

ABSTRACT
COUNSELING AND HUMAN DEVELOPMENT

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EFFECTIVENESS OF VIRTUAL ENVIRONMENT DESENSITIZATION
IN THE TREATMENT OF AGORAPHOBIA IN A COLLEGE
STUDENT POPULATION

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The primary purpose of this study was to investigate the effectiveness of the virtual environment technology in the area of counseling. Consequently, this study investigated the effectiveness of a virtual environment desensitization (VED) in the treatment of agrophobia on a select group of undergraduate students attending Clark Atlanta University during the 1994-1995 school year.

The design of this study was the traditional experimental design. The researcher selected subjects (N=60) for this study. Thirty (30) subjects were placed in the experimental group and thirty (30) subjects were placed in the control group. Only subjects in the experimental group were exposed to the VED treatment. Two instruments were used in this study. The first instrument was an Attitude Towards Agoraphobia Questionnaire (ATAQ). The second instrument was the Subjective Unit of Discomfort Scale (SUDS).

The virtual environment desensitization was effective in treatment of subjects with agoraphobia (experimental

group). The control group or no-treatment group did not change significantly. All the attitudes towards the agoraphobic situations decreased significantly for the virtual environment desensitization group (experimental group) but not for the control group. The average subjective unit of discomfort scale (SUDS) in each session decreased steadily across sessions, indicating habituation.

EFFECTIVENESS OF VIRTUAL ENVIRONMENT DESENSITIZATION IN THE
TREATMENT OF AGORAPHOBIA IN A COLLEGE STUDENT POPULATION

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CHAPTER I
INTRODUCTION

Statement of the Problem

In the field of mental health, agoraphobia is one of the most serious and prevalent anxiety disorders. It accounts for approximately 60% of all phobic disorders.¹ The American Psychiatric Association, in the Diagnostic and Statistical Manual Disorders, defines agoraphobia as fear of being in places or situations from which escape might be difficult or embarrassing.² Agoraphobic fears typically lead to a pervasive avoidance of a situation such as being alone, either outside the home or being in the home alone; being in a crowd of people; staying in a line; traveling in an automobile, bus, or airplane; or being on a bridge or in an elevator. People having this disorder suffer from marked distress about having the fear or from significant behavior difficulties. This behavior dysfunction causes interference

¹Larry Michelson, Matig Mavissakalian, and Karen Marchione, "Cognitive and Behavioral Treatment of Agrophobia: Clinical, Behavioral, and Psychophysiological Outcomes," Journal of Counseling and Clinical Psychology 53 (1985): 913-25.

²American Psychiatric Association, Diagnostic and Statistical Manual Disorders, 4th ed., (Washington, DC, 1994), 396.

with normal routines and/or with interpersonal relationships that can result in significant distress.

There have been relatively few publications of controlled research on the treatment of agoraphobia. However, behavioral therapy has included exposing the subject to anxiety-producing stimuli (technically called Systematic Desensitization). These stimuli are generated through a variety of modalities including imaginal (subject generates stimulus via imagination) and *in vivo* (subject experiences real situations).

In utilizing systematic desensitization, research reviews demonstrate that most of the clients appear to have difficulties imagining the prescribed, or relaxation, scene. They also express strong avoidance of experiencing real situations. This avoidance may be a learned behavior that appears to reduce the anxiety of clients, thus reducing their public embarrassment. Empirical studies also demonstrate that most clients express difficulties experiencing the real-world situation after treatment with systematic desensitization techniques.

Recently, the practical application of virtual environment (commonly known as virtual reality) has been extended to many diverse areas such as: database, production design, and modeling in the medical area (such as surgical simulation). Briefly, virtual environment is a technology that enables users to enter computer-generated

worlds and interface with their three-dimensionally through sight, sound, and touch.³ Virtual Environment offers a new human-computer interaction paradigm in which users are no longer simply external observers of data or images on a computer screen. They are active participants within a computer-generated three-dimensional virtual world. Virtual environment also is called virtual reality, telepresence, artificial worlds, cyberspace, or multisensory input/output.

Virtual environment technology may be utilized to overcome some of the difficulties inherent in the traditional treatment of agoraphobia. Virtual environment, like current imaginal and *in vivo* modalities, can generate stimuli that could be utilized in desensitization therapy. Like systematic desensitization therapy, virtual environment desensitization (VED) therapy will provide stimuli for clients who cannot imagine too well or are too phobic to experience real situations. Unlike systematic desensitization (i.e., *in vivo*) techniques, counselor-administered VED will be performed within the confines of a room, thus avoiding public embarrassment and violation of client confidentiality. Similar to lens-assisted *in vivo*⁴,

³H.P. Newquist, "Virtual Reality's Commercial Reality," Computer World (1992): 112.

⁴John W. Schneider, "Lens-Assisted *in vivo* Desensitization to Heights," Journal of Behavior Therapy & Experimental Psychiatry 13 (1982): 333-6.

virtual environment can generate stimuli of much greater magnitude than standard *in vivo* techniques, providing for greater desensitization. The VED will prepare clients before they actually experience the real world, and since it is under client control, it will appear safe and may prove to be more effective than conventional methods of treatment. VED will be used as a step in preparing clients for maintenance therapy involving self-directed *in vivo* exposure. VED also offers the ability to isolate which virtual stimulus parameters are essential in generating a phobic response. Finally, VED adds the advantage of greater efficiency and economy in delivering the equivalent of systematic desensitization within the counselor's office.

In order to investigate the effectiveness of VED in treatment of agoraphobia on college students, a traditional experimental design was utilized. The sample of this study consisted of self-reports of undergraduate male or female students (N=60) who were suffering from agoraphobia (i.e., agoraphobia without history of panic disorder) and who were willing to participate in the study. After screening the subjects, the selected subjects were randomly placed in the experimental group (30 students) and control group (30 students). The VED (experimental) group was familiarized with the virtual environment equipment in the first session. For the subjects' subsequent sessions, individual counseling was conducted in a standard format. The site of this study

was Atlanta, a large metropolitan city in the Southeast. Clark Atlanta University was the targeted institution. Two instruments were used in this study, the Attitude Towards Agoraphobia Questionnaire (ATAQ) and the Subjective Unit of Discomfort Scale (SUDS). ATAQ and SUDS were administered at pre- and post-periods of the experiment. The collected data were subjected to analysis of variance (t-test) to determine the effectiveness of the VED.

Purpose of the Study

The primary purpose of this study was to investigate the effectiveness of virtual environment technology in the area of counseling. Consequently, this study investigated the effectiveness of virtual environment desensitization (VED) in the treatment of agoraphobia on a select group of undergraduate students attending Clark Atlanta University during the 1994-1995 school year.

Research Questions

The research questions as perceived by this investigator were:

- (1) Would virtual environment desensitization (VED) treatment of clients with agoraphobia significantly affect experimental group performance?

- (2) Could virtual environment technology assist counselors in treating clients by providing virtual environments that are safe and under the control of those clients?

Null Hypotheses

In carrying out the purpose of this study, the following null hypotheses were tested:

- H01: There will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.
- H02: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.
- H03: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitudes Towards Agoraphobia Questionnaire.
- H04: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Attitudes Towards Agoraphobia Questionnaire.

H05: There will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

H06: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

H07: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale.

H08: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

Significance of the Study

This research is expected to contribute significantly to the existing body of knowledge on the treatment of psychological problems, specifically in the treatment of agoraphobia. The outcome may provide specific significant contributions to the research area of counseling and establish a new paradigm for utilizing virtual environment technology in the effective, economical, and confidential treatment of psychological problems.

The results of the study may provide specific significant contributions to the areas of counseling, virtual environment, and human-computer interaction by:

1. Providing alternative techniques for treatment of agoraphobia;
2. Expanding the impact of virtual environment technology to combat other psychological problems; obsessive/compulsive disorders; and phobic behavior modifications;
3. Advancing emerging technology in the virtual environment area by attracting researching advances from the fields of counseling, psychology, computer science, engineering, and mathematics;
4. Prompting researchers to search for applications of virtual environment in their own fields of expertise; and
5. Elevating public awareness of virtual environment technology beyond its present entertainment and business applications by promulgating its possibilities to enhance human conditions.

Assumptions

Two basic assumptions were made in conducting this study.

1. It was assumed that the participants in this study would show significant reductions in anxiety levels if they were exposed to safe, supportive experimental activities through virtual environment desensitization.
2. It was assumed that the phenomenon of regression toward the mean would not favor one group over another since the groups were randomly assigned. To ensure the balance between the experimental and control groups, participants were screened so that the independent variables of age and education were within a close range.

Limitations of the Study

This study was confined to undergraduate students currently enrolled at Clark Atlanta University. The study involved a population of 60 students. Generalizations from the finding of this study should be limited to situations that do not differ significantly from the situations in this current study. The instruments of this study were of a self-reporting nature; thus, the validity of the data was dependent upon the attitude, honesty, and accuracy of the participants' responses.

Definition of Terms

1. Agoraphobia (without history of panic disorder):

fear of being in places and situations from which escape might be difficult or embarrassing.

2. Desensitization: graduated exposure of the client to the anxiety-invoking stimuli.
3. *in vivo* techniques: exposure of client to the anxiety-invoking stimuli in the real world rather than the imaginary world.
4. Virtual Environment: computer-generated world that allows users an interactive interaction through the use of sight, sound, and touch.
5. Virtual Environment Desensitization (VED): the use of virtual environment technology as an alternative to systematic desensitization and self-directed maintenance systematic desensitization.

CHAPTER II

LITERATURE REVIEW

The literature review for this research study is divided into the following sections: (1) Relationship between counseling and psychotherapy; (2) Nature of agoraphobia; (3) Traditional treatments for agoraphobia; (4) Computer applications in counseling; (5) Virtual environment and applications; and, (6) Virtual environment and counseling. The sections comprise pages 11 to 37.

Relationship Between Counseling and Psychotherapy

Surprisingly, the range of literature reflects a remarkable diversity of opinions on the similarities and differences between counseling and psychotherapy. There has historically been ambiguity regarding the use of these terms. The helping professional knows that these two terms are used interchangeably and do overlap. As a result of this use, a semantic equivalency between counseling and psychotherapy has emerged.¹ In the psychological realm, problems vary from deeply embedded emotional conflicts to minor emotional conflicts. Over a period of many years,

¹Gary S. Belkin, Introduction to Counseling (Dubuque: Wm.C. Brown Publishing, 1988), 21-5.

specialists of different skills and backgrounds have emerged to expertly address one or more categories of problems, yet maintain insight into all of the areas.

Confusion also exists about the terms and roles of counselor, counselor psychologist, and clinical psychologist.² In general, there is no universal agreement as to whether counseling and psychotherapy are synonymous or distinct.^{3, 4, 5}

One predominant point of view is "No, there is no difference, so let us get on with more important issues." Patterson agrees with this view and writes:

If experts in counseling and psychotherapy were asked to list the theories that should be considered under each heading, there would probably be great overlapping in the list. The difficulty in determining which are theories of counseling and which are theories of psychotherapy is taken as one evidence of lack of clear or significant differences between them. The position taken by the writer is that there are no essential differences between counseling and psychotherapy ... the definitions of counseling would in most cases be acceptable as definitions of psychotherapy and vice versa. There seems to be agreement that both counseling and psychotherapy are processes involving a special kind of relationship between a person who asks

²J. M. Whitely, N. Kagan, L. W. Harmon, B. R. Fretz and D. Tanney The Coming Decade in Counseling Psychology (Schenectady, NY: Character Research Press, 1984), 58.

³Gary S. Belkin Introduction to Counseling (Dubuque: Wm. C. Brown Publishing, 1988), 21-5.

⁴W. J. Kirman Modern Psychoanalysis in the Schools (Dubuque, IA: Kendall/Hunt, 1977), 4-20.

⁵J. M. Whitely, N. Kagan, L. W. Harmon, B. R. Fretz and D. Tanney The Coming Decade in Counseling Psychology (Schenectady, NY: Character Research Press, 1984), 58.

for help with a psychological problem ... and a person who is trained to provide that help The nature of the relationship is essentially the same.... The process that occurs also does not seem to differ from one side to the other. Nor do there seem to be any distinct techniques or group of techniques that separate counseling and psychotherapy. (pp. xii-xiii)

The other prominent position is that counseling differs from psychotherapy in terms of seriousness of the client's psychological problems, and depth or intensity of the treatment. This position relies on the degree of the client's disturbance; in counseling, the client is an "adequately functioning individual," but in psychotherapy, the patient is "neurotic and pathological."^{6, 7} Perry deliberates a similar view that supports the difference between counseling and psychotherapy and writes:

Counseling is concerned with helping individuals learn new ways of dealing with and adjusting to life situations. It is a process through which people are helped to develop sound decision-making processes either in an individual or group setting.... Counseling does not attempt to restructure personality, but rather to develop what already exists. p. 15

Marks also supports the notion of counseling being a procedure with a more comprehensive approach than psychotherapy. The concern of the helper lies not only with the client's problem, but with the client as a total

⁶Gary S. Belkin, Introduction to Counseling (Dubuque: Wm. C. Brown Publishing, 1988), 21-5.

⁷W. G. Perry, Jr., et al., On the Relation of Psychotherapy to Counseling, Annals of the New York Academy of Science 63 (1955): 369-407.

individual. On the contrary in psychotherapy, the problem sometimes takes precedence over the patient's total reality.⁸

This debate has continued and will continue for many years, and a helper can decide which one to subscribe to or may consider the middle ground. However, the role of the professional helper remains the same regardless of the similarities and differences between counseling and psychotherapy. This short summary of different positions demonstrates that counseling and psychotherapy may seem to have differences in theoretical perspectives, while also having similar ways of approaching the same psychological problems of highly complex human beings.

Nature of Agoraphobia

Recent studies report that anxiety disorders are frequently found in the general population. Most disorders in this group are more common among first-degree biologic relatives of people. For example, agoraphobia has been reported as the most common form of anxiety disorder among the general population.⁹

⁸M. J. Marks, "Conscious/Unconscious Selection of the Psychotherapist's Theoretical Orientation," Psychotherapy: Theory, Research, and Practice 15 (1978): 354-8.

⁹American Psychiatric Association, Diagnostic and Statistical Manual Disorders, 4th ed., (Washington, DC, 1994), 393-444.

Agoraphobia is the abnormally intense fear of being in places or situations from which escape might be difficult or embarrassing. People having this disorder suffer from marked distress about having the fear or from significant behavior difficulties. This behavior dysfunction causes interference with normal routines or with interpersonal relationships. Agoraphobia can result in significant distress in any setting.

