

Thesis Portfolio

Investigating the Efficacy of Virtual Experiences on Stress Reduction
(Technical Report)

**Applying the Diffusion of Innovation Model to Understand Adoption Patterns for
Virtual Reality Exposure Therapy (VRET) in Clinical Psychology**
(STS Research Paper)

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SOCIOTECHNICAL SYNTHESIS

INVESTIGATING THE EFFICACY OF VIRTUAL EXPERIENCES ON STRESS REDUCTION

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Technical Advisor: Laura E. Barnes, Department of Systems Engineering

APPLYING THE DIFFUSION OF INNOVATION MODEL TO UNDERSTAND ADOPTION PATTERNS FOR VIRTUAL REALITY EXPOSURE THERAPY (VRET) IN CLINICAL PSYCHOLOGY

STS Advisor: Kent Wayland, Department of Engineering and Society

PROSPECTUS

Technical Advisor: Laura E. Barnes, Department of Systems Engineering

STS Advisor: Kent Wayland, Department of Engineering and Society

Studies reveal that an overwhelming number of individuals with anxiety do not receive treatment because standard care is unfeasible with respect to cost, availability, duration, or surrounding fears. The embedded projects address the underlying problem of how to enhance mental healthcare through increased use of novel therapies and improved availability and accessibility of treatment. Digital technologies designed for improving mental health can be implemented in clinical as well as non-traditional settings, such as an office, to provide stress relief and anxiety treatment for individuals. Such readily accessible treatments have the potential to mitigate the rising cost of healthcare for both employers and employees, as well as permit access to mental health treatment to those who may not otherwise receive it. Virtual reality exposure therapy (VRET) is the use of virtual reality (VR) technologies to immerse patients in computer-generated environments for psychological or occupational therapy. VRET is a substantiated method for stress and anxiety management but has not become routinely implemented although mental health disorders are common and accessible treatment is needed. VRET is a promising technology for assuaging workplace stress to improve productivity and supplementing traditional psychological treatment methods for anxiety.

The Technical Report explores the combination of Attention Restoration Theory and immersive virtual technology as a novel therapy for short-term stress reduction in the workplace. The objective of this study was to understand the effect of computer-generated environments on acute stress through various technology platforms. Study participants were guided through “micro-vacations,” or a series of virtual nature or urban images, following completion of stress inducing tasks. The micro-vacations were presented via three different virtual immersive technologies: a VR experience wearing a headset while seated in a booth, a GeoDome experience observing images and videos projected on a 180-degree view domed screen, or a 2D

experience watching a screen, which served as a control. Biometric, subjective mood and comfort data were gathered from the participants throughout the study in order to measure the changes in stress and mood before, during, and after the micro-vacation experiences. We hypothesize that the nature environments are more relaxing than the urban environments, and that both the VR booth and GeoDome will reduce stress levels in participants to a greater degree than the 2D images. Preliminary results in this study suggest nature stimuli have restorative effects on stress. The data also reports that participants viewing nature in the GeoDome exhibit the most restorative properties after a stressor was applied to the participant, which is evident by both subjective data and biometric data in terms of self-reported stress and GSR. Therefore, there is potential for immersive virtual technology applications for stress management and relaxation.

The STS research paper draws on Everett Rogers' Diffusion of Innovation (DOI) theory to grasp the current state and future trajectory of VRET integration into clinical psychology. Although other research has evaluated VR in psychology, DOI theory has yet to be applied to this topic to understand adoption patterns and the corresponding "diffusion" status into the field. Previous studies have analyzed the integration of VRET in psychology and found that adoption among mental health professionals has been slow and familiarity with the technology is limited. Rogers' DOI theory was applied to investigate why user acceptance might be slow through exploration of the following elements: the innovation, communication channels, social system, and time. Examination of each of these elements suggests that slow VRET acceptance might be because the innovation is not well understood by potential users and existing communication channels are not sufficiently developed. While decades have passed since the first documented use of VRET, continued observation of VRET implementation over time and analysis of the attitudes and perspectives of prospective adopters will be vital to discern the degree of diffusion

and fate of VRET in clinical psychology. With an understanding of the diffusion path, innovators, investors and individuals interested in the psychological health field can assess if VRET may be the future of clinical psychology and deem if investing time and resources into advancing this treatment technology is worthwhile.

The COVID-19 pandemic caused significant limitations with respect to the technical project. The complete study was unable to be conducted as planned so analysis and conclusions are based on preliminary results from a limited sample of older adults exploring Geodome and 2D conditions. The STS research paper evolved from the Prospectus and substituted the intended case study on Invisalign with a more focused and thorough application of the DOI theory to VRET in clinical psychology. Despite modifications, findings from the technical and STS research projects reveal that the restorative effects of VRET have the potential to revolutionize how and where we receive mental health treatment. It will be critical for future work to monitor and analyze the spread of VRET as the technology advances to map the diffusion trajectory and understand the reach and degree of implementation of the innovation.