E-mail: jsanchez@dcc.uchile.cl

Most interactive virtual environment tools are designed with a visual interface without considering the possibility to be accessed by users with visual disabilities. We study efficient ways to integrate these tools to the non visual community to improve their education and adaptation to the real world. In past audio-based projects evaluation measures using usability questionnaires, cognitive tasks and anecdotic forms to register the interaction with virtual environments have been implemented. In particular, when evaluating the interaction with a virtual world in groups of blind

users it is almost impossible to register most critical events. For this reason it is critical to design a system to support usability problems, issues detection, and help to better measure the cognitive impact on the users. Different studies have demonstrated that audio signals can help to create virtual environments that can be mentally represented by users with visual disabilities. Actually not all virtual environments can be mentally represented by these users independently of their complexity and the time of interaction. To study this issue we have implemented software to process the data and information produced during the interaction to recreate interactions through simulations, to draw relevant graphics, and to visualize the information from different point of view. This can help to observe with detail a specific interaction session and to process information of various sessions to analyze issues and long term goals. Likewise this allows identifying usability issues and to gather information about cognition. The only requisite is that the software has to allow automatic backups of the data produced during interaction according to a preestablished format. In this study we worked with AudioDoom2, a revisited version of the known software AudioDoom [developed in 1997. This new version considers features such as automatic saving of login files that contain information about the behavior of users during interaction. It also considers uploading new maps and labyrinths from external files. This allows more freedom to study different maps in accordance with the needs of the study. As a result we have observed and studied more fully and accurately different types of mental representation and the complexity of virtual environments navigated by the blind users and thus helping us to define the degree of complexity of a virtual environment (basic, middle, advanced), to create a progressive work plan to help users to increase their auditory perception (audio memory, fidelity, and audio discrimination), and to understand some geometric issues such as the shorter distance to be attained and symmetry. The study has shown that not all virtual environments are represented with high fidelity by users with visual disabilities. We have learned about the characteristics that make a virtual environment to be complex or simple. We need to study when a virtual environment becomes complex based on auditory perception skills of users. Finally, the use of our software will help to identify differences between novice and experts users in their cognitive representation of different labyrinths within the software.

Virtual Reality Intervention for Chemotherapy Symptoms

Susan M. Schneider

Correspondence:
Susan M. Schneider
Duke University
Durham, North Carolina
E-mail: Susan.schneider@duke.edu

PURPOSE: Successful completion of chemotherapy offers a greater chance of tumor non-recurrence and long-term quality of life. However, many patients have difficulty adhering to the prescribed regimen because of related symptoms. Virtual reality (VR) provides a distracting, immersive environment, which blocks out competing stimuli, ameliorates chemotherapy symptoms, and thus, helps patients tolerate their chemotherapy regimen. This study explored VR as a distraction intervention to relieve symptom distress in outpatients receiving chemotherapy and to determine the post-treatment effect on symptom distress after 48 hours. METHODS: Lazarus and Folkman's Stress and Coping Model identifies interactive distraction as an emotion-focused coping strategy utilized by individuals experiencing a threatening situation. VR is an immersive and interactive intervention, which engages several senses simultaneously. Study participants used a head mounted display (i-Glasses SVGA 3D) to display encompassing images and block competing stimuli during chemotherapy infusions. A crossover design was used to determine whether VR was effective in reducing chemotherapy-related symptom distress in patients and whether the effects last for two days. 123 adults receiving chemotherapy for breast, colon, or lung cancer at Duke University Comprehensive Cancer Center were randomly assigned to receive VR during one chemotherapy treatment and no VR (control) during an alternate treatment. The Adapted Symptom Distress Scale-2, the Revised Piper Fatigue Scale and the State Anxiety Inventory measured symptom distress. All instruments have demonstrated reliability and validity in this population. RESULTS: Evaluation of the intervention indicated that patients thought the VR was easy to use, they experienced no cybersickness, 86% liked the VR intervention, and 82% would use VR again. Patients had an altered perception of time (p<.001) when using the VR, validating the distracting capacity of the intervention. However, analysis demonstrated no significant differences in symptom distress

immediately or two days following chemotherapy treatments. Patients stated that using the VR seemed to make treatment time shorter and that chemotherapy treatments with VR were better. However these positive experiences did not result in a decrease in symptom distress. CONCLUSION: Findings support the notion that using VR can help make chemotherapy treatments more tolerable, but clinicians should not assume that use of VR will improve chemotherapy related symptoms. ACKNOWLEDGEMENT OF FUNDING: This study was funded by the Oncology Nursing Foundation through an unrestricted grant from Ortho Biotech Products, L.P. and Duke University Medical Center.

Injecting Emotive Content into Medical Simulation: Behavioral Health and Beyond

CDR Russell Shilling

Correspondence:
Russell Shilling
U.S. Naval Research Laboratory
E-mail: russell_shilling@nrl.navy.mil

The use of videogame technologies for mainstream military simulation has increasingly gained acceptance in both the operational and medical communities. In 2004, the Office of Naval Research (ONR) initiated programs using videogame technology to treat acute Post-Traumatic Stress Disorder (PTSD) in active duty personnel returning from Iraq and Afghanistan. The Army's Telemedicine and Advanced Technologies Research Center (TATRC) is currently collaborating with ONR to expand this research into new realms. TATRC and the Naval Research Laboratory (NRL) are also embarking on projects to use gaming technologies to revolutionize military medical care, pandemic planning, medical training, and are also exploring the possibilities of developing innovative techniques for "inoculating" against the effects of acute stress. ONR is currently working with Texas A&M – Corpus Christi to develop an advanced healthcare training application based on videogame technology that will provide accredited training for healthcare professionals. As a first step in this project, the Trauma Center at the National Naval Medical Center in Bethesda, MD has been modeled. The theme that binds these various programs together is the use of entertainment technologies to inject emotional content into simulation. During this talk, a detailed analysis of

the current VR-based behavioral health programs will be provided. Additionally, the various medical simulation initiatives will be summarized in the context of the "Serious Games" initiative and a vision for the future synergy of military simulation and the videogame industry will be discussed.