Specifically, persons with agoraphobia restrict their activities outside of their home. These include activities involving crowds, being on bridges, being in elevators, or traveling by public and private means (bus, train, car, or airplane). Usually, the person suffers a limited symptom attack -- he or she develops a single symptom or a number of symptoms. These physiological symptoms may include dizziness, falling, loss of bladder or bowel control, vomiting, cardiac distress, depersonalization or derealization. In most cases the symptoms may have occurred in the past, and the person anticipates them to reoccur. An additional factor for fear may be the anticipation of humiliation or embarrassment in specified situations. Therefore, the person may avoid situations that would provoke the anxiety.

The incremental and decremental level of anxiety can be predicated by the function of location or nature of the phobic stimulus (e.g., height of a building). In general,

the person with a phobia avoids situations that may invoke anxiety-causing stimuli.¹⁰

The Diagnostic and Statistical Manual Disorders, Fourth Edition, describes the diagnostic criteria for agoraphobia (300.22 Agoraphobia without history of panic disorder) as:¹¹

- A. The presence of Agoraphobia related to fear of developing panic-like symptoms (e.g., dizziness or diarrhea).
- B. Criteria have never been met for panic disorder.
- C. The disturbance is not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition.
- D. If an associated general medical condition is present, the fear described in Criterion A is clearly in excess of that usually associated with the condition.

Traditional Treatments for Agoraphobia

Behavioral approaches to counseling, one of the major schools of thought in counseling and psychotherapy, have traditionally been relatively effective in the treatment of

¹⁰Ibid., 396.

¹¹Ibid., 244-5.

phobias.¹² Specifically, the utilization of systematic desensitization, one of several behavioral approach techniques, has been well documented.¹³

Behavioral approaches to counseling and psychotherapy are based on learning theory. Learning theory assumes that the behavior of all humans is learned. Patterson defined neurosis (anxiety) when he wrote that "Neurosis is a product of experience rather than primarily of instinct or organic damage".¹⁴

Belkin describes behavior counseling as a combination of related approaches with the beliefs that:

Emotional, learning and adjustment difficulties can be treated through a variety of prescriptive, mechanical, usually nondynamic techniques and procedures.¹⁵

One of the major techniques used in the behavioral approach to counseling and psychotherapy is systematic desensitization. The technique of systematic desensitization is based upon the learning principle of

¹²A. E. Kazdin and L. A. Wilcoxon, "Systematic Desensitization and Non-specific Treatment Effects: A Methodological Evaluation," Psychiatric Bulletin (1983): 93-103.

¹³Mark G. Pendelton and Raymond L. Higgins, "A Comparison of Negative Practice and Systematic Desensitization in the Treatment of Acrophobia," Journal of Behavioral Therapy and Experimental Psychiatry 14 (1983): 317-23.

¹⁴Cecil H. Patterson, Theories of Counseling and Psychotherapy (New York: Harper & Row, Publishers, Inc., 1986).

¹⁵Gary. S. Belkin, Introduction to Counseling (Dubuque: Wm. C. Brown Publishing, 1988), 273.

reciprocal inhibition, which was developed by Wolpe.¹⁶ Specifically, Wolpe defines reciprocal inhibition as follows:

Reciprocal inhibition means that if a relaxing response is paired with an anxiety-producing stimulus, a new bond develops between the two so that the anxiety-provoking stimulus no longer provokes anxiety.¹⁷

In other words, systematic desensitization eliminates fear because fear is incompatible with relaxation.

Systematic desensitization consists of two components:

- (1) the relaxation component that teaches the client to adopt a mental set of relaxation; and
- (2) the imaginal component that teaches the client to visualize the anxiety-producing scene systematically.

Gradually, stronger stimuli are invoked as the previous ones are reduced to zero anxiety, until the maximum anxiety-arousing stimulus has no effect on patient responses. Finally, patients are encouraged to experience real world situations.

Garvey and Hegrenes¹⁸ described systematic desensitization by providing an excellent case study that

¹⁶Joseph Wolpe, Psychotherapy by Reciprocal Inhibition (Calif: Stanford University Press, 1958).

¹⁷Gary. S. Belkin, Introduction to Counseling (Dubuque: Wm. C. Brown Publishing, 1988).

¹⁸W. P. Garvey and J. R. Hegrenes, "Desensitization techniques in the treatment of school phobia," American Journal of Orthopsychiatry 36 (1966): 147-52.

shows how a school psychologist treated a child suffering from school phobia -- a disorder that responds well to the systematic desensitization technique. A ten-year-old boy was not able to enter the car in which he travels to school. The planned systematic desensitization consisted of twelve graduated stages. The psychologist accompanied the boy in every stage. When the boy felt comfortable with a certain stage, then the next step was applied, and so on. The stages for this case were as follows:

1. Getting into the car that was parked in front of the school.
2. Getting out of the car and approaching the curb.
3. Going to the sidewalk.
4. Going to the bottom of the school steps.
5. Going to the top of steps.
6. Going to the door.
7. Entering the school.
8. Approaching the classroom a certain distance each day.
9. Entering the classroom.
10. Being present in the classroom with the teacher.
11. Being present in the classroom with the teacher and one or two classmates.
12. Being present in the classroom with the full class.

James, Hampton, and Larsen¹⁹ described the relative efficacy of imaginal and *in vivo* desensitization in the treatment of agoraphobia in their work. The participants in the study were six agoraphobic women with a mean age of 44.7 years (participants' ages ranged from 34 to 62 years). All of the participants exhibited marked anxiety. These anxieties were spontaneous panic attacks, high levels of general anxiety and avoidance of going out-of-doors, traveling in public transportation, and being in crowds. The results of the study indicate that the imaginal and *in vivo* procedures were equally effective in reducing observed avoidance behavior and subjective distress.

Computer Applications in Counseling

One of the most significant developments of the past decade has been the impact of computer technology on our daily lives. Computers have become integral components of education, communication, and entertainment. There are two major factors that account for the increased use of the computers. First, there has been a steady reduction in the

¹⁹Jack E. James, B. A. May Hampton, and Shirley A. Larsen, "The Relative Efficacy of Imaginal and In vivo Desensitization in the Treatment of Agoraphobia," Journal of Behavioral Therapy & Experimental Psychiatry 14 (1983): 203-7.

cost of the computing.²⁰ Second, the overall computing power of individual computers has increased tremendously.²¹ In addition, there are two major trends that influence the expanding use of computers. The first is the existence of microcomputers that are small, inexpensive, and easily maintained. These microcomputers are designed for use by persons with limited backgrounds and expertise in computer programming. The ease of technical operation and the wide variety of existing application programs places the power of the computers in the hands of the general public. The second trend involves the use of computer networks. The recent improvement in electronic communication technology has empowered the connection of computers in various locations by telephone lines (e.g., fiber optics) and satellite.

Computer application in psychology and counseling is a worthy example of the new trend of computer applications. Specifically, many different functions may be carried out by individuals interacting with a computer. Problem solving, information dissemination, instruction in decision making strategies, test administration and interpretation are just

²⁰Daniel L. Slotnick, Evan M. Butterfield, Earnest S. Colantonio, Daniel J. Kopetzky, and Joan K. Slotnick, Computers and Application, An Introduction to Data Processing (Lexington Massachusetts: D.C. Heath and Company, 1986), 3-25.

²¹Ibid., 48-52.

a few of the many functions that can be performed.

There have been several isolated attempts to develop computer programs that may assist counselors with the treatment of their clients, especially clients with phobias. One of these programs was developed by Weil et al.,²² who presented their research at the 16th Annual Meeting of the Society for Computers in Psychology, New Orleans, Louisiana. Weil et al, described the program's development, funded by a three-year U.S. Department of Education Grant, that was being used to study computer phobia at the college level and the type of discomfort college students may experience. The researchers designed a clinically-based five-week model computer phobia reduction program. Their results demonstrated a significant pre-post treatment change in anxiety, attitude, cognition, and feelings.

Furthermore, specific use of the computer for treatment of resistance to Magnetic Resonance Imaging (MRI) has been investigated and reported by Klonoff, et al.²³ This case study involves a 43-year old woman with a possible tumor who demonstrated resistance to examination by an MRI scan

²²Michelle M. Weil, Larry D. Rosen, and Deborah C. Sears, "The Computerphobia Reduction Program: Year 1 Program Development and Preliminary Results," Behavior Research Methods Instruments and Computers 19 (1987): 180-4.

²³Elizabeth A. Klonoff, Jeffrey W. Janata, and Benjamin Kaufman, "The Use of Systematic Desensitization to Overcome Resistance to Magnetic Resonance Imaging (MRI) Scanning," Journal of Behavior Therapy and Experimental Psychiatry 17 (1986): 189-92.

because of her claustrophobic disorder. The subject was successfully treated with systematic desensitization in four treatment sessions.

Another group of researchers has reported the design of successful computer programs that provide systematic desensitization for phobias. Specially, Chandler, et al²⁴ describe an experiment utilizing computer programs that provides systematic desensitization for phobic clients. First, clients received an overview of relaxation training and other general instructions. Then clients were encouraged to develop their own personalized phobic hierarchy by computer-aided instruction. This phobic hierarchy was used by the computer to direct phobic stimuli in the desensitization procedure. The result of their pilot study with a 35-year-old agoraphobic male client showed that the computer program was successful.

In 1988, Chandler, Burck, Sampson, and Wray²⁵ reported successful results of their research entitled, "The Effectiveness of a Generic Computer Program for Systematic Desensitization." These researchers describe a design of

²⁴Gerald M. Chandler, Harman D. Burck, and James P. Sampson, "A Generic Computer Program for Systematic Desensitization: Description, Construction and Case Study," Journal of Behavior Therapy and Experimental Psychiatry 17 (1986): 171-4.

²⁵Gerald M. Chandler, Harman Burck, James P. Sampson, and Robert Wray, "The Effectiveness of a Generic Computer Program for Systematic Desensitization," Computers in Human Behavior 4 (1988): 339-46.

computer programs that provide systematic desensitization. The subjects for this study were five phobic volunteers. Subjects outlined goals for goal-attainment scaling and completed a questionnaire on the subject of fear before participating in the experiment. Outcomes that were assessed both immediately and eight months after the experiment indicated that all of the subjects achieved their goals.

Specifically, clients with phobia have been successfully treated by utilizing computer and exposure treatment. Carr and Marks,²⁶ in a report published in the Canadian Journal of Psychiatry, described an experiment of computer-supervised exposure treatment for phobias. The experiment utilized twenty phobic patients who were treated by eight weekly interviews at the console of a desk computer. The computer interview was conducted by using conversational and multiple choice question dialogues. The computer assisted patients to build a hierarchy of tasks. Routinely, patients' progress and motivation were assessed, and the patients were encouraged to accept progressively more difficult tasks. The control group was comprised of twenty patients who were matched in age, sex and type of phobia, and they were treated conventionally by a therapist.

²⁶A. C. Carr, A. Ghosh, and Isaac M. Marks, "Computer-Supervised Exposure Treatment for Phobias," Canadian Journal of Psychiatry 33 (1988): 112-7.

Both the experimental and control group showed significant improvement on all the scales (70% to 80%).

In another study, Buglione, Devito, and Mulloy²⁷ reported on the traditional group therapy for test anxiety which was compared with the computer-administered treatment. Both treatments contained cognitive and behavioral elements, including systematic desensitization and relaxation techniques. Subjects of this study were 36 test-anxious students. The effectiveness of each treatment was assessed by observing changes in test anxiety that were measured with the Test Anxiety Inventory and also changes in students' grade point average (GPA). These researchers reported a significant reduction in the test anxiety measures for both treatments. Findings support the efficacy of the computerized treatment, which may be used as an alternative to traditional group therapy.

Virtual Environment and Applications

Virtual environment (commonly known as virtual reality) is essentially a new paradigm. This section documents its very short history, introduces several definitions and applications of virtual environment, and discusses some technical aspects of its components and architecture.

²⁷Stephen A. Buglione, Anthony J. Devito, and Jean M. Mulloy, "Traditional Group Therapy and Computer-Administered Treatment for Test Anxiety," Anxiety Research 3,1 (1990): 33-9.

Most of the pioneer research of the virtual environment can be traced to Ivan Sutherland²⁸ in 1960. He postulated that (1965):

The ultimate display would, of course, be a room within which the computer could control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal."²⁹

In 1965, Ivan Sutherland designed the first head-mounted computer-graphics display that also tracked the position of the wearer's head. This marked the beginning point of virtual environment research and applications.

In 1967, Fredrick Brooks began the Grope project to explore force feedback utilizing computers at the University of North Carolina. Force feedback directs physical pressure or force through a computer user interface to the user so that the user can feel computer-simulated forces.³⁰ This line of research significantly contributed to the current state of the virtual environment user interfaces.

The next technological advances occurred in 1972 when Nolan Bushnell introduced Pong. The first interactive electronic game that allowed the player to interact with a bouncing ping-pong ball displayed on a TV screen.

²⁸Ivan Sutherland, "The Ultimate Display," Proceedings of IFIP 65,2 (1965): 506-8.

²⁹Ibid., 582-3.

³⁰F. P. Brooks, Jr., The Mythical Man-Moth; Essays in Software Engineering, Reading (MA: Addison-Wesley, 1975).

In the mid-eighties, the Ames Research Center at NASA started the development of a relatively low-cost virtual environment head-mounted display from an LCD TV. This new low-cost technology made virtual environment technology affordable and reachable for other researchers in the field.

After a very slow technological advancement period (1986-1988) in the field of virtual environment, many researchers began to revisit this technology. Today, virtual environment research is conducted by government, industry, academia, and others (e.g., NASA Ames Research Center, IBM, Boeing Co., University of North Carolina in Chapel Hill).³¹ Furthermore, many researchers see virtual environment as a way to meet human needs by creating intelligent, people-centered products, with applications in business, education, and entertainment.

Recently, the practical applications of virtual environment have extended to many diverse areas. Current research on virtual reality includes the area of a database that will enable users to "see" the database as a three-dimensional (3-D) model. By wearing a glove and a headset, the user can manipulate the data and its links. A second area of research is networking. For example, the network administrator using eye goggles and a glove will work in 3-D images of a computer-generated network grid. Other areas of

³¹H.P. Newquist, "Virtual Reality's Commercial Reality," Computer World (1992).

research include product design and modeling in areas of pharmaceuticals, biotechnology, and medical applications (such as surgical simulation).

Many claims have been made about virtual environment utilization to solve various kinds of problems. However, the fact remains that with limited available data, there seem to be some disabling bottlenecks that seriously limit the implication of these various applications. According to Bryson,³² the type of applications that may be utilized from virtual environment is an open question.

Considering the short life of virtual environment technology, there exists limited data in the field of virtual environment. There are very few working applications and fewer controlled experiments.

In spite of these limitations, virtual environment is a sophisticated integration of a number of technologies that has caught people's imagination and seems capable of becoming a significant tool in a number of applications. These include education and training, medicine, design, counseling and psychotherapy, and entertainment. Their applications document a number of good isolated facts and principles of what works and what does not work.³³

³²Steve Bryson, "Survey of Virtual Environment Technologies and Techniques," Computer Science Corporation, Applied Research Branch, Numerical Aerodynamic Simulation Systems Division, MST045-1, NASA Ames Research Center, ACMSIGGRAPH '92 Course Notes (1992).

