Virtual Reality and Mental Disorders

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This panel discusses the use of virtual reality and augmented reality treatment for individuals with a variety of mental disorders, including phobias, autism, and Parkinson's Disease. Panelists will describe their actual case studies and the insights and concerns they discovered in their research. The psychologists and computer scientists on the panel will address the ethical, psychological, and social questions. as well as the technical issues which arise from such applications. They will discuss ideas and suggestions for future directions in using virtual reality with mental disorders, and describe what is needed from the graphics community to refine and extend this work.

Despite enthusiasm from the press and media, the virtual reality worlds experienced in a headset are generally disappointing. There are a great many things we can not do well in VR. Visually, virtual environments are still cartoonish and lacking in realism. The combination of current tracker technology and the graphics pipeline guarantee a lag between head movement and response of the visual image. The spaces we can track are small, and tracker accuracy is poor. Haptic cues in virtual environments are usually nonexistent or very limited. As a result, examples of VR applications that offer sufficient value beyond that available from less exotic technologies are still rare.

To create successful applications with today's VR technology, we must begin by asking: what are we good at? Despite all the obvious technical limitations, psychological studies are showing that VR provides a convincing illusion of actually inhabiting a computer-generated space. VR creates and controls sensory stimulation in formerly unattainable ways. Augmented reality allows an overlay of a "real" world with an imaginary world. Both VR and augmented reality can add, delete, or emphasize details to better help mental patients perform basic functions. These unique features can provide the mental patient with specialized, safer treatment techniques for problems that previously were expensive or impossible to treat in traditional training and therapy.

Larry F. Hodges

Virtual reality offers a new human-computer interaction paradigm in which users no longer are simply external observers of images on a computer screen, but are active participants within a computer-generated three-dimensional virtual world. Exposure therapy involves exposing the subject to anxiety-producing stimuli while allowing the anxiety to attenuate. These stimuli are traditionally generated through a variety of modalities including imaginal (subject generates stimulus via imagination) and in vivo (subject is exposed to real situations). Virtual Reality Exposure (VRE) Therapy involves exposing the patient to a virtual environment containing the feared stimulus in place of taking the patient into a real environment or having the patient imagine the stimulus. In a controlled study, VRE Therapy has been shown to be very effective in reducing acrophobic patient anxiety and avoidance of heights. VRE has also been shown in case studies to be successful in treating fear of flying.

VRE Therapy has several advantages, as compared to more traditional exposure modalities. Many stimuli for exposure are difficult to arrange or control, and when exposure is conducted outside of the therapist's office, it becomes more expensive in terms of time and money. The ability to conduct exposures of virtual airplanes for flying phobics or virtual highways for driving phobics, for example, without leaving the therapist's office, would make better treatment available to more sufferers at a lower cost.

In addition to cost reduction, VRE Therapy offers innovative treatment alternatives for patients. Like in vivo therapy, VRE Therapy can provide stimuli for patients who can not imagine well. Unlike therapist-assisted in vivo techniques, VRE Therapy will be performed within the confines of a room, thus avoiding public embarrassment and violation of patient confidentiality. Virtual environments have the added advantage of giving the therapist greater control over multiple stimulus parameters, as well as the ability to isolate the particular parameters that are most essential in generating the phobic response. VRE Therapy could also be used as an intermediate step in preparing patients for maintenance therapy involving self-directed in vivo exposure.

Virtual reality exposure therapy is also appropriate for networked delivery of clinical psychology and psychiatry services to remote locations. Since the patient is receiving therapy within a virtual environment, the clinician conducting the therapy session could be present physically or participate via computer networks from a remote location.

Dorothy Strickland

Another potential application for VR is in treating autism. Autism is a pervasive developmental disorder characterized by severe impairment in social, communicative, cognitive, and behavioral functioning. Approximately half of individuals with autism never gain useful communicative speech. Serious difficulties exist with generalization. For example, if an individual learns to identify a wooden chair in one room, the word chair may be limited to that example in that identical setting. Because normal input can be overpowering, individuals with autism may not respond to real environments.

VR affords control of the environment in ways previously unattainable. Regulation of visual and auditory stimulation allows forced attention and focused directions. Input stimuli can be reduced to an individually acceptable level. Distortions in size and character of the components of reality allow matches to the user's expectations or abilities. Distracting visual complexity, sounds, and touch can be removed and introduced in a slow, regulated manner. Minimal modifications across similar scenes may allow generalization to another scene if differences are reduced until the similarities are recognizable. The measurement of user motion response to the environment permits dynamic scene modification and learning emphasis based on response, rather than speech. Two case studies with non-high functioning children with autism indicated that they could be taught the beginning steps necessary to learn how to independently cross a virtual street, an example of using VR to provide a less hazardous and more forgiving environment for developing skills associated with activities of daily living.