Development of a Virtual Reality-based Power Wheelchair Simulator

Ajay Sonar, James Carroll, George Fulk, Christopher Wood, and Janice Searleman

Correspondence:
James Carroll
Clarkson University
Potsdam, NY
E-mail: jcarroll@clarkson.edu

For many individuals with physical and/or cognitive disabilities, the assistive technology provided by a power wheelchair (PWC) offers the means for independent mobility thereby improving their ability to participate in society. Despite the independence afforded by a PWC, third party payers are often reluctant to purchase a PWC for those individuals until the person can demonstrate the ability to operate it independently. This creates a classic "catch-22" scenario whereby an insurance company won't purchase a PWC unless the individual can operate it independently, but the individual does not have the opportunity to demonstrate this ability because they don't have access to a PWC. Additionally, current methods used to teach an individual to use a PWC are inefficient and potentially unsafe. Ideally a large space is required with different environments to train in. Those users who are new to a PWC may find it difficult to initially operate the wheelchair since they may not have inadequate cognitive and/or physical ability to effectively and safely control the device. The Virtual Reality-based Power Wheelchair (VRPWC) simulator presented here may offer an alternative way to train individuals to use a PWC and provide objective data on the client's ability to successfully operate a PWC independently. The proposed VRPWC offers potential benefits over traditional PWC training methods. For example, the associated VE can be made easier to maneuver through at first, with the difficulty/realism increasing as the clients ability improves. Additionally, the VRPWC simulator can provide quantitative data on the client's performance that can be used to document change and capacity to independently operate a PWC,

e.g., for insurance purposes. The developed VRPWC system provides the user with realistic visual and kinesthetic feedback that is highly immersive. A six degree–of–freedom Stewart platform (a form of parallel robot) with a turntable at the end-effector serves as a motion base capable of providing large scale haptic feedback to a user seated in a manual wheelchair mounted on the turntable. The user wears a stereoscopic head-mounted display (HMD) that presents a real-time virtual environment (VE) that can be navigated using a standard PWC control device, e.g., a joystick or puff-and-sip device. A slave computer mounted on the motion base communicates wirelessly with a stationary master computer that generates the visual data for the HMD as well as the control signals required to servo the motion base and provide realistic kinesthetic feedback. The VE and dynamics of the wheelchair are simulated using a software package called Virtools while the real-time control of the motion base is implemented using Matlab/Simulink. The resulting experimental setup is a first step towards the development of a system capable of generating realistic haptic feedback for PWC simulation. The accuracy of the system has been tested in terms of wheelchair stability and found to compare favorably with other published results.

Does Virtual Reality Motivates Children to Do Exposure?

Julie St-Jacques, Stéphane Bouchard, and Claude Bélanger

Correspondence :
Julie St-Jacques
Université du Québec en Outaouais
Université du Québec à Montréal
Canada
E-mail: juliestjacques@netscape.net

Anxious disorders are highly prevalent among children and adolescents, and specific phobia appears in the forefront. Exposure-based treatments are the most effective interventions for anxiety disorders in children, but motivation and compliance with exposure is often an issue with this population (Rapee et al, 2000). In order to make therapy less aversive to a child and his relatives, to increase compliance as well as decreasing the drop-out rate, virtual reality exposure (*in virtuo* exposure) offers an interesting alternative to *in vivo* exposure. The first objective

of this study is to assess if a combined treatment with mostly *in virtuo* exposure motivates children suffering from arachnophobia to complete their treatment, compared to a traditional treatment consisting only *in vivo* exposure. The secondary objective is to document the efficacy of both treatment methods. In this randomized control trial, 31 participants aged between 8 and 12 years old are randomly assigned to one of two treatment conditions: *in vivo* exposure or *in virtuo* exposure. The treatment is divided in two parts in order to assess to comparative and additive effects of both exposure methods. The first part lasts four sessions and consists of *in virtuo* exposure or *in vivo* exposure (according to the condition they are assigned to). The second part consists of one *in vivo* exposure session for all children, no matter which condition they are assigned to. The addition of one *in vivo* session to the VR treatment allows to consolidate treatment gains and see whether VR facilitates the introduction of *in vivo* exposure. Measures of interest and motivation are taken at each week for the entire duration of the treatment, while efficacy measures are taken at pretest, after the end of each part of the treatment and at a 6-month follow-up. The results show that children having received *in virtuo* exposure don't have a higher level of motivation toward their treatment and do not comply more to exposure than those who received *in vivo* exposure alone. As for treatment's efficacy, the results show that adding one in vivo session is useful to boost treatment success in children who undergo *in virtuo* exposure. These results have important clinical implications concerning motivation of children in therapy. They are discussed in the light of how to present *in virtuo* exposure to children, who may be more apprehensive toward VR exposure than adults.

The Usefulness of Virtual Reality Stress Inoculation Training for Military Medical Females

Melba Stetz, Brenda K. Wiederhold, and Robert Wildzunas

Correspondence:
Melba Stetz
United States Army Aeromedical Research Laboratory (USAARL)
Fort Rucker, Alabama
E-mail: melba.stetz@us.army.mil