³³Ibid., 1.3.

The simplest definition of the virtual environment is offered by Thomas Furness who writes:

Virtual Environment technology provides a medium through which computers can generate three dimensional worlds into which humans can enter. These worlds consist of three dimensional objects which can be seen, heard, and touched but which are virtual projects into the senses.³⁴

Sherdian introduces the human-computer interaction aspects of the virtual environment. Virtual environment offers 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 environment world. Virtual environment differs 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.³⁵

Newquist defines virtual environment as a technology that enables users to enter computer-generated worlds and interface with them three-dimensionally through sight,

³⁴Thomas A. Furness, "Expeditions in Virtual Space," Distinguished Lecture Series, Graphics, Visualization & Usability Center College of Computing, Georgia Institute of Technology, 1993.

³⁵Thomas. B. Sherdian, "Musing on Telepresence and Virtual Presence," Presence: Teleoperators and Virtual Environment 1,1 (1992): 120-5.

sound, and touch.³⁶ In general, the power of the virtual environment technology is that users can treat virtual objects as if they were real.

Bryson, in an article entitled "Survey of Virtual Environments Techniques," defines virtual environment as a world that the user interacts with, and this world contains three-dimensional objects that respond interactively to each other and to the user. The interaction of computer and various input and display technologies can create the sense of immersion in a computer generated reality, which is referred to as immersive virtual environment. Bryson explains immersive virtual environment and writes:

What is special about immersive virtual environment is the paradigm they introduce into computer-human interfaces: To interact with a computer generated thing, as opposed to a computer-generated picture of a thing.³⁷

Bryson reports that virtual environment also provides 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

³⁶H.P. Newquist, "Virtual Reality's Commercial Reality," Computer World (1992).

³⁷Steve Bryson, "Survey of Virtual Environment Technologies and Techniques," Computer Science Corporation, Applied Research Branch, Numerical Aerodynamic Simulation Systems Division, MST045-1, NASA Ames Research Center, ACMSIGGRAPH '92 Course Notes (1992).

treadmills, bicycles, or "flying" chairs that allow users to move about in the environment.³⁸

Virtual environments differ from traditional displays. The computer graphics and various display and input technologies are integrated to give the user a sense of presence or immersion in the virtual environment.^{39, 40}

The "sense of presence" that users experience in a virtual environment is perhaps the best-known attribute of virtual reality. It is an appeal to this sense of presence that is used to distinguish virtual reality as something different from merely a multimedia system or an interactive computer graphics display.

There have been a number of recent articles published on the experience of presence in a virtual or remote environment. Sheridan proposes three measurable physical variables that determine presence: extent of sensory information, control of relation of sensors to the environment, and ability to modify the physical environment.

³⁸Ibid., 1.4.

³⁹Thomas B. Sheridan, "Musing on telepresence and virtual presence," PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 120-6.

⁴⁰Max M. North and Sarah M. North, "Relative Effectiveness of Virtual Desensitization and Imaginal Desensitization in the Treatment of Aerophobia," Electronic Journal of Virtual Culture 2,4 (1994), 23-4.

Both Naiman⁴¹ and Loomis⁴² have argued that the normal human experience is not of the physical world but of our perceptions of the physical world, i.e., reality is what we perceive it to be. In his taxonomy of graphics simulation systems, Zeltzer⁴³ identified presence with the number and fidelity of available sensory input and output channels. Heeter⁴⁴ discusses three dimensions (personal, social, and environmental) of the subjective experience of presence. Fontaine⁴⁵ identifies a sense of presence with a state of consciousness in which one experiences "realness, vividness, and feeling very much alive", "attending the immediate situation", "a perception of thinking and acting in new and innovative ways", and "a broad awareness of everything around." Held and Durlach⁴⁶ discuss the need to define

⁴¹A. Naiman, "Presence, and Other Gifts," PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 145-8.

⁴²J. M. Loomis, "Understanding Synthetic Experience Must Begin With the Analysis of Ordinary Perceptual Experience," IEEE Symposium on Research Frontiers in Virtual Reality San Jose, California, (1993): 54-7.

⁴³D. Zeltzer, "Autonomy, Interaction and Presence," PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 127-32.

⁴⁴C. Heeter, "Being There: The Subjective Experience of Presence," PRESENCE, Teleoperations and Virtual Environments 1,2 (1992): 262-71.

⁴⁵G. Fontaine, "The experience of a sense of presence in intercultural and international encounters," PRESENCE, Teleoperations and Virtual Environments 4 (1992): 482.

⁴⁶R. M. Held and N. I. Durlach, "Presence," PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 109-12.

sensorimotor and cognitive factors that determine a sense of presence. Mowafy, Russo, and Miller⁴⁷ are investigating the role of presence in training tasks involving construction of mental models of spatial relationships.

Immersive virtual environment⁴⁸ deals with several important constraints. The primary constraint is that all the computation and rendering must occur at very high speeds, at least ten frames per second, to generate the sense of immersion. The other major constraint is the desire for more natural interaction such as body tracking.

The immersive feeling consists of the following facts:

- (i) The user must feel that there are objects around him or her and feel that these objects have position and properties;
- (ii) The user must feel that objects in the virtual environment have behaviors and respond to him or her.

The number of objects that may be rendered is limited by the fact that ten frames per second is needed to feel immersed.⁴⁹ Since the fastest computer graphics system

⁴⁷L. Mowafy, T. Russo and L. Miller "Is Presence a Training Issue?," IEEE Symposium on Research Frontiers in Virtual Reality San Jose, California, (1993): 124-5.

⁴⁸Steve Bryson, "Survey of Virtual Environment Technologies and Techniques," Computer Science Corporation, Applied Research Branch, Numerical Aerodynamic Simulation Systems Division, MST045-1, NASA Ames Research Center, ACM SIGGRAPH '92 Course Notes (1992).

⁴⁹Ibid., 1.3.

available today has drawing speeds of a million polygons per second, for a system that runs ten frames per second, it translates to only 100,000 polygons per frame. In short, the major limitation to virtual environment development is hardware rather than software.

In brief, the major basic components of virtual environment systems are:

1. Display - A system that may display the computer generated graphics scene which may move with the user. This display system usually is accompanied with a head tracking device.
2. Tracking - A system used to track the positions and actions of the user. This system may include gloves or other devices.
3. Computation - A computer system that may compute the current state of the environment to draw the scenes and incorporate various inputs/outputs devices.

In addition, other systems may be used to enhance the virtual environment, such as sound output, and/or voice input and recognition.

Display systems may possess several features such as color, high resolution, and head tracking. There seems to be a difference in the feeling of immersion when utilizing different display systems. For example, a regular color

display or even high resolution display is not very immersive when compared with a head mounted-display -- the most immersive display system.

Bryson reports on the vision of the virtual environment technology when he writes:

Part of the vision of virtual environments is to make user control of the environment as natural and intuitive as possible. Another way to look at this is to make the interface 'invisible'. This means that the interactions with objects in the virtual environment should mimic as much as possible the interaction we have with real objects. At this stage in the technology, the goal of natural interaction that can be reached is only limited.⁵⁰

There are several approaches to creating virtual environment. Head-mounted displays consist of separate display screens for each eye that are attached to the head along with some type of display optics and a head-tracking device.⁵¹ Time-multiplexed CRT displays present a stereoscopic image by alternating right- and left-eye views of a scene on a CRT. The image is viewed through a shutter system that occludes the left-eye when the right-eye image is on the screen and vice versa.⁵² Time-multiplexed projection displays operate similarly to time-multiplexed CRTs, but the images are projected onto one or more large

⁵⁰Ibid., 1.2.

⁵¹M. A. Teitel, "The Eyeophone: A Head-Mounted Stereo Display," Proceedings of SPIE 1256 (1990): 168-71.

⁵²Larry F. Hodges, "Time-Multiplexed Stereoscopic Computer Graphics," IEEE Computer Graphics and Applications 12,2 (1992): 20-30.

screens.⁵³ Projection and CRT stereoscopic displays may or may not incorporate head-tracking.

Virtual Environment and Counseling

A recent pilot collaborative research study conducted by five researchers^{54, 55, 56} on the application of virtual environment to psychotherapy seems to be the only attempt to define a new paradigm involving psychotherapy and virtual environment. These researchers investigated the effectiveness of virtual environment graded exposure in the treatment of acrophobia. Subjects for this pilot research were thirty students who were randomly assigned to one of two groups, a virtual environment graded exposure or a waiting list control group. The preliminary findings of the pilot study are very encouraging. The major conclusion of

⁵³Carolina Cruz-Neira, Daniel J. Sandin, Thomas A. Defanti, Robert V. Kenyon, and John C. Hart, "The Cave: Audio Visual Experience Automatic Virtual Environment," Communication of ACM, SIGGRAPH '92 Showcase 35,6 (1992): 64-72.

⁵⁴James S. Williford, Larry F. Hodges, Max M. North, and Sarah M. North, "Relative Effectiveness of Virtual Environment Desensitization and Imaginal Desensitization in the Treatment of Acrophobia," Proceedings of Graphics Interface '93 Conference (1993): 162.

⁵⁵Barbara O. Rothbaum, Larry F. Hodges, Dan Opdyke, Rob Kooper, James S. Williford, and Max M. North, "Virtual Reality Graded Exposure in the Treatment of Acrophobia: A Case Study," Journal of Behavior Therapy (1995).

⁵⁶Max M. North and Sarah M. North, "Virtual Environment and Psychological Disorders," Electronic Journal on Virtual Culture 2, 4 (1994): 23-4.

this unique research study indicated that the virtual environment was successful in the treatment of clients with acrophobia. In essence, in addition to current *in vivo* and imaginal modalities, virtual environments can also generate stimuli that will be utilized in desensitization therapy. The researchers were: Larry Hodges (Graphics, Visualization & Usability Center, College of Computing, Georgia Institute of Technology), James Williford (Eisenhower Army Medical Center, Department of Psychiatry and Neurology), Barbara Rothbaum (Department of Psychiatry, Emory University), and Max North and Sarah North (Human-Computer Interaction Group, Computer and Information Science Department, Clark Atlanta University).

In summary, the findings from the above cited pilot research appear to be encouraging. They demonstrate the first step in creating a new paradigm in the area of the virtual environment and counseling.

CHAPTER III
RESEARCH METHODOLOGY

Experimental Design

Experimental studies are designed to investigate a causal relationship among variables. Experimental design refers to the conceptual framework within which the experiment is conducted and serves two major functions:

1. It establishes the conditions for the comparisons required by the hypotheses of the experiment; and
2. It enables the experimenter, through statistical analysis of the data, to make meaningful interpretations of the results of the study.¹

As mentioned earlier, the design of this study was the traditional experimental design. The researcher selected subjects (N=60) for this study. Thirty (30) subjects were placed in the experimental group and thirty (30) subjects were placed in the control group (Table 1). The independent variable of this study was the effectiveness of virtual environment desensitization

¹Donald Ary, Lucy C. Jacobs, and Asghar Razavich Introduction to Research in Education (New York: Holt, Rinehart and Winston, 1983), 55-7.

TABLE 1

RESEARCH DESIGN - EXPERIMENTAL DESIGN USING EXPERIMENTAL AND CONTROL GROUP AND PRE-TEST AND POST-TEST ASSESSMENTS

Group	Pre-test	Treatment	Post-test
Experimental Group N=30	ATAQ SUDS	VED	ATAQ SUDS
Control Group N=30	ATAQ SUDS	No Treatment	ATAQ SUDS

VED: Virtual Environment Desensitization
ATAQ: Attitude Towards Agoraphobia Questionnaire
SUDS: Subjective Unit of Discomfort Scale

treatment on subjects who suffered from agoraphobia. The dependent variables of this research were the Attitude Towards Agoraphobia Questionnaire and Subjective Unit of Discomfort Scale instruments.

In the first treatment session, the experimental subjects were asked to rank order a list of agoraphobic experiences according to the degree of anxiety arousal. These hierarchies were later used for the treatment.² During the VED subjects' first session, they were familiarized, as a group, with the virtual environment equipment.

²Joseph Wolpe, "The Systematic Desensitization of Neuroses," Journal of Neuroses and Mental Diseases 132 (1961): 189-203.

For the subjects' subsequent sessions, individual counseling was conducted in a standard format. The computer program designed for VED generated a standard hierarchy of agoraphobic experiences. Assessment measures were administered under blind conditions and in a standard order. At the one month post-test, all subjects were asked to complete the ten-point rating scales (ATAQ and SUDS). The control subjects received no treatment or placebo.³

Site and Setting

The site of this study was Atlanta, a large metropolitan city in the Southeast. Atlanta is the home of the Atlanta University Center (AUC), the largest consortium of historically African American institutions of higher learning. Clark Atlanta University (CAU), one of the six AUC institutions, was the targeted institution. CAU is a private, urban coeducational institution which offers undergraduate, graduate, and professional education. CAU is also a member institution of the United Negro College Fund (UNCF). CAU has an enrollment of 3,300 students (2,300 undergraduate and 1,000 graduate students). The student body is represented by more than 40 states and 50 countries. The researchers selected Atlanta because of its

³R. M. Turner, and L. M. Ascher, "A Controlled Comparison of Progressive Relaxation, Stimulus Control, and Paradoxical Intention Therapies for Insomnia," Journal of Consultant Clinical Psychology 47 (1979): 500-8.

accessibility, its diverse population, and access to virtual environment technology through the Graphics Visualization and Usability Center of the College of Computing at the Georgia Institute of Technology.

The study was conducted in two parts, one at the Graphics Visualization and Useability Center of the College of Computing at Georgia Institute of Technology for virtual environment software design, development, and validation. The other part was conducted in the Human-Computer Interaction Group of Computer and Information Science Department in conjunction with the Counseling and Human Development Department at Clark Atlanta University for the virtual environment desensitization treatment phase.

Subjects Pool

The subject pool consisted of a select group of male and female undergraduate students who attended Clark Atlanta University and were enrolled in an undergraduate course. These subjects were suffering from agoraphobia (without history of panic disorder). Finally, all subjects were willing to participate in the study.

Human Subjects Contract

A human subjects contract was needed. Because of the direct services that were rendered and also for the experimental treatment that was involved.

Research Team

The research team consisted of the principal investigator (PI) and research assistant (RA). The PI's and RA's tasks were as follows:

1. Announced the research study to CAU undergraduate students and solicit subjects for study;
2. Interviewed and screened the volunteer subjects for the study;
3. Conducted a group session with all potential subjects to explain the procedures for the study;
4. Collected consent from and grouped the subjects;
5. Selected subjects for experimental and control groups using a randomization technique;
6. Prepared the instruments;
7. Administered pre test to all subjects participating in the research study;
8. Designed, developed, tested, and implemented the software for the virtual environment desensitization treatment;
9. Conducted all the treatment sessions with the experimental group;
10. Administered post test to both the experimental and control group subjects;
11. Collected all the data and subjected them to certain statistical analyses for interpretation.