VR with autism might provide safe, customized training for situations which would be difficult, if not impossible, to learn from real world exposure. The technology needs are different from general graphic applications. High-speed rendering of complex scene generation is not required. Only limited color ranges recognized by the user are needed. Sound was removed in our study, because the children with autism found processing of vision alone preferable. Larger field of view may be necessary to provide the sense of immersion. Since patients may not be able to indicate if a problem exists in the helmet, judging of safety factors becomes more critical. Standard user input controls need to be simplified. Vestibular mismatch from latency may actually provide a treatment tool with autism where the vestibular system appears to differ from normal systems.

The social and ethical issues are more complex. Individuals with autism are often already isolated within their own worlds. To create an artificial computer reality that only extends this isolation may be a disservice to them. Any use of VR should involve limited exposures, with the goal of integrating the artificial setting into its real equivalent.

Suzanne Weghorst

Traditional psychotherapy has focused on modifying behavior by changing the client's internal processes, be they perceptions, interpretations, articulations, contingency associations, or deeper psychoanalytic processes. The goal of therapy, from these perspectives, is to change the client to better fit reality. Augmented reality, or the merging of artificial and natural stimuli, affords the possibility of modifying behavior by altering the client's sensory inputs, in essence changing reality to better fit the client. This approach may be quite effective for certain disorders, particularly those due to specific neurological dysfunction, and may provide an alternative to pharmacological treatment.

I anticipate at least two broad applications of AR in psychotherapy: (1) as a tool to enhance face-to-face therapeutic techniques, and (2) as a "perceptual prosthesis" for everyday use by the client. A candidate example of the former might be in directing the client's attention to the therapist or to some object of discourse. This application would benefit from a collaborative form of augmented reality, termed "shared space."

One fortuitous application of the second approach to AR therapy has been demonstrated in the treatment of Parkinson's Disease. Capitalizing on a well-known but little used visual cueing phenomenon (kinesia paradoxa), appropriate artificial cues can enable walking in akinetic patients and reduce the severity of dyskinesia resulting from long-term drug treatment. Ancillary positive effects on affect and cognitive functioning have also been observed.

Augmented reality technology is currently in its infancy, and its practical applications are somewhat limited. In particular, current visual display methods suffer from restricted field of view, relatively poor spatial resolution, and insufficient brightness in competition with normal ambient light levels. Solutions to these technological problems are in sight, however, and long-term prospects for AR therapy are intriguing.

Nat Durlach

NEEDED RESEARCH ON VR-ASSISTED THERAPY: During the last three years, a number of individuals have begun to explore the use of VR technology in psychotherapy. Most studies to date have focused on behavioral therapy (exposure and desensitization) for phobias such as fear of heights. Although the results of these preliminary efforts appear promising, much work needs to be done in order to determine the ways in which, and the extent to which, VR technology can be truly useful (i.e., cost effective) in this area. In this presentation, we outline briefly some of the R & D issues that we believe require attention.

Research On VR-Assisted Behavioral Therapy For Anxiety Disorders: Previous work in this area needs to be extended by (a) developing improved, less expensive, and easier-to-use VR facilities, (b) systematically evaluating the usefulness of VR by comparing VR-assisted therapy to therapy without VR on various types of clinical populations, and (c) extending the use of VR to a wider variety of anxiety disorders.

Other Types Of Therapeutic Applications: Efforts are also emerging to conceptualize and probe the use of VR for other types of psychotherapeutic interventions and other types of disorders. In addition to the use of VR for expressive purposes, and in addition to the work discussed above concerning autism and Parkinson's Disease, consideration is now being given to its use for treating individuals with distorted body images associated with eating disorders.

Relevant Technical Issues: Among the relevant technical issues that are being considered (apart from those associated with general power, flexibility, ease-of-use, and cost) are those concerned with (a) providing an improved sense of presence for the patient, (b) incorporating appropriate virtual actors in the therapeutic process, (c) designing appropriate VR stations for both the patient and the therapist, as well as the communication channels between them, (d) integrating physiological-response monitoring equipment with traditional VR equipment in an appropriate manner for the patient's VR station, and (e) exploring the potential of haptic interfaces for psychotherapy.

Simplified Systems For Increased Cost-Effectiveness- The Search For The Effective Stimulus: It is easy to envision ideal VR systems that are likely to be useful in psychotherapy. However, realization of these ideal systems lies far in the future. In the meantime, we have to determine which dimensions of the VR experience are most crucial to the success of therapy and focus on the development of systems that perform well along these dimensions.

Potential Hazards: Despite the enthusiasm for VR-assisted therapy among technologists, patients, and some therapists, there are a variety of potential hazards. One class of such hazards relates to sensorimotor and perceptual phenomena such as eye strain, simulator sickness, and distorted perceptual fields. A second class concerns possible psychological damage to the patient resulting from unwanted and unexpected effects of VR on the patient's sense of identity, ability to distinguish between reality and fantasy, etc. A third class concerns psychosocial issues related to societal values about such issues as sex. A fourth class, which has not yet received much attention but probably will in the not-too-distant future, concerns the extent to which VR systems, particularly when augmented by physiological sensors (or displays), constitute ideal systems for "brain washing." Clearly, it makes sense to consider these potential hazards, as well as the potential benefits of VR when making plans for the future.