Warfighters face stressors such as sleep deprivation, information overload, exposure to injuries/dead bodies, and anxiety for the welfare of fellow warfighters and family left behind (Lukey, Stetz, & Romano, 2005). Consequently, many warfighters are being medically evacuated out of theater due to psychological stress (Stetz et al., 2005). Researchers as COL Hoge et al. (2004) have recently reported that approximately 18% of warfighters returning from Iraq and 11% returning from Afghanistan (n = 6, 201) screened positive to Post Traumatic Stress Disorder (PTSD). PTSD is a debilitating condition resulting from experiencing trauma, characterized by continuous memories of the traumatic experience (National Center for PTSD, 2005). Military medical personnel are not immune to stress and have a challenging and demanding dual role — that of a warfighter and a first responder. In fact, Deahl (2000) found that many first responders report serious psychological distress, including PTSD. Even though many researchers are studying warfighters' stress (Stetz, Stetz, & Bliese, in press; Britt, Stetz, & Bliese, 2004), there is still a gap in the literature on studies with (1) support personnel (i.e., medics) and (2) females. During a recent interview by Elias (2005), a researcher from COL Hoge's group, also reported finding no statistically significant PTSD symptoms difference between males (11%, n = 300) and females (12%, n = 50) in a sample of warfighters holding violence-prone support jobs (i.e., medics). On the other hand, Foa, Davidson, and Frances (1999) had previously reported that approximately 20% of females and 8% of males who had been exposed to traumatic events did develop PTSD symptoms. Furthermore, some researchers suggest that females might be less likely to be exposed to adverse stressful events but more likely to develop PTSD, if exposed. Thus, an overall increased prevalence of PTSD in females (10% vs. 5% in males, see Kessler et al., 1995) can be accounted for by a significantly greater vulnerability to develop PTSD after exposure. Females also seem to have a longer course of illness than males with a median time to remission being 35 months for females compared to 9 months for males (Breslau et al., 1997). The purpose of this study is not to identify which gender is more prone to PTSD. However, given the premise that males typically grow-up being exposed to more stressful situations than females (i.e., teasing each other, playing rough sports, see Murray, 1999), and the lack of studies on female warfighters (especially, in the medical field), we propose to test the effectiveness of stress inoculation training (SIT) for military medical females. SIT proposes that repeated exposure in stressful, but controlled conditions (i.e., via virtual reality) enables individuals to gradually adapt to stressors and learn how to cope (Wiederhold, Bullinger, & Wiederhold, 2005; Driskell & Johnston, 1998). By conducting virtual reality SIT, or "VR-SIT", the stressors can be applied systematically and paced appropriately for each individual. Our VR-SIT study is currently underway and preliminary findings will be presented at the 2006 CyberTherapy Conference in Canada.

Computer Simulated Standardized Patients for Training Health Professionals on Chemical and Biological Agent Exposures

Debbie L. Sticha, LTC Michael J. Roy, and Dale E. Olsen

Correspondence:
Dale E. Olsen
SIMmersion LLC
Columbia
E-mail: Dale.Olsen@SIMmersion.com

Research Status: Research is being performed in response to the Army's Telemedicine and Advanced Technology Research Center's SBIR to prepare the medical community for bioterrorism. This collaborative effort involves a small business [SIMmersion™], Uniformed Services University of Health Sciences [USUHS], and the National Capital Area Medical Simulation Center [SIMCEN]. The start date for Phase II research is Spring 2006. Background: Biological and chemical warfare agents such as smallpox, anthrax, and sarin are candidates for use in terrorist attacks because they have the potential to create widespread panic with serious medical and economic consequences. Since these agents are unlikely to be encountered in events other than terrorist attacks, most healthcare professionals have had negligible preparation for the diagnosis and treatment of medical conditions caused by such agents. A variety of means have been explored to adequately prepare health professionals to care for patients exposed to these agents. We have previously published a book, *Physicians' Guide to Terrorist Attack*, and a series of case-based booklets for Continuing Medical Education, which address a broad spectrum of chemical and biological agents. While these resources have been well-received and should benefit many, others learn less effectively by this static approach

or may be less inclined to read this material. We have also conducted hands-on training at medical meetings, during which standardized patients [SPs] simulate exposure to biological and chemical agents. Attendees have the opportunity to learn by interviewing and examining patients, as well as by participating in mock, mass-casualty exercises, followed by discussion. While this approach greatly enhances retention of material, it is very resource-intensive; each time it is conducted, it requires large numbers of personnel, training, and supplies. Methods: SIMmersion's expertise is to develop interactive computer-based simulations featuring characters with whom trainees can hold detailed, unpredictable conversations. These simulations can be used to effectively meet practical training objectives and require only a computer to operate. The partnership between SIMmersion, SIMCEN, and USUHS has produced an interactive, computer-based educational program that enables many users to learn to evaluate patients with potential biological and chemical exposures. The initial, prototype model addresses smallpox and uses chicken pox and Rocky Mountain spotted fever as alternative diagnoses. The realism of the interaction between the trainee and the computer simulated SP is attributed to speech-recognition software, filmed responses of an actor moulaged to depict a character with one of the aforementioned medical conditions, and responses that reflect the user's interaction with the simulated patient over time. Trainees can play the module many times with broad variation based on both chance and statement selection. Results & Conclusions: Anecdotal evidence indicates that the training is extremely engaging and that the use of highly interactive role-play simulations improves training effectiveness and "boost[s] learning retention rates dramatically"[1]. Future research will assess the effectiveness of this simulation technology to train with computer SPs. Discussion: Topics that match well with SIMmersion's simulation capabilities include diagnosis of depression, PTSD, alcoholism, or drug abuse, as well as grievance counseling, marriage counseling, and suicide intervention.

Low-Cost Telerehabilitation Using Force Feedback Joysticks

Heidi Sugarman, Joseph Tiran, Arnon Lauden, Aviva Weisel-Eichler, and Ehud Dayan

Correspondence:

Heidi Sugarman
Ono Academic College
Kiryat Ono, Israel
E-mail: hsugarman@hakirya.ac.il

Background/Problem: In recent years, many researchers have investigated the use of computerized mechanical devices to automate movement therapy for neurological conditions. Robotic therapy has been found to significantly improve the movement ability of the affected upper limb in stroke patients. However, most of these systems are expensive and not suitable for home use. We have followed the lead of inexpensive systems such as the Java Therapy System, and are developing a low cost robotic system - The Jerusalem Telerehabilitation System - using a commercially available force feedback joystick, an ordinary home PC and a standard high-speed internet connection. As a preliminary test of our system, we conducted a pilot usability trial with several subjects after stroke or head trauma. The goal was to see if the subjects were able to use the system, and to examine the nature of the data obtained from the trials. We also conducted a usability study with two physiotherapists to test the system for clarity, reliability, and ability of the therapists to run the system independently. Methods/Tools: Using the joystick, the patient performs exercises designed to aid in recovering motor function of the upper limb. The joystick has been programmed to either assist or resist the patient's movements. The system monitors the status and progress of the patient, records the kinematic parameters of his movements, and summarizes the results. There are 2 modes of operation – the cooperative mode, in which therapist and patient are online together and the therapist can guide the patient's movements and the stand-alone mode in which the patient works by himself, not necessarily online. Results: After a short (less than 1 hour) training session, therapists were able to use the system independently. Also, patient subjects had no problem understanding how to do the exercises; they reported that they enjoyed using the system as an alternative to their regular exercises, and felt safe using it. Tests of the cooperative mode over the internet demonstrated that the therapist joystick was able to guide the patient joystick, with a delay of 30-150 msec. Novelty/Discussion: Unlike the Java Therapy system, which relies on Java applets on a web site, in our system, client programs and data on exercise sessions are stored locally on the client's computer and uploaded to a central server at a later date. Our system also differs from Java

Therapy, which uses a commercially available arm support and specially made splint for each individual, in that we have designed and built our own arm support which allows even subjects with little or no control of wrist and fingers to control the joystick without the difficulty of attaching a splint. Use of the support allows the subject to move the joystick via relatively large movements of the shoulder and elbow instead of via small wrist movements. The internet cooperative mode is another novel aspect of our system. Conclusion: Both therapists and patients are able to use the system and we are ready to begin a full-scale trial.