12. Summarized findings, conclusions, discussions, implementations, and recommendations.

Sample

The sample of this study consisted of self-report undergraduate male and female students (N=60) who were suffering from agoraphobia and who were willing to participate in the study. These subjects met the following criteria:

1. A diagnosis of agoraphobia (without history of panic disorder) according to the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders;⁴
2. A score between two points and eight points on the Attitudes Towards Agoraphobia Questionnaire (ATAQ)⁵ and the Subjective Unit of Discomfort Scale (SUDS);⁶
3. Permission of the subject.

The research consisted of two groups: one experimental group and one control group.

⁴American Psychiatric Association, Diagnostic and Statistical Manual Disorders, 4th ed., (Washington, DC, 1994), 396.

⁵J.L. Abelson and G.C. Curtis, "Cardiac and Neuroendocrine Responses to Exposure Therapy in Height Phobics." Behaviour Research and Therapy 27, 561 (1989), 84.

⁶Joseph Wolpe, The Practice of Behavior Therapy (New York: Pergamon, 1969), 125.

Selection Procedure

Subjects were recruited through questionnaires distributed to undergraduate students enrolled in undergraduate courses at Clark Atlanta University. The questionnaires contained questions that screened students for agoraphobia according to Diagnostic and Statistical Manual disorders and excluded subjects with history of panic disorder. Additional screening criteria included in the questionnaire were symptoms' duration of at least one year and a strong motivation toward overcoming agoraphobia. Subjects rated their maximum level of anxiety during the test on a ten-point Attitude Towards Agoraphobia Questionnaire (ATAQ) and a ten-point Subjective Unit of Discomfort Scale (SUDS). Subjects with an anxiety rating of less than two or more than eight on the ATAQ and/or SUDS were excluded from the study. Remaining subjects were randomly assigned to one of two groups: A virtual environment desensitization group (experimental group) or a waiting list (control group).

In order to minimize the confounding variable of treatment expectancy, informed consent for treatment was obtained after randomization. After the pre-test of the two groups, the control group subjects were asked not to communicate with other experimental subjects and not to self-treat. All subjects also were asked to keep a diary of any kind of exposure to agoraphobic situations, other

significant stresses, and new illness and/or treatment. The treatment schedule consisted of eight sessions for the VED group. The session length was fifteen minutes (total of 60 hours). Only subjects in the experimental group were exposed to VED treatment. The experimental and control subjects reported for the post test.

Instrument

Two instruments were used in this study.^{7, 8} The first instrument was an Attitude Towards Agoraphobia Questionnaire (ATAQ).⁹ The ATAQ has twelve different attitude attribute measures (six pairs of antonyms) on a rating scale ranging from zero to ten. These attributes are: good-bad, nice-awful, pleasant-unpleasant, safe-dangerous, unthreatening-threatening, and harmless-harmful. Subjects were able to complete the ATAQ in a few minutes. In addition, the experimenter could visually (graphically)

⁷Jack E. James, B. A. May Hampton, and Shirley A. Larsen, "The Relative Efficacy of Imaginal and *in vivo* Desensitization in the treatment of Agoraphobia," Journal of Behavior Therapy and Experimental Psychiatry 14,3 (1983): 303-7.

⁸C. R. Derogatis, R. S. Limpman, K. Rickels, E. H. Uhlenhuth, and L. Coul, "The HSCL: A Self-Report Inventory," Behavioral Sciences 19 (1974): 1-15.

⁹J.L. Abelson and G.C. Curtis, "Cardiac and Neuroendocrine Responses to Exposure Therapy in Height Phobics." Behaviour Research and Therapy 27, 561 (1989), 84.

observe the scores without any transformation of scores.¹⁰ The scores could be computed manually or by using any computerized statistical package for further interpretation. At the end of each session, subjects were given an ATAQ form to complete. All of the ATAQ scores were summed for each subject. The second instrument was the Subjective Unit of Discomfort Scale (SUDS).¹¹ SUDS is comprised of a ten-point rating scale from zero to ten that was reported at intervals of every five minutes by subjects during the VED treatment. SUDS also can be completed in a few minutes by the subjects. All of the SUDS scores were summed for each subject. The SUDS in conjunction with ATAQ provided simple but powerful instruments for this study.^{12, 13, 14}

¹⁰Mark G. Pendleton, and Higgins L. Raymond, A Comparison of Negative Practice and Systematic Desensitization in the Treatment of Acrophobia, Journal of Behavior Therapy & Experimental Psychiatry 114,4 (1983): 317-23.

¹¹Joseph Wolpe, The Practice of Behavior Therapy (New York: Pergamon, 1969), 125.

¹²Jack E. James, B. A. May Hampton, and Shirley A. Larsen, "The Relative Efficacy of Imaginal and *in vivo* Desensitization in the treatment of Agoraphobia," Journal of Behavior Therapy and Experimental Psychiatry 14,3 (1983): 303-7.

¹³John W. Schneider, "Lens-Assisted *in vivo* Desensitization to Heights," Journal of Behavioral Therapy and Experimental Psychiatry 13,4 (1982): 333-6.

¹⁴D. C. Cohen, "A Comparison of Self-Report and Behavioral Procedures for Assessing Acrophobia," Behavioral Therapy 8 (1977): 17-23.

Apparatus

The virtual environment system for this study consisted 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. Interactive imagery was generated by software developed at the Graphics, Visualization & Usability Center at Georgia Tech and the Human-Computer Interaction Group at Clark Atlanta University, executing on Silicon Graphics Workstation and Pentium Personal Computer. This arrangement allowed for time-parallel stereoscopic display with visual panning controlled by head movement in all virtual directions.

Procedure for Implementing the Study

In brief, the procedure for implementing the study was as follows:

1. Reviewed the literature pertinent to this study;
2. Designed, developed, and tested software for VED;
3. Identified the targeted population;
4. Contacted potential participants;
5. Screened the participants;
6. Administered pre test;
7. Carried out treatment procedures;
8. Administered post test; and

9. Collected, organized, analyzed, interpreted, and reported the study's data.

Treatment Procedures

Only subjects in the experimental group were exposed to the VED treatment. The individual procedures are detailed below.

Initial Treatment

In the initial treatment session, the VED subjects were familiarized, as a group, with the virtual environment equipment. For the VED subjects' subsequent eight sessions, individual virtual environment desensitization counseling was conducted in a standard format. The computer program designed for VED generated a standard hierarchy of phobic situations. All measures were administered under blind conditions and in a standard order. Post-tests of all subjects were obtained to complete an ATAQ and SUDS, including degrees for worsening symptoms and the degree to which their agoraphobic symptoms had changed since the pre-tests (ATAQ and SUDS).

Activity

Duration

1. First session:

10 Hours

Group session familiarized subjects with virtual environment equipment

2. Subsequent Sessions: 60 Hours
- Exposed subjects to VED treatment and administered ATAQ for each subject. Then the experimenter collected data for SUDS. Each session was fifteen minutes in length.

Data Collection Procedure

Data from ATAQ and SUDS instruments were collected from the participants in pre and post modes and analyzed by the investigator as described below:

Statistical Treatments of Data

The data collected (ATAQ and SUDS) were subjected to the following statistical treatments:

1. Analysis of variance (t-test) was applied to determine significant differences between the pre and/or post mean scores of the experimental group and/or the control group as designed in the hypothesis section. If a statistically significant difference was found, the null hypothesis was rejected. If no statistically significant difference was found, the null hypothesis was accepted. The 0.05 level of significance represented the decision rule by which to accept or reject the study's hypotheses.

CHAPTER IV
RESULTS AND DISCUSSIONS

This chapter presents the statistical analysis of the data in the study, results, and the discussion of research findings. This information is presented written and graphic (tables) form.

Statistical Analysis

The data were subjected to appropriate statistical procedures. These procedures included a measure of central tendency, and the analysis of variance (t-test).

Results

The purpose of the study was to investigate the effectiveness of a virtual environment desensitization (VED) in the treatment of agoraphobia. Null hypothesis number one was designed to determine the mean difference between pre-test scores of the subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.

Null hypothesis number one was stated as:

H01: There will be no statistically significant difference between the mean pre-test scores of

subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire. The results of the t-test indicated that there exists no significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire ($t=0.508$, $df=58$, $p<0.05$), (Table 2).

TABLE 2

T-TEST RESULTS OF THE MEAN PRE-TEST SCORES OF THE SUBJECTS IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

	Pre-test Control Group	Pre-test Experimental Group	t	df
N	30	30		
Mean	5.209	5.487	0.508	58
S.D.	(0.538)	(0.938)		

The t-value was 0.508 which indicated no statistically significant difference at the 0.05 level. Due to this, null hypothesis one was accepted. That is, there was no statistically significant difference between the mean pre-test scores of the subjects in the control and experimental groups on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number two was designed to determine the mean difference between post-test scores of the subjects

in the control and experimental groups on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number two was stated as:

H02: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.

The results of the t-test indicated that there exists a significant difference between the mean post-test scores of the subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire ($t=3.196$, $df=58$, $p<0.05$), (Table 3).

TABLE 3

T-TEST RESULTS OF THE MEAN POST-TEST SCORES OF THE SUBJECTS IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

	Post-test Control Group	Post-test Experimental Group	t	df
N	30	30		
Mean	5.764	2.013	3.196	58
S.D.	(0.663)	(1.519)		

The t-value was 3.196 which indicated statistically significant difference at the 0.05 level. Due to this significant difference, null hypothesis two was rejected. That is, there was a statistically significant difference

between the mean post-test scores of the subjects in the control and experimental groups on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number three was designed to determine the mean difference between pre- and post-test scores of the subjects in the experimental group on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number three was stated as:

H03: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitudes Towards Agoraphobia Questionnaire.

The results of the t-test indicated that there exists a significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitudes Towards Agoraphobia Questionnaire ($t=3.065$, $df=58$, $p<0.05$), (Table 4).

TABLE 4

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF THE SUBJECTS IN THE EXPERIMENTAL GROUP ON THE ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

	Pre-test Experimental Group	Post-test Experimental Group	t	df
N	30	30		
Mean	5.487	2.013	3.065	58
S.D.	(0.938)	(1.519)		

The t-value was 3.065 which indicated a statistically significant difference at the 0.05 level. Due to this significant difference, null hypothesis three was rejected. That is, there was a statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number four was designed to determine the mean difference between pre- and post-test scores of the subjects in the control group on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number four was stated as:

H04: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Attitudes Towards Agoraphobia Questionnaire.

The results of the t-test indicated that there exists no significant difference between the mean pre- and post-test scores of the subjects in the control group on the Attitude Towards Agoraphobia Questionnaire ($t=0.376$, $df=58$, $p<0.05$), (Table 5).

The t-value was 0.376 which indicated no statistically significant difference at the 0.05 level. Due to this, null hypothesis four was accepted. That is, there was no statistically significant difference between

TABLE 5

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF THE SUBJECTS IN THE CONTROL GROUP ON THE ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

	Pre-test Control Group	Post-test Control Group	t	df
N	30	30		
Mean	5.29	5.764		
S.D.	(0.538)	(0.663)	0.376	58

the mean pre- and post-test scores of the subjects in the control group on the Attitude Towards Agoraphobia Questionnaire.

Null hypothesis number five was designed to determine the mean difference between pre-test scores of the subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

Null hypothesis number five was stated as:

H05: There will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

The results of the t-test indicated that there exists no significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale ($t=0.099$, $df=58$, $p<0.05$), (Table 6).

TABLE 6

T-TEST RESULTS OF THE MEAN PRE-TEST SCORES OF THE SUBJECTS
IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE SUBJECTIVE
UNIT OF DISCOMFORT SCALE

	Pre-test Control Group	Pre-test Experimental Group	t	df
N	30	30		
Mean	5.381	5.241	0.099	58
S.D.	(0.672)	(0.699)		

The t-value was 0.099 which indicated no statistically significant difference at the 0.05 level. Due to this, null hypothesis five was accepted. That is, there was no statistically significant difference between the mean pre-test scores of the subjects in either the control or experimental groups on the Subjective Unit of Discomfort Scale.

Null hypothesis number six was designed to determine the mean difference between post-test scores of the subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

Null hypothesis number six was stated as:

H06: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

The results of the t-test indicated that there exists a significant difference between the mean post-test scores of the subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale ($t=3.084$, $df=58$, $p<0.05$), (Table 7).

TABLE 7

T-TEST RESULTS OF THE MEAN POST-TEST SCORES OF THE SUBJECTS IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE SUBJECTIVE UNIT OF DISCOMFORT SCALE

	Post-test Control Group	Post-test Experimental Group	t	df
N	30	30		
Mean	5.531	2.04	3.084	58
S.D.	(0.718)	(1.401)		

The t-value was 3.084 which indicated statistically significant difference at the 0.05 level. Due to this significant difference, null hypothesis six was rejected. That is, there was a statistically significant difference between the mean post-test scores of the subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

Null hypothesis number seven was designed to determine the mean difference between pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale.

Null hypothesis number seven was stated as:

H07: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale.

The results of the t-test indicated that there exists a significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale ($t=2.956$, $df=58$, $p<0.05$), (Table 8).

TABLE 8

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF THE SUBJECTS IN THE EXPERIMENTAL GROUP ON THE SUBJECTIVE UNIT OF DISCOMFORT SCALE

	Pre-test Experimental Group	Post-test Experimental Group	t	df
N	30	30		
Mean	5.241	2.04	2.956	58
S.D.	(0.699)	(1.401)		

The t-value was 2.956 which indicated statistically significant difference at the 0.05 level. Due to this significant difference, null hypothesis seven was rejected. That is, there was a statistically significant difference between the mean pre- and post-test scores of the subjects

in the experimental group on the Subjective Unit of Discomfort Scale.

Null hypothesis number eight was designed to determine the mean difference between pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

Null hypothesis number eight was stated as:

H08: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

The results of the t-test indicated that there exists no significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale ($t=0.103$, $df=58$, $p<0.05$), (Table 9).

TABLE 9

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF THE SUBJECTS IN THE CONTROL GROUP ON THE SUBJECTIVE UNIT OF DISCOMFORT SCALE

	Pre-test Control Group	Post-test Control Group	t	df
N	30	30		
Mean	5.381	5.531	0.103	58
S.D.	(0.672)	(0.718)		

The t-value was 0.103 which indicated no statistically significant difference at the 0.05 level. Due to this, null hypothesis eight was accepted. That is, there was no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

The mean SUDS for each of the eight VED sessions are presented in table 10. The data indicated that the average SUDS in each session decreased steadily across sessions, indicating habituation.

