RELATIVE EFFECTIVENESS OF VIRTUAL ENVIRONMENT DESENSITIZATION AND IMAGINAL DESENSITIZATION IN THE TREATMENT OF ACROPHOBIA

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ABSTRACT
A person with acrophobia experiences substantial difficulty, especially within a large metropolitan city. Imaginal and *in vivo* systematic desensitization (SD) have been effective in the treatment of acrophobia. Current computer and display technology allows the creation of virtual environments (VEs) that can provide an important intermediate step between imaginal system desensitization (ISD) and self-directed maintenance *in vivo* SD. As *in vivo* SD provides stimuli for the patient who cannot imagine well, VEs based on stereoscopic head-mounted displays with head-tracking produce visual and auditory stimuli. Unlike the *in vivo* technique VEs allow therapist-assisted SD within the confines of a clinician's office, thus avoiding public embarrassment and violation of patient confidentiality. Also, VEs can generate apparent heights of much greater magnitude than standard *in vivo* techniques, producing greater desensitization. This study assesses the relative effectiveness of VESD and ISD in the treatment of acrophobia. The preliminary results of the pilot case studies so far are very encouraging.

INTRODUCTION
Acrophobia, the fear of heights, is classified as a simple phobia in the *Diagnostic and Statistical Manual of Mental Disorders*. People having this disorder suffer from marked distress about having fear of, or from, significant behavior difficulties. Behavior dysfunction involves interference with normal routines or with interpersonal relationships.

There have been relatively few publications of controlled research on the therapy of acrophobia. Behavioral therapy has included exposing the subject to anxiety-producing stimuli. These stimuli are generated through a variety of modalities including imaginal (subject generates stimulus via imagination) and *in vivo*. The effective utilization of lenses to magnify apparent height during *in vivo* desensitization has been reported. Also in a controlled study, imaginal desensitization and negative practice (subject practices anxiety response) were demonstrated to be equally effective in the treatment of acrophobia.

In addition to current *in vivo* and imaginal modalities, virtual environments (VEs) can also generate stimuli that may be utilized in desensitization therapy. Like *in vivo* therapy, VE systematic desensitization (VESD) therapy provides stimuli for patients who can not imagine well. Unlike *in vivo* techniques, VESD, with a therapist, is performed within the confines of a room, thus avoiding public embarrassment and violation of patient confidentiality. Also, similar to lens-assisted *in vivo* exposure, VEs can generate apparent heights of much greater magnitude than standard *in vivo* techniques, providing for greater desensitization. VESD is used as an intermediate step in preparing patients for maintenance therapy involving self-directed *in vivo* exposure.

VIRTUAL ENVIRONMENTS
Virtual Environments (VEs) offer a new human-computer interaction paradigm in which users are no longer simply external observers of data or images on a computer screen but are active participants within a computer-generated three-dimensional virtual word. Virtual environments differ from traditional displays in that computer graphics and various display and input technologies are integrated to give the user a sense of *presence* or *immersion* in the virtual environment.

Virtual environments also provide special techniques that allow users to interact with virtual spaces. Current techniques include the use of special gloves that track hand and finger positions so that the user can grasp virtual objects, six-degrees-of-freedom mouse and navigation devices, and locomotive devices such as treadmills, bicycles, or "flying" chairs that allow users to move about in the environment.

The virtual environment for this study consists of a stereoscopic head-mounted display (VR Flight Helmet), an electromagnetic head-tracker (Ascension Technology Bird), and a glove (Virtual Technologies CyberGlove) worn by the user for interacting with objects in the virtual environment.