Social Networks and Presence in Second Life

Kona Taylor, Robert Chamot, and Sharon Tettegah

Correspondence:
Kona Taylor
University of Illinois
Urbana Champaign
College of Education
E-mail: ktaylor@uiu.edu

Massively Multiplayer Online Simulations technologies are becoming a great tool for educators to evaluate various behaviors there were once done in real life environments. The synthetic world of Second Life was used as a platform for this study. Second Life is a 3D synthetic world built by the inhabitants of the world. Prior research documents virtual environments (VE's) are most useful when they are believable to the user. The environment should allow individuals to immerse themselves in an experience that is both functional and easy to relate too. Second Life was developed by its members to depict various representations of real life events. This research investigates human relations and social presence within the synthetic environment of Second Life. We investigated social interactions and social presence of 24 class members who had to work on collaborative teams. It is important to learn how these synthetic worlds can be used to investigate social presence, perception and other aspects related to human cognition and behaviors. With the increased growth of simulations and synthetic worlds, these environments may help researchers to examine influences on human functioning in ways with little effect on the lives of the participants, which very few studies have looked at in terms of how people react in these environments and how they perceive themselves within this environment.

Narratives, Virtual Reality Environments and Identity Semiotics of Pre-Service Teachers

Sharon Tettegah, Eun Won Whang, and Kona Taylor

Correspondence:
Sharon Tettegah
University of Illinois
Urbana-Champaign
E-mail: stettega@uiuc.edu

The current study explored text based and animated narrative vignette (ANV) social simulations to specifically examine pre-service teacher's social cognitions and personal identities. This research sought to address identity semiotics of 20 elementary pre-service teachers through examination of their animated narrative social simulations and their social identity exercises. Content analyses revealed animated narrative vignette simulations provide a psycho-educational outlet to engage in reflective cognitive processes which can engage pre-service teachers in expressions of joy and healing related to positive and traumatic events from childhood school related experiences. This paper discusses how animated narrative vignette social simulations can provide a way of learning about personal social identity involving a critical examination of self using animated narrative vignette social simulations as reflected in past school experiences.

Use of a Computerized Exercise Program in a Rehabilitation Setting: A Pilot Study

Marianne Thornton, Yvon Boudrias, Shawn Millar, and Heidi Sveistrup

Correspondence:
Marianne Thornton
The Rehabilitation Centre
Ottawa Hospital
Canada
E-mail: mthornton@ottawahospital.on.ca

Virtual reality (VR) is increasingly available for use in rehabilitation settings. Practicing different ways to complete an activity may help individuals with planning and problem solving. Virtual Reality can be more engaging and enjoyable than other forms of rehabilitation. Through the use of VR, voluntary

control of balance has been improved in neurological patients. The successful integration of VR technologies into rehabilitation has demonstrated the possibilities of practicing challenging, but safe, activities in realistic environments, while being able to control the stimulus and measure the outcome. For the therapist, there is the advantage of having full control over the level of difficulty, allowing the treatment to meet individual needs. The ability to change the virtual environment relatively easily, to grade task difficulty, and to adapt it according to the patient's capabilities are important advantages that contribute to its effectiveness in motor remediation. In addition to allowing for standardization of assessment and retraining protocols, it may also be easier to keep a person's attention for a longer period of time, allowing for increased compliance and fun. Virtual Reality could be a valuable modality for therapists, providing a device to allow use of new strategies in everyday situations, reliable data collection and a training protocol. As new ideas and technology become available, methods need to be found to help integrate them into practice. Identifying barriers and aspects that facilitate their use may help identify valid practices and implement these new techniques into practice. The main objective of this pilot study was to test the feasibility of use of the VR equipment in the general rehabilitation setting by determining 1) the opinion of therapists about satisfaction with ease of use, practicality, intervention value, comments on space required, location, perceived enjoyment and interest of the patient and 2) the opinion of patients regarding interest and enjoyment. Subjects were 12 therapists who agree to participate and one or two patients from the caseload of each of the 12 therapists. Patients with decreased balance participated in four exercise sessions each consisting of up to 40 minutes of exercise started and ended with five minutes of stretching. The sessions included a variety of activities that followed an outline designed to improve balance and endurance. Therapists were asked to measure the activity level of their patients using the Physiotherapy Clinical Outcome Variables Scale (COVS) before they began the exercise program. Questionnaires and focus group comments helped determine barriers, facilitators and other suggestions for facilitating the integration of the technology into practice. This project helps identify factors that contribute towards changing practice in physiotherapy by identifying barriers and facilitators to the use of a new technology. This is relevant to physiotherapy in the current health care climate where therapists are challenged to be knowledgeable about and apply best practices, while there are increasing service demands, decreasing resources, complicated by increasing information, research, and involvement of consumers.