TABLE 10
MEAN SUDS ACROSS ALL SUBJECTS FOR EACH OF THE EIGHT SESSION
(EXPERIMENTAL GROUP)

SESSION	MEAN SUDS (S.D.)
ONE	5.66 (0.735)
TWO	5.54 (0.736)
THREE	5.24 (0.765)
FOUR	4.54 (0.797)
FIVE	3.72 (1.029)
SIX	3.25 (1.188)
SEVEN	2.76 (1.215)
EIGHT	2.42 (1.381)

In general, table 10 shows the superior habituation of agoraphobia of the experimental group utilizing the VED over the control group who did not receive any treatment.

Discussions

The current experiment demonstrated that agoraphobic clients can be successfully treated with VED, where confidentiality can be assured. In addition, the results of this study demonstrated that the computer (i.e., Virtual Environment) can be a viable tool of counseling.^{1, 2, 3, 4,}
⁵ Specifically, the virtual environment desensitization can provide clients with an important alternative opportunity for systematic desensitization and self-directed maintenance systematic desensitization.

In summary, the VED appeared to be the first extensive known controlled study of the application of virtual environment to the treatment of a psychological disorder. The results indicated that the VED was very effective in

¹Max M. North and Sarah M. North, "Virtual Environment and Psychological Disorders", Electronic Journal on Virtual Culture, 2, 4 (1994), 23-4.

²Barbara A. Rothbaum, Larry F. Hodges, James S. Williford, Dan Opdyke, Rob Kooper, and Max M. North, "Effectiveness of Virtual Reality Graded Exposure in the Treatment of Acrophobia", Journal of Psychiatry, 1995.

³Larry F. Hodges, Barbara A. Rothbaum, James S. Williford, Dan Opdyke, Rob Kooper, and Max M. North, "Presence as the Defining Factor in a VR Application", SIGGRAPH '94, 1994.

⁴Luciano L'Abate, Programmed Writing: A Self-administered Approach for Interventions With Individuals, Couples, and Families, (Pacific Grove, CA: Brooks/Cole, 1991).

⁵Luciano L'Abate and K. Platzman, "Programmed Writing (PW) in Therapy and Prevention With Families", American Journal of Family Therapy, 19 (1991).

reducing self-reported anxiety of the experimental group, whereas the control group did not demonstrate any significant change.

Theoretically, the present results are remarkable for many reasons. They attest to the sense of presence experienced by subjects in the virtual environment. The degree of anxiety and habituation observed would not have occurred if the subjects did not immerse in virtual environment. In addition, it seems that the fear structures of the subjects were activated (increases in anxiety) and modified (increases in habituation). The results also appeared to indicate that stimuli and responses were directly manipulated via virtual environment desensitization and habituation.^{6, 7}

⁶Max M. North and Sarah M. North, "Virtual Environment and Psychological Disorders", Electronic Journal on Virtual Culture, 2, 4 (1994), 23-4.

⁷Barbara A. Rothbaum, Larry F. Hodges, James S. Williford, Dan Opdyke, Rob Kooper, and Max M. North, "Effectiveness of Virtual Reality Graded Exposure in the Treatment of Acrophobia", Journal of Psychiatry, 1995.

CHAPTER V
RECAPITULATION, FINDINGS, CONCLUSIONS, IMPLICATIONS, AND
RECOMMENDATIONS

This chapter presents a recapitulation of this study. It also includes the study's findings, conclusions, implications, and recommendations.

Recapitulation

Purpose of the Study

The primary purpose of this study was to investigate the effectiveness of virtual environment technology in the areas of counseling. Consequently, this study investigated the effectiveness of a virtual environment desensitization (VED) in the treatment of agoraphobia on the select group of undergraduate students attending Clark Atlanta University.

Research Questions

The research questions as perceived by this investigator were:

- (1) Would virtual environment desensitization (VED)

treatment of clients with agoraphobia significantly affect an experimental group performance?

- (2) Could virtual environment technology assist counselors in treating clients by providing virtual environments that are safe and under those clients' control?

Null Hypotheses

In carrying out the purpose of this study, the following null hypotheses were tested:

- H01: There will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.
- H02: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire.
- H03: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitudes Towards Agoraphobia Questionnaire.
- H04: There will be no statistically significant difference between the mean pre- and post-test

scores of the subjects in the control group on the Attitudes Towards Agoraphobia Questionnaire.

H05: There will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

H06: There will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

H07: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale.

H08: There will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

Literature Review

The literature review for this research study was divided into the following sections: (1) Relationship between counseling and psychotherapy; (2) Nature of agoraphobia; (3) Traditional treatments for agoraphobia; (4) Computer applications in psychotherapy; (5) Definition

of virtual environment and applications; and, (6) Virtual environment and psychotherapy.

Relationship Between Counseling and Psychotherapy

Surprisingly, the range of literature reflects a vast diversity of opinions on the similarities or differences between counseling and psychotherapy. There has always been ambiguity regarding these terms. The helping professional knows these two terms are used interchangeably, and do overlap. As the result, over the years the semantic equivalency between counseling and psychotherapy has emerged. Specialists of different skills and background have emerged to handle expertly one or more categories of problems, yet maintain insight into all of the areas.

One predominant point of view regarding the two areas (counseling and psychotherapy) is "No, there is no difference, so let us get on with more important issues." Patterson is one author who agrees that there is no difference between counseling and psychotherapy. The other prominent position is that counseling differs from psychotherapy in terms of seriousness of the client's psychological problems, and depth or intensity of the treatment.

This on-going debate will probably continue for many years. Helpers will personally decide which one to subscribe to or may consider the middle ground. However,

the role of the professional helper remains the same regardless of the similarities and differences between counseling and psychotherapy. In brief, this summary of different positions demonstrates that counseling and psychotherapy may seem to have differences in theoretical perspectives, but they seem to share similarities in approaching the same psychological problems of the highly complex human beings.

Nature of Agoraphobia

Recent studies report that anxiety disorders are frequently found in the general population. Most of these disorders are more common among first-degree biologic relatives of people. Simple phobias (for example agoraphobia) have been reported as the most common form of anxiety disorders among the general population.¹

Agoraphobia is the abnormally intense fear of being in places or situations from which escape might be difficult or embarrassing.² People having this disorder suffer from marked distress about having the fear of, or from, significant behavior difficulties. Behavior dysfunction involves interference with normal routines or with interpersonal relationships. In a large metropolitan city,

¹American Psychiatric Association, Diagnostic and Statistical Manual Disorders, 4th ed., (Washington, DC, 1994), 396.

²Ibid., 393-444.

agoraphobia can result in significant distress.

Specifically, persons with agoraphobia restrict their activities including being alone, either outside the home or being in the home alone; being in a crowd of people; staying in a line; traveling in an automobile, bus, train, or airplane; or being on a bridge or in an elevator. Usually, these persons anticipate and suffer from a limited symptom attack. That is, they develop a single or few number of symptoms. These physiological symptoms may include dizziness, falling, loss of bladder or bowel control, vomiting, having cardiac distress, depersonalization or derealization. In most cases, such symptoms may have occurred in the past and a person would anticipate it reoccurring. In essence, the person may avoid situations that may provide such anxiety.

Traditional Treatments for Agoraphobia

In behavioral approaches to counseling and psychotherapy, one of the major schools of thoughts in the counseling and psychotherapy, have been traditionally relatively effective in the treatment of phobias.³ Specifically, the utilization of systematic

³A. E. Kazdin and L. A. Wilcoxon, "Systematic Desensitization and Non-specific Treatment Effects: A Methodological Evaluation," Psychiatric Bulletin (1983): 93-103.

desensitization, one of the behavioral approach techniques, has been well documented.⁴

Computer Applications in Psychotherapy

One of the most significant developments of the past decade has been the impact of computer technology on our daily lives. Thus, computers have become integral components of education, communication, entertainment, etc.

Computer applications in psychology and counseling is a specific example of the evolving trend of computer applications in general. Many different functions may be carried out by individuals in the counseling field who are interacting with a computer. Some of these functions include those of, problem-solving, information decimation and instruction in decision-making strategies, and test-administration and interpretation.

Definition of Virtual Environment

Virtual environment offers 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 world. Virtual environment

⁴Mark G. Pendelton and Raymond L. Higgins, "A Comparison of Negative Practice and Systematic Desensitization in the Treatment of Acrophobia," Journal of Behavioral Therapy and Experimental Psychiatry 14,4 (1983): 317-23.

differs 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.⁵ The interaction of computer and various input and display technologies can create the sense of immersion in a computer generated reality, which is referred to as immersive virtual environments.⁶

Virtual reality is a technology that enables users to enter computer-generated worlds and interface with it three-dimensionally through sight, sound, and touch.⁷ Virtual reality also is called virtual environment, telepresence, artificial worlds, cyberspace, or multisensory Input/Output. The power of the virtual reality is that users can treat virtual objects as if they were real.

Today, virtual reality research is conducted by those in government, industry, and academia. These researchers view virtual reality as a way to meet human needs by creating intelligent, people-centered products with applications in business, entertainment, and education.

⁵T. B. Sherdian, "Musing on Telepresence and Virtual Presence," Presence: Teleoperators and Virtual Environment 1,1 (1992): 120-5.

⁶Steve Bryson, "Survey of Virtual Environment Technologies and Techniques," Computer Science Corporation, Applied Research Branch, Numerical Aerodynamic Simulation Systems Division, MST045-1, NASA Ames Research Center, ACMSIGGRAPH '92 Course Notes (1992).

⁷H.P. Newquist, "Virtual Reality's Commercial Reality," Computer World (1992).

Virtual Environment and Psychotherapy

An extensive manual and electronic literature search of applications of virtual environment in psychotherapy manifest that there exists no published study involving virtual environment and psychotherapy application. However an isolated recent pilot research was discovered and which is detailed below.

A recent pilot collaborative research study⁸ was conducted by five researchers, Larry Hodges (Graphics, Visualization & Usability Center, College of Computing, Georgia Institute of Technology), James Williford (Eisenhower Army Medical Center, Department of Psychiatry and Neurology), Barbara Rothbaum (Department of Psychiatry, Emory University), and Max North and Sarah North (Human-Computer Interaction Group, Computer Science and Information Department, Clark Atlanta University). Their application of virtual environment and psychotherapy seem to be the only attempt to define a new paradigm involving psychotherapy and virtual environment. This pilot research investigated the effectiveness of virtual environment graded exposure in the treatment of acrophobia. Subjects for this pilot research were thirty students who were randomly assigned to one of the two groups, a virtual environment graded exposure or a

⁸James S. Williford, Larry F. Hodges, Max M. North, and Sarah M. North, "Relative Effectiveness of Virtual Environment Desensitization and Imaginal Desensitization in the Treatment of Acrophobia," Proceedings of Graphics Interface '93 Conference (1993): 162.

waiting list control group. The preliminary findings of the pilot study were encouraging. The major conclusion of this unique research study indicated that the virtual environment was successful in the treatment of clients with acrophobia. In essence, in addition to current *in vivo* and imaginal modalities, virtual environments can also generate stimuli that will be utilized in desensitization therapy. The study demonstrates the first step in creating a new paradigm in the area of the virtual environment and psychotherapy.

Experimental Design

The design of this study was the traditional experimental design. The researcher selected subjects (N=60) for this study. Thirty (30) subjects were placed in the experimental group and thirty (30) subjects were placed in the control group. The independent variable of this study was the effectiveness of virtual environment desensitization treatment on subjects who suffer from agoraphobia. The dependent variables of this research were the Attitude Towards Agoraphobia Questionnaire and Subject Unit of Discomfort Scale instruments.

Site and Setting

The site of this study was Atlanta, a large metropolitan city in the Southeast. Atlanta is the home of the Atlanta University Center (AUC), the largest consortium

of historically African American institutions of higher learning in the world. Clark Atlanta University was the targeted institution.

Subjects Pool

The subject pool consisted of a select group of undergraduate students (males and females) who attended Clark Atlanta University.

Sample

The sample of this study consisted of undergraduate male and female students (N=60) who were suffering from agoraphobia and who were willing to participate in the study.

Selection Procedure

Subjects were recruited through questionnaires distributed to undergraduate students enrolled in undergraduate courses at Clark Atlanta University. The questionnaires contained questions that screened students for agoraphobia according to diagnostic and statistical manual disorders and excluded subjects with history of panic disorder. Additional screening criteria included in the questionnaire were symptoms' duration of at least one year and a strong motivation toward overcoming agoraphobia. Subjects rated their maximum level of anxiety during the

test on a ten-point Attitude Towards Agoraphobia Questionnaire (ATAQ) and a ten-point Subjective Unit of Discomfort Scale (SUDS). Subjects with an anxiety rating of less than two and more than eight on the ATAQ and/or SUDS were excluded from the study. Remaining subjects were randomly assigned to one of two groups: A virtual environment desensitization group (experimental group) or a waiting list (control group).

Instrument

Two instruments were used in this study.^{9, 10} The first instrument was an Attitude Towards Agoraphobia Questionnaire (ATAQ).¹¹ The ATAQ has twelve different attitude attributes measures (six pairs of antonyms attributes) on a rating scale ranging from zero to ten. These attributes are: good-bad, nice-awful, pleasant-unpleasant, safe-dangerous, unthreatening-threatening, and harmless-harmful. The second instrument was the Subjective

⁹Jack E. James, B. A. May Hampton, and Shirley A. Larsen, "The Relative Efficacy of Imaginal and *in vivo* Desensitization in the Treatment of Agoraphobia," Journal of Behavior Therapy and Experimental Psychiatry 14,3 (1983): 303-7.

¹⁰C. R. Derogatis, R. S. Limpman, K. Rickels, E. H. Uhlenhuth, and L. Coul, "The HSCL: A Self-Report Inventory," Behavioral Sciences 19 (1974): 1-15.

¹¹J.L. Abelson and G.C. Curtis, "Cardiac and Neuroendocrine Responses to Exposure Therapy in Height Phobics." Behaviour Research and Therapy 27, 561 (1989), 84.

Unit of Discomfort Scale (SUDS).¹² SUDS is comprised of a ten-point rating scale from zero to ten that will be reported in intervals of every five minutes by subjects during the VED treatment.

Apparatus

The virtual environment system for this study consisted 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. Interactive imagery was generated by software developed at the Graphics, Visualization & Usability Center at Georgia Tech and the Human-Computer Interaction Group at Clark Atlanta University, executing on Silicon Graphics Workstation and Pentium Personal Computer. This arrangement allowed for time-parallel stereoscopic display with visual panning controlled by head movement in all virtual directions.

Procedure for Implementing the Study

In brief, the procedure for implementing the study was as follows:

1. Reviewed the literature pertinent to this study;

¹²Joseph Wolpe, The Practice of Behavior Therapy (New York: Pergamon, 1969), 125.

2. Designed, developed, and tested software for VED;
3. Identified the targeted population;
4. Contacted potential participants;
5. Screened the participants;
6. Administered pre test;
7. Carried out treatment procedures;
8. Administered post test;
9. Collected, organized, analyzed, interpreted, and reported the study's data;

Treatment Procedures

Only subjects in the experimental group were exposed to the VED treatment. In the initial treatment session, the VED subjects were familiarized, as a group, with the virtual environment equipment. For the VED subjects' subsequent eight sessions, individual virtual environment desensitization counseling were conducted in a standard format. The computer program designed for VED generated a standard hierarchy of phobic situations. All measures were administered under blind conditions and in a standard order. A post-test of all subjects were obtained to complete an ATAQ and SUDS, including degrees for worsening symptoms and the degree to which their agoraphobia symptoms have changed since the pre-tests (ATAQ and SUDS).

Activity**Duration**

1. First session: 10 Hours
Group session were familiarized subjects with virtual environment equipment
2. Subsequent Sessions: 60 Hours
Exposed subjects to VED treatment and administered ATAQ for each subject. Then the experimenter collected data for SUDS. Each session was fifteen minutes in length.

Statistical Treatments of Data

The data collected from ATAQ and SUDS instruments were subjected to the following statistical treatment:

1. Analysis of variance (t-test) was applied to determine significant differences between the means scores of the experimental group and/or the control group.

Findings

The null hypothesis number one stated that there will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire. The analysis of data supported the hypothesis; there was no significant difference. Therefore, the null hypothesis one was accepted. That is, there was no statistically

significant difference between the mean pre-test scores of the subjects in the control and experimental groups on the Attitude Towards Agoraphobia Questionnaire.

The null hypothesis number two stated that there will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Attitudes Towards Agoraphobia Questionnaire. The analysis of data did not support the hypothesis; there was a significant difference. Therefore, the null hypothesis two was rejected. That is, there was a statistically significant difference between the mean post-test scores of the subjects in the control and experimental groups on the Attitude Towards Agoraphobia Questionnaire.

The null hypothesis number three stated that there will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitudes Towards Agoraphobia Questionnaire. The analysis of data did not support the hypothesis; there was a significant difference. Therefore, the null hypothesis three was rejected. That is, there was a statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Attitude Towards Agoraphobia Questionnaire.

The null hypothesis number four stated that there will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control

group on the Attitudes Towards Agoraphobia Questionnaire. The analysis of data supported the hypothesis; there was no significant difference. Therefore, the null hypothesis four was accepted. That is, there was no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Attitude Towards Agoraphobia Questionnaire.

The null hypothesis number five stated that there will be no statistically significant difference between the mean pre-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale. The analysis of data supported the hypothesis; there was no significant difference. Therefore, the null hypothesis five was accepted. That is, there was no statistically significant difference between the mean pre-test scores of the subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale.

The null hypothesis number six stated that there will be no statistically significant difference between the mean post-test scores of subjects in the control and experimental groups on the Subjective Unit of Discomfort Scale. The analysis of data did not support the hypothesis; there was a significant difference. Therefore, the null hypothesis six was rejected. That is, there was a statistically significant difference between the mean post-test scores of the subjects in the control and experimental

groups on the Subjective Unit of Discomfort Scale.

The null hypothesis number seven stated that there will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale. The analysis of data did not support the hypothesis; there was a significant difference. Therefore, the null hypothesis seven was rejected. That is, there was a statistically significant difference between the mean pre- and post-test scores of the subjects in the experimental group on the Subjective Unit of Discomfort Scale.

The null hypothesis number eight stated that there will be no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale. The analysis of data supported the hypothesis; there was no significant difference. Therefore, the null hypothesis eight was accepted. That is, there was no statistically significant difference between the mean pre- and post-test scores of the subjects in the control group on the Subjective Unit of Discomfort Scale.

Conclusions

This research, including the pilot studies, has established a new paradigm for utilizing virtual environment

technology in the effective, economical, and confidential treatment of psychological disorders.

Based on the findings of the study, the following conclusions seemed warranted:

1. The virtual environment desensitization was effective in treatment of subjects with agoraphobia (experimental group).
2. The control group or no-treatment group did not change significantly.
3. All the attitudes towards agoraphobic situation decreased significantly for the virtual environment desensitization group (experimental group) but not for the control group.
4. The average SUDS in each session decreased steadily across sessions, indicating habituation.

Implications

According to this study, there was a significant difference between the pre-mean scores of the virtual environment desensitization group (experimental group) and the post-mean scores of the experimental group.

The implications of these results are numerous. Some of these are listed below:

1. Providing alternative techniques for treatment of agoraphobia.

2. Expanding the impact of virtual reality technology to combat other psychological disorders.
3. Establishing a new paradigm for utilizing virtual environment technology effectively, economically, and confidentially in the treatment of other psychological disorders.
4. Advancing emerging technology in the virtual environment and prompting researchers to search for application of virtual environment in their fields of expertise.
5. Encouraging counselor educators to build up a platform for computer technology research that pertains to counseling and psychotherapy applications.
6. Prompting counselor educators to participate in professional development activities such as visiting established educational computer laboratories, attending professional meetings, participating in seminars and colloquia, and other professional development activities in the area of computer technology and applications.
7. Encouraging counselor educators as well as their students to conduct research that is compatible with mainstream research of the other institutions.

Recommendations

The implications drawn from the conclusions of this study seemed to warrant the following recommendations:

1. That this study be replicated using instruments (e.g., Biofeedback machine) to collect physiological data in conjunction with psychological data to objectively validate the results of the study.
2. That virtual environment desensitization be developed and experimented with other psychological disorders.
3. That virtual environment desensitization be utilized by practitioners as an alternative technique for treatment of psychological disorders (e.g., agoraphobia).
4. That more research be conducted in other areas of counseling to determine effectiveness of the virtual environment technology.

Finally, the researcher strongly states that future research should focus on expanding the applications of virtual environment in the treatment of other psychological disorders.

APPENDIX-A

ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

Client Number: _____ Date: _____ Pre Test ____ Post Test ____

Please circle a number on each line below to indicate your rating of the present state of your phobic symptoms as you feel towards them right now.

0--1--2--3--4--5--6--7--8--9--10
GOOD BAD

0--1--2--3--4--5--6--7--8--9--10
NICE AWFUL

0--1--2--3--4--5--6--7--8--9--10
PLEASANT UNPLEASANT

0--1--2--3--4--5--6--7--8--9--10
SAFE DANGEROUS

0--1--2--3--4--5--6--7--8--9--10
UNTHREATENING THREATENING

0--1--2--3--4--5--6--7--8--9--10
HARMLESS HARMFUL

APPENDIX-B

ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE

Client Number: _____ Date: _____ Pre Test ____ Post Test ____

Please circle a number on each line below to indicate your rating of the present state of your phobic symptoms as you feel towards them right now.

0--1--2--3--4--5--6--7--8--9--10
GOOD BAD

0--1--2--3--4--5--6--7--8--9--10
NICE AWFUL

0--1--2--3--4--5--6--7--8--9--10
PLEASANT UNPLEASANT

0--1--2--3--4--5--6--7--8--9--10
SAFE DANGEROUS

0--1--2--3--4--5--6--7--8--9--10
UNTHREATENING THREATENING

0--1--2--3--4--5--6--7--8--9--10
HARMLESS HARMFUL

APPENDIX-C

CONSENT FORM

The primary purpose of this study is to investigate the effectiveness of the virtual environment technology in the areas of counseling. Consequently, this study will investigate the effectiveness of a virtual environment desensitization (VED) in the treatment of agoraphobia.

Individual responses and scores will be kept completely confidential and the students' names will not be associated with test scores in any way. Feedback on the general results of the experiment will be available upon request in writing.

There is a possibility that this approach may not work for some students who are severely phobic or who do not profit by this type of program. These students will be identified during the course of this project by their test scores. Those students who do not improve, and who will still score in the phobic range in the post-test battery, will be referred to appropriate sources for professional help, either during or at the end of this project.

I have read the above information. I have had ample opportunity to ask questions about the procedures, and I agree to participate in this study. I feel that I meet the requirements for this study. I am aware that my participation is voluntary and I may withdraw at any time without penalty.

Signature _____ Age ____ Sex ____ Date _____

APPENDIX-D

VIRTUAL ENVIRONMENT SCENES

Several virtual environment scenes were created, as described by subjects and considering software limitation, for use in the therapy sessions: an elevator, a series of balconies, a canyon with series of bridges, a dark barn, a dark barn with a cat inside, a covered bridge, an empty room, a covered driveway, and a series of balloons. The SVE (Simple Virtual Environments) and VREAM software were used to create virtual environment scenes for this study.

AN ELEVATOR SCENE

The elevator was modeled as an open elevator (no walls or ceiling) located on the inside of a 49 story hotel.

A SERIES OF BALCONIES SCENE

The balconies model consisted of several balconies attached to a tall building. Four balconies were created at different heights: ground level, second floor (six meters), tenth floor (thirty meters), and twentieth floor (sixty meters).

A CANYON WITH SERIES OF BRIDGES SCENE

The canyon model contained a series of bridges of different heights spanning the canyon from one side to the other. A river ran through the bottom of the canyon. The bridges varied not only in height but also in apparent steadiness. The lowest two bridges (seven and fifty meters) appeared safe and solid. The highest bridge (eighty meters) was a rope bridge with widely spaced wooden slats as the flooring.

A DARK BARN SCENE

The dark barn model was a barn in an open field. The interior of the barn was black (simulating darkness). The barn had a wide opening for entrance. Therefore subjects could exit the barn as quickly as they wished. There were several dark colored objects inside the barn.

A DARK BARN WITH A BLACK CAT SCENE

A black cat was simulated within the dark barn. The black cat was placed on the top of an object. The black cat was not visible from outside of the barn. In order to see the black cat, the subject had to enter the barn and look to the right side.

A COVERED BRIDGE SCENE

The covered bridge scene contained a bridge (ten meters high) that crossed a river, had walls on each side and a ceiling. There were two windows on each side of the walls. Dark colors were used to simulate a dark closed environment.

THE EMPTY ROOM SCENE

The empty room scene was created using four walls, ceiling, and floor. The room was four by six meters in size. It was relatively a small size room with only one door (entrance and exit). There were no windows or furniture in this room.

THE COVERED DRIVEWAY SCENE

The covered driveway was attached to an office building. This driveway had a solid wall on one side and was open on the other side (and was held only by columns).

A SERIES OF BALLOONS SCENE

A series of balloons at different heights was created for this scene. The first balloon was at a twenty meters height, the second balloon was at a thirty meters height, and the third balloon was at forty

meters height. There was a one-floor building and a four-floor office building on the scene.

APPENDIX-E

 ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE
 CONTROL GROUP PRE-TEST SCORES

SUBJ. #	1	5.5
SUBJ. #	2	4.83
SUBJ. #	3	4.83
SUBJ. #	4	5.33
SUBJ. #	5	5.16
SUBJ. #	6	6
SUBJ. #	7	3.66
SUBJ. #	8	5.5
SUBJ. #	9	5.3
SUBJ. #	10	4.5
SUBJ. #	11	4.83
SUBJ. #	12	5.5
SUBJ. #	13	5.66
SUBJ. #	14	5.16
SUBJ. #	15	5.33
SUBJ. #	16	5.88
SUBJ. #	17	4.5
SUBJ. #	18	5.83
SUBJ. #	19	6
SUBJ. #	20	4.66
SUBJ. #	21	6
SUBJ. #	22	5.66
SUBJ. #	23	4.83
SUBJ. #	24	5
SUBJ. #	25	5.66
SUBJ. #	26	5.5
SUBJ. #	27	4.83
SUBJ. #	28	5
SUBJ. #	29	5
SUBJ. #	30	4.83

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.209

MEASURES OF VARIABILITY

N = 30
RANGE = 2.34
VARIANCE = .290
STAN. DEV. = .538
STAN. ERROR = .098

CONFIDENCE INTERVALS

95% CONF. INT. 5.004 TO 5.414
99% CONF. INT. 4.929 TO 5.489

 ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE
 EXPERIMENTAL GROUP PRE-TEST SCORES

SUBJ. #	1	5.5
SUBJ. #	2	4.66
SUBJ. #	3	6.5
SUBJ. #	4	6.66
SUBJ. #	5	6
SUBJ. #	6	6.16
SUBJ. #	7	5.83
SUBJ. #	8	4.66
SUBJ. #	9	2.5
SUBJ. #	10	6
SUBJ. #	11	4
SUBJ. #	12	5.5
SUBJ. #	13	6.33
SUBJ. #	14	6.87
SUBJ. #	15	6.5
SUBJ. #	16	4.83
SUBJ. #	17	5.33
SUBJ. #	18	5.16
SUBJ. #	19	5
SUBJ. #	20	4.66
SUBJ. #	21	5.16
SUBJ. #	22	6.5
SUBJ. #	23	6.33
SUBJ. #	24	4.5
SUBJ. #	25	4.83
SUBJ. #	26	5.16
SUBJ. #	27	5.66
SUBJ. #	28	6
SUBJ. #	29	6.33
SUBJ. #	30	5.5

MEASURES OF CENTRAL TENDENCY

N = 30

MEAN = 5.487

MEASURES OF VARIABILITY

N = 30

RANGE = 4.37

VARIANCE = .879

STAN. DEV. = .938

STAN. ERROR = .171

CONFIDENCE INTERVALS

95% CONF. INT. 5.130 TO 5.845

99% CONF. INT. 4.999 TO 5.975

ATTITUDES TOWARDS AGORAPHOBIA QUESTIONNAIRE
CONTROL GROUP POST-TEST SCORES

SUBJ. #	1	6.16
SUBJ. #	2	4.83
SUBJ. #	3	6.66
SUBJ. #	4	5.33
SUBJ. #	5	5.33
SUBJ. #	6	6.83
SUBJ. #	7	5.5
SUBJ. #	8	6.66
SUBJ. #	9	4.85
SUBJ. #	10	5.66
SUBJ. #	11	4.5
SUBJ. #	12	5.5
SUBJ. #	13	5.16
SUBJ. #	14	6.33
SUBJ. #	15	6.66
SUBJ. #	16	5.33
SUBJ. #	17	5.33
SUBJ. #	18	6.5
SUBJ. #	19	6
SUBJ. #	20	5.33
SUBJ. #	21	4.83
SUBJ. #	22	6.33
SUBJ. #	23	5.5
SUBJ. #	24	6.5
SUBJ. #	25	6.33
SUBJ. #	26	5.5
SUBJ. #	27	5.83
SUBJ. #	28	5.16
SUBJ. #	29	5.83
SUBJ. #	30	6.66