Acceptance of a Virtual Social Environment by Pre-Schoolers with Autism Spectrum Disorder

Cheryl Y. Trepagnier, Marc M. Sebrechts, Andreas Finkelmeyer, Willie Stewart, Jr., and Jordana Woodford

Correspondence:
Cheryl Y. Trepagnier
The Catholic University of America
Washington DC
E-mail: trepagnier@cua.edu

Background/Problem: Impaired social reciprocity is a core deficit of Autism Spectrum Disorder (ASD). We report preliminary trials of an experimental intervention using eye-tracking and virtual social interaction to attempt to increase attention to faces. The goal is to motivate participation, while differentially rewarding progress. This is particularly important because in the absence of continued engagement, training terminates. Method/Tools: Subjects are children 24 to 60 months with ASD. Training is presented by live-action video clips on a monitor inside a kiddie-ride helicopter, showing a 'Virtual Buddy' who addresses the child and offers social praise. Increase in gaze at eyes triggers an entertainment video, while decreasing score triggers additional prompts and cues, e.g., masking of all but the face. Once there is gaze at eyes for at least .5 sec, the Buddy directs the child's attention to particular locations. As soon as the child's gaze begins to move in the indicated direction, a video reward appears at the target location. Among the questions for this preliminary study are: acceptance of the experimental set-up, time and techniques needed to entice children into it and maintain their motivation, how best to schedule 20 sessions per child, children's acceptance of interruptions in the video, maintenance of calibration, management of transitions and children's response to the social display and masking cues. Results: We report on 5 males, mean age 50 months, number of sessions 1 to 15. Initial acceptance of the helicopter was immediate for 3 children. One child required a period of

several minutes to accustom himself to the device. As the child peered in, video curtains were parted to allow him to see more of the screen. Once he was seated in the car seat, the curtains disappeared. One child has not yet entered after 2 sessions. Eye-tracking: Calibration was readily achieved and maintained after leaving and returning (within the same day). Engagement: Entertainment videos and toy videos have effectively reinforced participation. On two occasions a child decided he did not want to watch any more video after the break. Transition: Video sessions are terminated by closing the curtains. This plus the offer of playing with toys is usually successful in enticing the child out of the device. On one occasion a child refused to leave the helicopter. Video will be presented showing the data monitoring and acquisition system, which includes gaze coordinates and a multi-window video record of the child's face, the tracked eye, and the screen display with superimposed eye cursor. Data currently being analyzed will be presented representing the effect of training and use of cues on gaze direction. Conclusion: Preliminary results of the feasibility study appear to support the use of an approach of this type with this target population. Novelty: These data represent the first attempt to entice children with ASD to participate voluntarily in training in social attention in a computerized, virtual social environment.

Presence Enhances Relaxation: A Preliminary Controlled Study

Daniela Villani, Alessandra Preziosa, Francesco Riva, and Giuseppe Riva

Correspondence:
Daniela Villani
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Department of Psychology
Catholic University of Milan
Milan, Italy
E-mail: d.villani@auxologico.it

Technologies such as Virtual Reality (VR) that induce presence in a virtual, but still external, perceived world, have great power to evoke emotional experiences that can lead to psychotherapeutically valuable changes in the individual. This reflects the power of presence – seen as the feeling of being located in a perceived, external world – in developing and affecting psychological wellbeing (1). In this sense the feeling of presence allows VR to play an important role in clinical psychology, that is expected to increase in the next years (2,3). Until today Virtual reality Environments (VEs) have been incorporated into a variety of clinical and everyday settings to improve mental health and to enhance well-being. Nonetheless many areas in the health field can be still explored using this innovative technology. One example is represented from stress management area, one of the leading mental health problems of western societies linked to several pathologies (4). Following this trend our proposal is to investigate the correlations between the feeling of presence induced by different media and the relaxation process. More in detail, the specific goal of this study is to compare the effectiveness of different media- characterised from different level of presence - coupled with an adequate relaxing protocol in producing emotional modifications. In a controlled studies we compared three different media: Immersive VR (experienced with head-mounted display and head-tracking), DVD (video with relaxing music) and Audio speaker, using the same therapeutic narrative and protocol. A control group without treatment was also included in the study. The sample included 64 university students, randomly divided in the four experimental conditions.

Qualitative and quantitative measures have been used: The *Positive and Negative Affect Schedule* (PANAS) to measure the positive and negative affects (4); The *State Trait Anxiety Inventory* (STAI) to measure the level of anxiety (5); The *ITC-SOPI Presence Questionnaire* to evaluate the level of presence (6); Different physiological parameters (RES, HR, SC). Non parametric test and correlation were used to analyse self-reports and physiological parameters. Within groups analysis - in both VR and DVD conditions - showed a significant increasing of positive emotional state (relaxation), a reduction of negative emotional state (anxiety) and significative physiological changes in respiration rate, heart rate and skin conductance parameters. No significant differences were found from the between groups analysis. This results appear coherent with data referred to correlations between sense of presence and changes in anxiety and emotional state. Considering both the whole group of participants and the four conditions separately, results indicate that the sense of presence experienced from the subjects during the experiment could play a critical role in enhancing the effectiveness of the treatment. In particular ecological presence and engagement, from ITCSOPI Inventory, reveal good

correlations with anxiety reduction and relaxation increasing. Further reflections about sense of presence in relaxing virtual environments will be discussed.

Narrative vs Environment: The Role of Media Content in Emotional Induction

Daniela Villani, Mauro Lucchetta, Alessandra Preziosa, and Giuseppe Riva

Correspondence:
Daniela Villani
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Department of Psychology
Catholic University of Milan
Milan, Italy
E-mail: d.villani@auxologico.it

It is well known that media may induce strong emotions. But what are the features of media that are critical in the process of emotional induction? Typically communication literature separates between media form and media content (1). On one side with Media Form we refer to physical, objective properties of a display medium. On the other side we use the category Media Content to refer to the overall theme, narrative or story depicted via a display system. In this research we focussed our analysis on media content: we evaluated the effects of two dimensions of media content - narrative and environment – on emotional induction. In particular, the goal that drove this study was the analysis of the impact of environment and narrative on user's emotions in two different moments: during a virtual reality experience and after it. We manipulated a virtual reality experience using a mixed 2x2 experimental design. More precisely we created two different virtual environments (island and canyon) that were explored by the sample after being exposed to two different narrative backgrounds (positive: the stay on the island/canyon was the prize of a game; and negative: the stay on the island/canyon was the result of a natural disaster). In all the groups the goal of the experience was to escape from the environment by finding a boat guarded by a man. The sample included 80 females with age ranging from 20 to 26 years (M=23+/-1.4), randomly assigned to the four conditions. Dependent measures were the emotional state of the subject and the level of presence perceived. In particular both qualitative and quantitative measures were used:1) Emotional state: The *Positive and Negative Affect Schedule* (PANAS) (2); *Visual Analogue Scale* (VAS) (3); State dimension of *State Trait Anxiety Inventory* (STAI) (4); Different physiological parameters (Respiration Rate, Heart Rate, Heart Amplitude, Skin Conductance); 2) Presence: The *ITC-SOPI Presence Questionnaire* (5). All these measures were taken at two different times: pre and post the virtual experience. The data from the measures were not normally distributed. So we used in our statistical analysis non parametric tests only. The results highlighted the influence of both narratives and environments on the users' emotions. Main effects: 1) Narration on emotions: the negative narrative had a significant effect on negative emotions and vice versa; 2) Environment on emotions: the experience of the island ("positive" environment) induced an higher level of relax and a lower level of sadness than the one of the canyon ("negative" environment); 3) Environment on presence: the experience of the island induced an higher sense of presence than the one of the canyon. Correlations: 1) There is a significant positive correlation between the "engagement" presence scale and the "positive affect" scale of PANAS; 2) There is a significant negative correlation between the "negative effects" presence scale and the "positive affect" scale of PANAS; 3) There is a significant positive correlation between the "negative effects" presence scale and the "negative affect" scale of PANAS. These data underline the influence of both dimensions of the media content on the emotional experience during a virtual reality session. This result may be critical for the future development of applicative virtual environments because shifts the attention of the developer of both features of media content: on one side, a good clinical protocol may be enhanced by an engaging virtual environment; on the other side, an engaging virtual environment may be enhanced by a meaningful narrative background.