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.764

MEASURES OF VARIABILITY

N = 30
RANGE = 2.33
VARIANCE = .440
STAN. DEV. = .663
STAN. ERROR = .121

CONFIDENCE INTERVALS

95% CONF. INT. 5.511 TO 6.017
99% CONF. INT. 5.419 TO 6.109

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 2.013

MEASURES OF VARIABILITY

N = 30
RANGE = 6.17
VARIANCE = 2.309
STAN. DEV. = 1.519
STAN. ERROR = .277

CONFIDENCE INTERVALS

95% CONF. INT. 1.434 TO 2.593
99% CONF. INT. 1.223 TO 2.804

T-TEST RESULTS OF THE MEAN PRE-TEST SCORES OF THE SUBJECTS
IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE ATTITUDES
TOWARDS AGORAPHOBIA QUESTIONNAIRE

***** t-test *****

Mean of X1: 5.209
Square x1: 822.413
N : 30

Mean of x2: 4.487
Square x2: 928.819
N : 30

t is : .5088914
df is: 58
Ok

T-TEST RESULTS OF THE MEAN POST-TEST SCORES OF THE SUBJECTS
IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE ATTITUDES
TOWARDS AGORAPHOBIA QUESTIONNAIRE

***** t-test *****

Mean of X1: 5.764
Square x1: 1009.463
N : 30

Mean of x2: 2.013
Square x2: 188.559
N : 30

t is : 3.196497
df is: 58
Ok

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF
THE SUBJECTS IN THE EXPERIMENTAL GROUP ON THE ATTITUDES
TOWARDS AGORAPHOBIA QUESTIONNAIRE

***** t-test *****

Mean of X1: 5.487
Square x1: 928.819
N : 30

Mean of x2: 2.013
Square x2: 188.559
N : 30

t is : 3.065416
df is: 58
Ok

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF
THE SUBJECTS IN THE CONTROL GROUP ON THE ATTITUDES TOWARDS
AGORAPHOBIA QUESTIONNAIRE

***** t-test *****

Mean of X1: 5.209
Square x1: 882.413
N : 30

Mean of x2: 5.764
Square x2: 1009.463
N : 30

t is : -.3763623
df is: 58

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 CONTROL GROUP PRE-TEST SCORES

SUBJ. #	1	5.83
SUBJ. #	2	6.66
SUBJ. #	3	5.33
SUBJ. #	4	5.5
SUBJ. #	5	4.83
SUBJ. #	6	6
SUBJ. #	7	4.33
SUBJ. #	8	5.66
SUBJ. #	9	4.33
SUBJ. #	10	5.66
SUBJ. #	11	4.83
SUBJ. #	12	5.16
SUBJ. #	13	5.66
SUBJ. #	14	5.83
SUBJ. #	15	4.5
SUBJ. #	16	6
SUBJ. #	17	5.33
SUBJ. #	18	6.16
SUBJ. #	19	4.66
SUBJ. #	20	6
SUBJ. #	21	5.66
SUBJ. #	22	5.5
SUBJ. #	23	4.83
SUBJ. #	24	5
SUBJ. #	25	4.83
SUBJ. #	26	6.87
SUBJ. #	27	6.16
SUBJ. #	28	4.83
SUBJ. #	29	5
SUBJ. #	30	4.5

MEASURES OF CENTRAL TENDENCY

N = 30

MEAN = 5.381

MEASURES OF VARIABILITY

N = 30

RANGE = 2.54

VARIANCE = .452

STAN. DEV. = .672

STAN. ERROR = .123

CONFIDENCE INTERVALS

95% CONF. INT. 5.125 TO 5.638

99% CONF. INT. 5.032 TO 5.731

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 EXPERIMENTAL GROUP PRE-TEST SCORES

SUBJ. #	1	4.83
SUBJ. #	2	5.33
SUBJ. #	3	6.33
SUBJ. #	4	5.83
SUBJ. #	5	4.66
SUBJ. #	6	4.83
SUBJ. #	7	5.33
SUBJ. #	8	5.66
SUBJ. #	9	3.5
SUBJ. #	10	6.16
SUBJ. #	11	5.66
SUBJ. #	12	4.66
SUBJ. #	13	5.66
SUBJ. #	14	4.83
SUBJ. #	15	5
SUBJ. #	16	4.5
SUBJ. #	17	5.66
SUBJ. #	18	4.83
SUBJ. #	19	5
SUBJ. #	20	5.16
SUBJ. #	21	4.18
SUBJ. #	22	5.5
SUBJ. #	23	5.33
SUBJ. #	24	4.83
SUBJ. #	25	6.33
SUBJ. #	26	6.83
SUBJ. #	27	4.83
SUBJ. #	28	4.66
SUBJ. #	29	5.5
SUBJ. #	30	5.83

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.241

MEASURES OF VARIABILITY

N = 30
RANGE = 3.33
VARIANCE = .488
STAN. DEV. = .699
STAN. ERROR = .128

CONFIDENCE INTERVALS

95% CONF. INT. 4.975 TO 5.508
99% CONF. INT. 4.878 TO 5.605

SUBJECTIVE UNIT OF DISCOMFORT SCALE
CONTROL GROUP POST-TEST SCORES

SUBJ. #	1	5.16
SUBJ. #	2	4.66
SUBJ. #	3	5.33
SUBJ. #	4	6.66
SUBJ. #	5	4.83
SUBJ. #	6	5.5
SUBJ. #	7	4.5
SUBJ. #	8	4.85
SUBJ. #	9	5.66
SUBJ. #	10	6.33
SUBJ. #	11	6.5
SUBJ. #	12	5.16
SUBJ. #	13	5.33
SUBJ. #	14	6
SUBJ. #	15	4.18
SUBJ. #	16	5.33
SUBJ. #	17	5.83
SUBJ. #	18	6.5
SUBJ. #	19	5.5
SUBJ. #	20	4.33
SUBJ. #	21	6.33
SUBJ. #	22	6.5
SUBJ. #	23	5.16
SUBJ. #	24	5.83
SUBJ. #	25	6.66
SUBJ. #	26	5.33
SUBJ. #	27	5.16
SUBJ. #	28	5.66
SUBJ. #	29	6.33
SUBJ. #	30	4.83

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.531

MEASURES OF VARIABILITY

N = 30
RANGE = 2.48
VARIANCE = .516
STAN. DEV. = .718
STAN. ERROR = .131

CONFIDENCE INTERVALS

95% CONF. INT. 5.257 TO 5.805
99% CONF. INT. 5.157 TO 5.905

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 EXPERIMENTAL GROUP POST-TEST SCORES

SUBJ. #	1	1.93
SUBJ. #	2	2.33
SUBJ. #	3	1.66
SUBJ. #	4	1.33
SUBJ. #	5	5.66
SUBJ. #	6	1.16
SUBJ. #	7	2
SUBJ. #	8	1.33
SUBJ. #	9	1.83
SUBJ. #	10	1.33
SUBJ. #	11	4.66
SUBJ. #	12	1.33
SUBJ. #	13	2.33
SUBJ. #	14	1.16
SUBJ. #	15	1.33
SUBJ. #	16	2.36
SUBJ. #	17	5.36
SUBJ. #	18	1.5
SUBJ. #	19	.66
SUBJ. #	20	1.66
SUBJ. #	21	1.33
SUBJ. #	22	.66
SUBJ. #	23	1.33
SUBJ. #	24	1.66
SUBJ. #	25	1.5
SUBJ. #	26	1.33
SUBJ. #	27	1.66
SUBJ. #	28	1.33
SUBJ. #	29	5.83
SUBJ. #	30	1.66

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 2.040

MEASURES OF VARIABILITY

N = 30
RANGE = 5.17
VARIANCE = 1.961
STAN. DEV. = 1.401
STAN. ERROR = .256

CONFIDENCE INTERVALS

95% CONF. INT. 1.506 TO 2.574
99% CONF. INT. 1.311 TO 2.769

T-TEST RESULTS OF THE MEAN PRE-TEST SCORES OF THE SUBJECTS
IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE SUBJECTIVE
UNIT OF DISCOMFORT SCALE

***** t-test *****

Mean of X1: 5.381
Square x1: 881.865
N : 30

Mean of x2: 5.241
Square x2: 838.297
N : 30

t is : 9.956405E-02
df is: 58
Ok

T-TEST RESULTS OF THE MEAN POST-TEST SCORES OF THE SUBJECTS
IN THE CONTROL AND EXPERIMENTAL GROUPS ON THE SUBJECTIVE
UNIT OF DISCOMFORT SCALE

***** t-test *****

Mean of X1: 5.531
Square x1: 932.722
N : 30

Mean of x2: 2.04
Square x2: 181.731
N : 30

t is : 3.084456
df is: 58
Ok

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF
THE SUBJECTS IN THE EXPERIMENTAL GROUP ON THE SUBJECTIVE
UNIT OF DISCOMFORT SCALE

***** t-test *****

Mean of X1: 5.241
Square x1: 838.279
N : 30

Mean of x2: 2.04
Square x2: 181.731
N : 30

t is : 2.956263
df is: 58
Ok

T-TEST RESULTS OF THE MEAN PRE- AND POST-TEST SCORES OF
THE SUBJECTS IN THE CONTROL GROUP ON THE SUBJECTIVE
UNIT OF DISCOMFORT SCALE

***** t-test *****

Mean of X1: 5.381
Square x1: 881.865
N : 30

Mean of x2: 5.531
Square x2: 932.722
N : 30

t is : -.1038633
df is: 58
Ok

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION ONE SCORES

SUBJ. #	1	5.7
SUBJ. #	2	4.41
SUBJ. #	3	4.92
SUBJ. #	4	6.8
SUBJ. #	5	5.18
SUBJ. #	6	6.02
SUBJ. #	7	4.56
SUBJ. #	8	5.03
SUBJ. #	9	5.88
SUBJ. #	10	6.02
SUBJ. #	11	6.31
SUBJ. #	12	5.58
SUBJ. #	13	5.26
SUBJ. #	14	5.73
SUBJ. #	15	4.83
SUBJ. #	16	5.56
SUBJ. #	17	6.8
SUBJ. #	18	6.45
SUBJ. #	19	5.99
SUBJ. #	20	4.25
SUBJ. #	21	6.34
SUBJ. #	22	6.81
SUBJ. #	23	5.86
SUBJ. #	24	5.67
SUBJ. #	25	6.55
SUBJ. #	26	6.13
SUBJ. #	27	5.27
SUBJ. #	28	4.33
SUBJ. #	29	5.56
SUBJ. #	30	5.88

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.656
MEDIAN = 5.715

MEASURES OF VARIABILITY

N = 30
RANGE = 2.56
VARIANCE = .541
STAN. DEV. = .735
STAN. ERROR = .134

CONFIDENCE INTERVALS

95% CONF. INT. 5.375 TO 5.937
99% CONF. INT. 5.273 TO 6.039

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION TWO SCORES

SUBJ. #	1	5.2
SUBJ. #	2	4.3
SUBJ. #	3	4.65
SUBJ. #	4	6.13
SUBJ. #	5	5.5
SUBJ. #	6	5.29
SUBJ. #	7	4.2
SUBJ. #	8	4.92
SUBJ. #	9	5.87
SUBJ. #	10	5.16
SUBJ. #	11	6.25
SUBJ. #	12	5.6
SUBJ. #	13	5.08
SUBJ. #	14	6.59
SUBJ. #	15	4.92
SUBJ. #	16	5.56
SUBJ. #	17	6.76
SUBJ. #	18	6.1
SUBJ. #	19	5.99
SUBJ. #	20	4.46
SUBJ. #	21	6.25
SUBJ. #	22	6.1
SUBJ. #	23	5.76
SUBJ. #	24	5.86
SUBJ. #	25	6.23
SUBJ. #	26	6.52
SUBJ. #	27	5.1
SUBJ. #	28	4.13
SUBJ. #	29	6.2
SUBJ. #	30	5.55

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.541
MEDIAN = 5.58

MEASURES OF VARIABILITY

N = 30
RANGE = 2.63
VARIANCE = .541
STAN. DEV. = .736
STAN. ERROR = .134

CONFIDENCE INTERVALS

95% CONF. INT. 5.260 TO 5.822
99% CONF. INT. 5.158 TO 5.924

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION THREE SCORES

SUBJ. #	1	4.98
SUBJ. #	2	4.2
SUBJ. #	3	4.11
SUBJ. #	4	5.88
SUBJ. #	5	5.48
SUBJ. #	6	4.08
SUBJ. #	7	3.99
SUBJ. #	8	4.85
SUBJ. #	9	5.66
SUBJ. #	10	4.98
SUBJ. #	11	5.91
SUBJ. #	12	4.81
SUBJ. #	13	4.88
SUBJ. #	14	6.4
SUBJ. #	15	4.5
SUBJ. #	16	5.56
SUBJ. #	17	6.07
SUBJ. #	18	5.75
SUBJ. #	19	5.77
SUBJ. #	20	4.35
SUBJ. #	21	6.1
SUBJ. #	22	5.87
SUBJ. #	23	4.82
SUBJ. #	24	5.3
SUBJ. #	25	6.13
SUBJ. #	26	6.05
SUBJ. #	27	5.02
SUBJ. #	28	3.88
SUBJ. #	29	6.38
SUBJ. #	30	5.36

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 5.237
MEDIAN = 5.33

MEASURES OF VARIABILITY

N = 30
RANGE = 2.52
VARIANCE = .585
STAN. DEV. = .765
STAN. ERROR = .140

CONFIDENCE INTERVALS

95% CONF. INT. 4.946 TO 5.529
99% CONF. INT. 4.839 TO 5.635

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION FOUR SCORES

SUBJ. #	1	4.1
SUBJ. #	2	4.18
SUBJ. #	3	3.8
SUBJ. #	4	4.27
SUBJ. #	5	5.33
SUBJ. #	6	3.87
SUBJ. #	7	3.57
SUBJ. #	8	4.08
SUBJ. #	9	4.98
SUBJ. #	10	4.85
SUBJ. #	11	5.58
SUBJ. #	12	3.1
SUBJ. #	13	4.2
SUBJ. #	14	4.88
SUBJ. #	15	4.09
SUBJ. #	16	4.28
SUBJ. #	17	6.27
SUBJ. #	18	4.87
SUBJ. #	19	4.28
SUBJ. #	20	4.1
SUBJ. #	21	5.33
SUBJ. #	22	4.8
SUBJ. #	23	3.11
SUBJ. #	24	5.1
SUBJ. #	25	5.7
SUBJ. #	26	4.8
SUBJ. #	27	4.55
SUBJ. #	28	3.28
SUBJ. #	29	5.89
SUBJ. #	30	4.8

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 4.535
MEDIAN = 4.415

MEASURES OF VARIABILITY

N = 30
RANGE = 3.17
VARIANCE = .635
STAN. DEV. = .797
STAN. ERROR = .146

CONFIDENCE INTERVALS

95% CONF. INT. 4.231 TO 4.839
99% CONF. INT. 4.120 TO 4.949

SUBJECTIVE UNIT OF DISCOMFORT SCALE
SESSION FIVE SCORES

SUBJ. #	1	3.3
SUBJ. #	2	3.64
SUBJ. #	3	2.98
SUBJ. #	4	3.28
SUBJ. #	5	5.38
SUBJ. #	6	2.88
SUBJ. #	7	3.5
SUBJ. #	8	2.25
SUBJ. #	9	3.11
SUBJ. #	10	3.82
SUBJ. #	11	5.5
SUBJ. #	12	2.09
SUBJ. #	13	4.02
SUBJ. #	14	2.33
SUBJ. #	15	3.56
SUBJ. #	16	3.34
SUBJ. #	17	5.99
SUBJ. #	18	3.82
SUBJ. #	19	3.18
SUBJ. #	20	3.88
SUBJ. #	21	5.1
SUBJ. #	22	3.18
SUBJ. #	23	2.98
SUBJ. #	24	4.18
SUBJ. #	25	4.1
SUBJ. #	26	4.7
SUBJ. #	27	3.69
SUBJ. #	28	2.25
SUBJ. #	29	5.72
SUBJ. #	30	3.78

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 3.718
MEDIAN = 3.6

MEASURES OF VARIABILITY

N = 30
RANGE = 3.9
VARIANCE = 1.059
STAN. DEV. = 1.029
STAN. ERROR = .188

CONFIDENCE INTERVALS

95% CONF. INT. 3.325 TO 4.110
99% CONF. INT. 3.182 TO 4.253

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION SIX SCORES

SUBJ. #	1	2.5
SUBJ. #	2	4.21
SUBJ. #	3	2.43
SUBJ. #	4	2.34
SUBJ. #	5	5.2
SUBJ. #	6	2.72
SUBJ. #	7	3.38
SUBJ. #	8	2.11
SUBJ. #	9	3.02
SUBJ. #	10	3.18
SUBJ. #	11	5.36
SUBJ. #	12	1.98
SUBJ. #	13	3.95
SUBJ. #	14	2.18
SUBJ. #	15	3.12
SUBJ. #	16	3.09
SUBJ. #	17	6.13
SUBJ. #	18	2.43
SUBJ. #	19	3.12
SUBJ. #	20	2.3
SUBJ. #	21	4.36
SUBJ. #	22	1.95
SUBJ. #	23	2.1
SUBJ. #	24	3.89
SUBJ. #	25	3.85
SUBJ. #	26	3.55
SUBJ. #	27	2.11
SUBJ. #	28	2.13
SUBJ. #	29	5.92
SUBJ. #	30	2.99

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 3.253
MEDIAN = 3.055

MEASURES OF VARIABILITY

N = 30
RANGE = 4.18
VARIANCE = 1.411
STAN. DEV. = 1.188
STAN. ERROR = .217

CONFIDENCE INTERVALS

95% CONF. INT. 2.800 TO 3.707
99% CONF. INT. 2.635 TO 3.871

 SUBJECTIVE UNIT OF DISCOMFORT SCALE
 SESSION SEVEN SCORES

SUBJ. #	1	1.82
SUBJ. #	2	2.2
SUBJ. #	3	1.98
SUBJ. #	4	2.38
SUBJ. #	5	5.29
SUBJ. #	6	2.66
SUBJ. #	7	3.22
SUBJ. #	8	1.97
SUBJ. #	9	2.56
SUBJ. #	10	2.66
SUBJ. #	11	5.16
SUBJ. #	12	1.23
SUBJ. #	13	3.55
SUBJ. #	14	1.6
SUBJ. #	15	2.87
SUBJ. #	16	2.68
SUBJ. #	17	5.97
SUBJ. #	18	2.83
SUBJ. #	19	2.16
SUBJ. #	20	2.45
SUBJ. #	21	2.98
SUBJ. #	22	1.8
SUBJ. #	23	1.85
SUBJ. #	24	2.54
SUBJ. #	25	2.22
SUBJ. #	26	2.65
SUBJ. #	27	2.23
SUBJ. #	28	1.55
SUBJ. #	29	5.65
SUBJ. #	30	2.1

SUBJECTIVE UNIT OF DISCOMFORT SCALE
SESSION EIGHT SCORES

SUBJ. #	1	1.51
SUBJ. #	2	1.98
SUBJ. #	3	1.33
SUBJ. #	4	2.41
SUBJ. #	5	5.3
SUBJ. #	6	2.12
SUBJ. #	7	3.09
SUBJ. #	8	1.88
SUBJ. #	9	2.24
SUBJ. #	10	2.05
SUBJ. #	11	5.25
SUBJ. #	12	.98
SUBJ. #	13	3.46
SUBJ. #	14	1.59
SUBJ. #	15	2.13
SUBJ. #	16	2.58
SUBJ. #	17	5.83
SUBJ. #	18	1.87
SUBJ. #	19	1.65
SUBJ. #	20	2.39
SUBJ. #	21	1.12
SUBJ. #	22	1.68
SUBJ. #	23	1.55
SUBJ. #	24	2.09
SUBJ. #	25	1.85
SUBJ. #	26	2.31
SUBJ. #	27	1.05
SUBJ. #	28	1.38
SUBJ. #	29	5.97
SUBJ. #	30	1.86

MEASURES OF CENTRAL TENDENCY

N = 30
MEAN = 2.417
MEDIAN = 2.015

MEASURES OF VARIABILITY

N = 30
RANGE = 4.99
VARIANCE = 1.907
STAN. DEV. = 1.381
STAN. ERROR = .252

CONFIDENCE INTERVALS

95% CONF. INT. 1.890 TO 2.944
99% CONF. INT. 1.698 TO 3.135

Ok

BIBLIOGRAPHY

- Abelson, J. L., and Curtis, G. C. "Cardiac and Neuroendocrine Responses to Exposure Therapy in Height Phobics." Behaviour Research and Therapy 27, 561 (1989), 84.
- American Psychiatric Association. Diagnostic and Statistical Manual Disorders, 4th ed., Washington, DC, American Psychiatric Association 1994, 393-444.
- Ary, Donald, Jacobs, Lucy C., and Razavich Asghar. Introduction to Research in Education. New York: Holt, Rinehart and Winston, 1983, 55-7.
- Belkin, Gary. S. Introduction to Counseling. Dubuque: Wm. C. Brown Publishing, 1988.
- Brooks, F. P. Jr. Essays in Software Engineering, Reading, MA: Addison-Wesley, 1975.
- Bryson, Steve. "Survey of Virtual Environment Technologies and Techniques." Computer Science Corporation, Applied Research Branch, Numerical Aerodynamic Simulation Systems Division, MST045-1, NASA Ames Research Center, ACMSIGGRAPH '92 Course Notes (1992).
- Buglione, Stephen A., Devito, Anthony J., and Mulloy, Jean M. "Traditional Group Therapy and Computer-Administered Treatment for Test Anxiety." Anxiety Research 3,1 (1990): 33-9.
- Carr, A. C., Ghosh, A., and Marks, Isaac M. "Computer-Supervised Exposure Treatment for Phobias." Canadian Journal of Psychiatry 33 (1988): 112-7.
- Chandler, Gerald M., Burck, Harman D., and Sampson, James P. "A Generic Computer Program for Systematic Desensitization: Description, Construction and Case Study." Journal of Behavior Therapy and Experimental Psychiatry 17 (1986): 171-4.
- Chandler, Gerald M., Burck, Harman D., Sampson, James P., and Wray, Robert Wray. "The Effectiveness of a Generic Computer Program for Systematic Desensitization." Computers in Human Behavior 4 (1988): 339-46.

- Cohen, D. C. "A Comparison of Self-Report and Behavioral Procedures for Assessing Acrophobia." Behavioral Therapy 8 (1977): 17-23.
- Cruz-Neira, Carolina, Sandin, Daniel J., Defanti, Thomas A., Kenyon, Robert V., and Hart, John C. "The Cave: Audio Visual Experience Automatic Virtual Environment." Communication of ACM, SIGGRAPH '92 Showcase 35,6 (1992): 64-72.
- Derogatis, C. R., Limpman, R. S., Rickels, K., Uhlenhuth, E. H., and Coul, L. "The HSCL: A Self-Report Inventory." Behavioral Sciences 19 (1974): 1-15.
- Fontaine, G. "The Experience of a Sense of Presence in Intercultural and International Encounters." PRESENCE, Teleoperations and Virtual Environments 4 (1992): 482.
- Furness, Thomas A. "Expeditions in Virtual Space." Distinguished Lecture Series, Graphics, Visualization & Usability Center, College of Computing, Georgia Institute of Technology, 1993.
- Garvey, W. P., and Hegrenes, J. R. "Desensitization Techniques in the Treatment of School Phobia." American Journal of Orthopsychiatry 36 (1966): 147-52.
- Heeter, C. "Being There: The Subjective Experience of Presence." PRESENCE, Teleoperations and Virtual Environments 1,2 (1992): 262-71.
- Held, R. M., and Durlach, N. I. "Presence." PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 109-12.
- Hodges, Larry F. "Time-Multiplexed Stereoscopic Computer Graphics." IEEE Computer Graphics and Applications 12,2 (1992): 20-30.
- Hodges, Larry F., Rothbaum, Barbara A., Williford, James S., Opdyke, Dan, Kooper, Rob, and North, Max M. "Presence as the Defining Factor in a VR Application." SIGGRAPH '94, (1994).
- James, Jack E., Hampton, B. A. May, and Larsen, Shirley A. "The Relative Efficacy of Imaginal and In vivo Desensitization in the Treatment of Agoraphobia." Journal of Behavioral Therapy & Experimental Psychiatry 14 (1983): 203-7.

- Kazdin, A. E., and Wilcoxon, L. A. "Systematic Desensitization and Non-specific Treatment Effects: A Methodological Evaluation." Psychiatric Bulletin (1983): 93-103.
- Kirman, W. J. Modern Psychoanalysis in the Schools Dubuque, IA: Kendall/Hunt, 1977.
- Klonoff, Elizabeth, Janata, Jeffrey W., and Kaufman, Benjamin. "The Use of Systematic Desensitization to Overcome Resistance to Magnetic Resonance Imaging (MRI) Scanning." Journal of Behavior Therapy and Experimental Psychiatry 17 (1986): 189-92.
- L'Abate, Luciano. Programmed Writing: A Self-administered Approach for Interventions With Individuals, Couples, and Families. Pacific Grove, CA: Brooks/Cole, 1991.
- L'Abate, Luciano and Platzman, K. "Programmed Writing (PW) in Therapy and Prevention With Families." American Journal of Family Therapy 19 (1991).
- Loomis, J. M. "Understanding Synthetic Experience Must Begin With the Analysis of Ordinary Perceptual Experience." IEEE Symposium on Research Frontiers in Virtual Reality San Jose, California, (1993): 54-7.
- Marks, M. J. "Conscious/Unconscious Selection of the Psychotherapist's Theoretical Orientation." Psychotherapy: Theory, Research, and Practice 15 (1978): 354-8.
- Michelson, Larry, Mavissakalian, Matig, and Marchione, Karen. "Cognitive and Behavioral Treatment of Agrophobia: Clinical, Behavioral, and Psychophysiological Outcomes." Journal of Counseling and Clinical Psychology 53 (1985): 913-25.
- Mowafy, L., Russo, T., and Miller, L. "Is Presence a Training Issue?." IEEE Symposium on Research Frontiers in Virtual Reality San Jose, California, (1993): 124-5.
- Naiman, A. "Presence, and Other Gifts." PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 145-8.
- Newquist, H. P. "Virtual Reality's Commercial Reality." Computer World (1992).

- North, Max M., and North, Sarah M. "Relative Effectiveness of Virtual Desensitization and Imaginal Desensitization in the Treatment of Aerophobia." Electronic Journal of Virtual Culture 2,4 (1994), 23-4.
- Patterson, Cecil H. Theories of Counseling and Psychotherapy. New York: Harper & Row, Publishers, Inc., 1986.
- Pendelton, Mark G., and Higgins, Raymond L. "A Comparison of Negative Practice and Systematic Desensitization in the Treatment of Acrophobia." Journal of Behavioral Therapy and Experimental Psychiatry 14 (1983): 317-23.
- Perry, W. G. Jr., et al. "On the Relation of Psychotherapy to Counseling." Annals of the New York Academy of Science 63 (1955): 369-407.
- Rothbaum, Barbara O., Hodges, Larry F., Opdyke, Dan, Kooper, Rob, Williford, James S., and North, Max M. "Virtual Reality Graded Exposure in the Treatment of Acrophobia: A Case Study." Journal of Behavior Therapy (1995).
- Rothbaum, Barbara O., Hodges, Larry F., Opdyke, Dan, Kooper, Rob, Williford, James S., and North, Max M. "Effectiveness of Virtual Reality Graded Exposure in the Treatment of acrophobia." Journal of Psychiatry, (1995).
- Schneider, John W. "Lens-Assisted *in vivo* Desensitization to Heights." Journal of Behavior Therapy & Experimental Psychiatry 13 (1982): 333-6.
- Sheridan, Thomas B. "Musing on Telepresence and Virtual Presence." PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 120-6.
- Slotnick, Daniel L., Butterfield, Evan M., Colantonio, Earnest S., Kopetzky, Daniel J., and Slotnick, Joan K. Computers and Application, An Introduction to Data Processing. Lexington Massachusetts: D.C. Heath and Company, 1986.
- Sutherland, Ivan. "The Ultimate Display." Proceedings of IFIP 65,2 (1965): 506-8.
- Teitel, M. A. "The Eyephone: A Head-Mounted Stereo Display." Proceedings of SPIE 1256 (1990): 168-71.

- Turner, R. M., and Ascher, L. M. "A Controlled Comparison of Progressive Relaxation, Stimulus Control, and Paradoxical Intention Therapies for Insomnia." Journal of Consultant Clinical Psychology 47 (1979): 500-8.
- Weil, Michelle M., Rosen, Larry D., and Sears, Deborah C. "The Computerphobia Reduction Program: Year 1 Program Development and Preliminary Results." Behavior Research Methods Instruments and Computers 19 (1987): 180-4.
- Whitely, J. M., Kagan, N., Harmon, L. W., Fretz, B. R., and Tanney, D. The Coming Decade in Counseling Psychology. Schenectady, NY: Character Research Press, 1984.
- Williford, James S., Hodges, Larry F., North, Max M., and North, Sarah M. "Relative Effectiveness of Virtual Environment Desensitization and Imaginal Desensitization in the Treatment of Acrophobia." Proceedings of Graphics Interface '93 Conference (1993): 162.
- Wolpe, Joseph. Psychotherapy by Reciprocal Inhibition. Calif: Stanford University Press, 1958.
- Wolpe, Joseph. "The Systematic Desensitization of Neuroses." Journal of Neuroses and Mental Diseases 132 (1961): 189-203.
- Wolpe, Joseph. The Practice of Behavior Therapy. New York: Pergamon, 1969, 125.
- Zeltzer, D. "Autonomy, Interaction and Presence." PRESENCE, Teleoperations and Virtual Environments 1,1 (1992): 127-32.