Relationships Develop in Chat: A Web Research

Daniela Villani, Alessandra Preziosa, Giuseppe Riva, and Luigi Anolli

Correspondence:
Daniela Villani
Applied Technology for Neuro-Psychology Lab
Istituto Auxologico Italiano
Department of Psychology

Catholic University of Milan
Milan, Italy
E-mail: d.villani@auxologico.it

Today Internet represents a social device that modifies people communication and interaction. The literature about management of personal relationships present conflicting claims. Several studies suggest that these types of relationships are more limited compared to face-to-face relationships. From a different perspective, Joinson (2001) in examining the importance of disclosure, argues that, at the beginning of relationships, disclosing oneself to a new person causes a sensation of trust that enables the interlocutor to disclose in turn. According to this approach, Suler (2004) speaks of the on-line "disinhibition effect." Within this frame, the current research, carried out in a substantially descriptive design, aimed to consider psychological and social features of a particular electronic environment, the Chat room. Basic questions concerned to understand the principal features of online relationships and whether there was a prevailing personality type and a predominant value that drove the behaviors of individuals in Chat. To investigate what kinds of relationships Chat users develop in this environment, the present research referred to relevant studies in this field). An on-line questionnaire set was developed, designed to investigate the personality traits and the prevailing interpersonal values of those participants who set up interpersonal relationships on-line. The Web research showed that, if sampling control and validity assessment were provided, it could be a valid alternative to a more traditional paper-based procedure. The sample included 158 participants directly recruited in Chat or by e-mail messages and paper messages posted in the main Universities of Milan and by advertisement of the site in the most important Italian searchers. All voluntarily chose to participate and filled out the online questionnaire, composed of four sections: Section one focused on conventional socio-demographic variables of the participants and their employment of Internet and Chat in terms of time; 2) Section two analyzed the level of development of on-line relationships using a specific instrument "Development of online relationships" (DOR), created by Parks and Floyd; 3) Section three was formed by Italian version of the Eysenck Personality Inventory (EPI), which aimed to examine some personality traits of the participants; 4) Section four aimed to assess the most important clusters of values through the Italian version of Survey of Interpersonal Values (SIV). The analysis

carried out included a factor analysis to evaluate the Italian version of DOR questionnaire, several analysis of variance and correlations. The results highlighted that Chat users created deep on-line relationships and they found in Chat a suitable room to disclose themselves. They turned out to form a heterogeneous group of persons who showed some prevalent attitudes. Results put into evidence that Chat users were quite close, fairly introverted, basically nonconformist and independent, rather selfish and self-biased, needing of being supported and encouraged, although they, on the whole, did not reach pathological levels for any personality traits. The data, herein gained, underline that deep relationships developed on-line remained limited to the virtual world. Further research is needed to deepen the nature and the thickness of the border between virtual (Chat) and real relationships.

Virtual Reality Assisted Treatment of Public Speaking Anxiety

Helene S. Wallach, Margalit Bar-Zvi, and Marilyn Safir

Correspondence:
Helene S. Wallach
Department of Behavioral Studies
The Max Stern Academic College of Emek Yezree
E-mail: helenwa@yahoo.com

Social phobia is defined as fear of performing in front of people. This is exacerbated when these people are strangers, or are critical. Social phobia can take the form of public speaking anxiety, eating in a public place, talking to people in power, etc. Onset of social phobia typically occurs during adolescence or early adulthood and usually affects school performance, ability to create social networks as well as intimate relationships and the ability to work. This study focuses on a specific social phobia, *public speaking anxiety*, as this disorder causes a considerable degree of difficulty for many people, especially for university students. Research has found that cognitive-behavior therapy is superior to other therapies. A major factor is exposure, with in-vivo exposure superior to imagined exposure. Employing exposure via virtual reality overcomes the difficulties of employing in-vivo and imaginal exposure and conserves resources. The advantages of VR therapy, over imagery therapy, are especially relevant for people who have difficulty imagining situations vividly, or for those who avoid remaining

focused in the imagined fearful situation. In addition, the therapist has full knowledge of and control in VR over exposure to the simulated environment enabling the client to deal with relatively controlled levels of anxiety . The aim of this study was to determine whether virtual reality therapy is an efficient method of therapy for public speaking anxiety , and to compare it's efficacy to traditional cognitive behavior therapy. Forty-nine University students and staff who experienced public speaking anxiety participated in this study. After a brief psychiatric screening, they filled out three pre-treatment questionnaires (Fear of negative evaluation – FNE; Liebowitz Social Anxiety Scale – LSAS; Self Statements During Public Speaking – SSPS), and were randomly assigned to one of three groups: Virtual Reality with Cognitive-Behavior Therapy (VRCBT), Cognitive-Behavior Therapy (CBT), and Wait-List control (WL). Treatment lasted 12 weekly one-hour sessions. Upon completion of treatment, they filled out the same three questionnaires. The wait-list control subjects were assigned to one of the treatment groups following the 12 week wait period. The three groups were compared on improvement as measured by the three questionnaires. The three questionnaires yielded six anxiety and coping measures (FNE fear, LSAS avoidance, LSAS fear, SSPS coping, SSPS fear, SSPS total). On all measures the reductions in fear and avoidance and increase in coping was largest for the VRCBT group compared to the WL and to the CBT group. VRCBT proved to be significantly more effective than WL on three measures (LSAS avoidance, SSPS coping and SSPS total) and significantly more effective than CBT on one (SSPS coping). These results indicate the uility of using VR for the treatment of public speaking anxiety.

Simulations and Peer Relational Aggression: A Measurement of Pre-Service Teacher's Perceptions

Eun Won Whang, Kona Taylor, and Sharon Tettegah

Correspondence:
Eun Won Whang
University of Illinois
Urbana-Champaign
E-mail: ewhang2@uiuc.edu

Social simulations are becoming an important research tool for educators. These simulations can be used to study a variety of areas from emotions to training. This study examines clinical assessments of emotional states of pre-service teacher's (N = 515) perception and problem solving related to a simulation of a peer victimization incident on a playground. Open ended responses are used to investigate perceptions and problem solving. Participants were asked to respond to this situation as if they were the teacher, and these responses were then coded and analyzed. Consistent with other literature, the participants expressed perceptions were neutral and little focused was place on problem solving, or management of the situation with the victim. Future direction and educational implications are presented.

A Virtual Reality Application for Stroke Patient Rehabilitation

Daniel White, Kyle Burdick, George Fulk, Janice Searleman, and James Carroll

Correspondence:
James Carroll
Clarkson University
E-mail: jcarroll@clarkson.edu

Virtual Reality (VR) has been shown to be a promising intervention technique to improve motor function in individuals with stroke and other neurological disorders. VR can provide an effective human computer interface, allowing users to interact with a virtual environment (VE) to experience simulated worlds comparable to the real world [1], using various VR peripherals, e.g., data gloves. VEs can provide stimulating audiovisual feedback that promote motor learning and enhance participation in a rehabilitation process. VR based interventions allow the rehabilitation professional to shape the VE and desired tasks according to the abilities of the individual client. This customization of the VE can better engage the client in the treatment session and provide appropriate feedback in order to maximize motor learning. This research in progress involves the development a VR software application that is: (1) readily customizable to individual client needs, (2) provides a highly immersive environment where the client can safely practice common ADLs and improve the motor function required for these activities, while (3) providing quantitative data for the therapist to identify movement limitations and dysfunctions and assess the effectiveness of the VR-based physical

therapy intervention. 3D-Studio Max is used to model all objects and animations used by the application and Virtools Dev 3.5 is used to present the VE to the client and regulate the VE behavior. The resulting content is scalable in the sense that it can be delivered to clients via a web browser, a head-mounted display (HMD), or projected onto highly immersive CAVE-like displays. Multiple VE's are being designed to accommodate a variety of activities of daily-living (ADL) and to allow a therapist to customize the associated interventions for each client. In addition, the ability to gather real-time motion capture data allows a therapist to quantitatively document change and to better assist in the diagnosis of movement dysfunction. Client motion is tracked using devices such as a Polhemus FASTRAK system or a ViconPeak MX-series camera-based system. Joint angle data is captured as clients complete specified ADL-related tasks within the VE, e.g., making a virtual cup of coffee within a kitchen setting. Client motion is visualized using virtual limbs that provide patient feedback within the VE. Associated motion capture data is logged in a backend data that can be used to monitor/document client progress over time. This data can be used as a goal setting tool, allowing the practitioner and client to set goals in terms of range of motion and to verify when these goals have been met. The data collected also provides a way of demonstrating the effectiveness of treatments, which may prove beneficial for insurance purposes. Lastly, the data can be used as a diagnostic tool identifying movement limitations and abnormalities. The application under development has the potential to be a motivational tool for different demographics. For example, children and young adults may engage more fully in the treatment sessions employing VE's that are more game-like. The scalability of the application also offers the potential to be used in future tele-therapy applications.

From SIT to PTSD: Developing a Continuum of Care for the Warfighter

Brenda K. Wiederhold and Mark D. Wiederhold

Correspondence:
Brenda K. Wiederhold
President and CEO
Interactive Media Institute
E-mail: bwiederhold@vrphobia.com

The Virtual Reality Medical Center (VRMC) is currently conducting Stress Inoculation Training (SIT) and Posttraumatic Stress Disorder (PTSD) treatment for the United States Navy and Marine Corps, the combined result being a program that supports a *continuum of care* for troops. With SIT, very high stress and cognitive load situations not often encountered in real life can be created in the simulation environment. These scenarios, combined with physiological monitoring, allow military personnel to train themselves to better process stress through techniques such as breath retraining and relaxation. In this way, cognitive skill hardening can be achieved. It is our hope that SIT will help prevent or reduce rates of PTSD in returning troops. Another study that we are conducting entails the development and testing of Virtual Reality (VR) therapy for those returning from Iraq. This VR PTSD treatment program is currently in use at Naval Health Medical Center in San Diego and Marine Corps Base Camp Pendleton. By placing a patient in a virtual Iraqi war setting, and then having him or her slowly experience that situation in a controlled way, the patient should begin to habituate to his or her specific PTSD symptoms and come to reappraise the situation, allowing emotional processing to fully occur. Though the study, funded by the Office of Naval Research (ONR), is incomplete, initial pilot testing indicates that VR therapy produces both subjective (self-report) and objective (physiological) arousal in individuals suffering from PTSD. Finally, we have also deployed a VR system to Iraq under a program funded by the United States Army's Telemedicine and Advanced Technology Research Center (TATRC), with the goal of allowing for the earliest possible intervention and treatment of PTSD.

Developing Objective Metrics for Training Transfer Through the Use of Virtual Environments

Mark D. Wiederhold and Brenda K. Wiederhold

Correspondence:
Mark. D. Wiederhold
President
The Virtual Reality Medical Center
E-mail: mwiederhold@vrphobia.com

The Virtual Reality Medical Center (VRMC) is exploring training transfer through the use of virtual environments. Currently, VRMC is conducting Stress Inoculation Training (SIT) for the U.S. Army's Aeromedical personnel at Fort Rucker. With SIT, military personnel "experience" highly

stressful situations in a virtual environment while being physiologically monitored. SIT participants are then trained how to better process stress through techniques such as breath retraining and relaxation. In this way, cognitive skill hardening can be achieved. SIT is intended to help prevent or reduce rates of Posttraumatic Stress Disorder (PTSD) in returning troops. Furthermore, VRMC is conducting a study, funded by the U.S. Army's Telemedicine and Advanced Technology Research Center (TATRC), to test the efficacy of virtual training in preparing combat medics for real-life combative medical scenarios. This endeavor is an extension of VRMC's Student State Report, a three-year study (completed in July 2005) sponsored by the Defense Advanced Research Projects Agency (DARPA), which proved the effectiveness of a low-fidelity laptop simulator to train military personnel. The 970 participants were a combination of elite units of the U.S. Navy, U.S. Marine Corps, and U.S. Coast Guard. The objectives of the investigation were to examine the effectiveness of virtual reality training simulators in their ability to teach personnel tactical and trauma care skills, enable them to practice stress management techniques, and to improve performance during real-life combat situations. The test group first received training in a virtual combat scenario while their stress and arousal levels were monitored through non-invasive physiological means. The control group did not receive virtual training. Afterward, all participants were tested in a real-world version of this same combat scenario to determine the effectiveness of training in a virtual environment. The study proved virtual reality training to be an extremely effective and efficient method of preparing military personnel for combat situations.

A Study of Gambling Using a Virtual Casino

Matthew Young, Steve Baumann, Michael Wohl, Kimberly Matheson, Rachel Thompson, Hymie Anisman, Gregg Stangl, and Scott Fetzick

Correspondence:
Steve Baumann
Psychology Software Tools
Pittsburgh
E-mail: steveb@pstnet.com

Research Status: The study reported here has been completed, but it is part of a larger program of ongoing research studying gambling pathology using a virtual casino. Background/Problem: As the legalization of gambling continues to spread, addiction to gambling has become a greater social problem. The study of gambling behavior and pathological addiction is hampered by the ecological validity of laboratory studies that do not adequately simulate the natural environment; for many gamblers craving-to-gamble is strongly provoked by the ambience of a casino. Our previous research has shown the utility of VR for assessing craving among drug abusers, so we examined the impact of immersion in a VR casino on pathological gambling. Method/Tools: A virtual casino was created using 3D Game Studio (Conitec). Two of the games (blackjack and slot machines) displayed in the casino are interactive. A startup interface enables the experimenter to preset a number of variables, including the win/loss ratio for a sequence of random plays on the slot machines, payoff amounts, the individual cards dealt to player and dealer, or the icon display on 12 slot machines. Thirty-five problem gamblers, as defined by the DSM-IV checklist for gambling pathology, were recruited from the undergraduate population at Carleton University in Ottawa, Canada. Ostensibly, the machines were programs with the 40% payout rate of a local casino. In actuality the slot machines were pre-programmed to win or loose in a particular sequence. Specifically, half the participants lost $6 of their initial $10 seed money, whereas the other half won an additional $6. Subjective level of craving to gamble was obtained after the 2^{nd} and 18^{th} of 20 spins using a screen overlay rating scale (0-100) which asked *"How strong is your urge to gamble?"* As participants were aware prior to arrival at the laboratory that the session involved gambling, baseline craving was assessed with a random phone call two weeks after the laboratory session. Results: The results, displayed in Table 1 below, demonstrate that the VR simulation was able to significantly increase craving to gamble in problem gamblers ($p < .001$). This effect was qualified by a significant interaction effect of win/loss by time on craving rating ($p = .02$). As expected, winning caused craving to increase more than loosing, especially as gambling persisted up to the 18th spin.

Condition	Baseline	After 2nd spin	After 18th spin
Win	33	62	75
Loose	38	55	54

Table 1. Subjective Rating of Craving-to-Gamble

for Problem Gamblers

Conclusion: A virtual casino was used successfully to provoke craving in pathological gamblers. This effect was heightened following a winning sequence. Novelty/Discussion: To our knowledge this is the first use of a virtual reality simulation to study gambling behavior in pathological gamblers. The flexible user-interface and configuration wizard allows experimenters to preset a variety of variables to manipulate the wins and losses for either slot machines or blackjack games and thus control the gambling outcome of the experiment, unbeknownst to the subjects.

Addressing Cognitive and Sensorial Component of Phobias

Feryel Znaidi, Isabelle Viaud-Delmon, Roland Jouvent

Correspondence:
Feryel Znaidi
CNRS UMR 7593-UPMC, Paris, France,
E-mail: znaidi@ext.jussieu.fr

Therapies in virtual reality allow to address both the physiological and cognitive components of anxiety disorders. It provides indeed an exclusive way to access separately these two components. The aim of this study was to assess the rate of change on clinical, cognitive, behavioral and sensory variables during exposure therapy in the treatment of space-related anxiety. We recruited 10 phobic patients (4 patients with acrophobia, 2 with agoraphobia and 4 with claustrophobia) who followed a therapeutic trial composed of 3 phases. The protocol consisted of one session per week during 10 weeks. During these sessions, patients were equipped with a head-mounted display coupled with an electromagnetic sensor system and immersed in different virtual environments. The first phase was proposed to provide habituation to the sensorial conflicts inherent to the technique (latency, sensorimotor inconsistency). Three kinds of virtual environments with different sensory information were used (one per session). The objective of the three first sessions is to reduce cybersickness usually experienced at the beginning of the therapy and to improve the level of presence (an important concept which contributes to the effectiveness of the therapy). The second phase consisted in exposure to three environments containing features generating anxiety in different phobias. The chosen environments did not represent the feared situation as described by the patient, but could potentially generate anxiety as they deal with space. The aim was to treat the anxious reactions in situations different from those dreaded. The third phase represents a more classic progressive exposure to the fearful situation. The aim was mainly to address the threat-related beliefs and behaviors. The post-treatment evaluations (Global state, Quality of life, Handicap, Behavioral Avoidance, Fear questionnaire) showed an improvement in overall functioning of all of the measures. The present study suggests therefore that both cognitive and sensorial components addressed through the interaction with different virtual environments contribute to the beneficial effect of virtual exposure.

Appendix B

Annual Review of CyberTherapy and Telemedicine –

Virtual Healing: Designing Reality