

Brief Virtual Reality Therapy for Public Speaking Anxiety

SANDRA R. HARRIS, Ph.D., ROBERT L. KEMMERLING, Ph.D.,
and MAX M. NORTH, Ph.D.

ABSTRACT

The primary goal of this research program was to investigate the effectiveness of virtual reality therapy (VRT) in reducing public speaking anxiety of university students. The prevalence and impact of public speaking anxiety as a type of Social Phobia are discussed. Studies of VRT as an emerging treatment for psychological problems are reviewed. In the present study, eight students completed VRT individual treatment and post-testing, and six students in a Wait-List control group completed post-testing. Assessment measures included four self-report inventories, self-report of Subjective Units of Discomfort during exposure to VRT and physiological measurements of heart rate during speaking tasks. Four weekly individual exposure treatment sessions of approximately 15 min each were conducted by the author serving as therapist. Results on self-report and physiological measures appear to indicate that four virtual reality treatment sessions were effective in reducing public speaking anxiety in university students, corroborating earlier studies of VRT's effectiveness as a psychotherapeutic modality. Future research directions are discussed, primarily the need for research on younger populations, to assess the effectiveness of VRT for earlier intervention with public speaking anxiety.

INTRODUCTION

ACCORDING TO THE *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed., "The essential feature of Social Phobia is a marked and persistent fear of social or performance situations in which embarrassment may occur . . . Exposure to social or performance situations almost invariably provokes an immediate anxiety response."¹ "In the general population, most individuals with Social Phobia fear public speaking . . ."² Antony, in discussing social phobias that meet DSM-III-R diagnostic criteria, reports that, "Social phobia affects up to 13% of individuals at some time

in their lives . . . tends to begin in middle to late teenage years . . . is often associated with moderate to severe functional impairment in the areas of education, employment, family relations, romantic relationships, friendships and other interests."³

Persons with public speaking anxiety, as with other types of social phobia, often avoid anxiety-producing social or performance situations, but when unavoidable, these situations are endured with feeling of intense anxiety and distress. Also, anticipatory anxiety frequently occurs as an individual imagines the situation in advance of the actual experience (e.g., worrying each day about a presentation

to be given in a class several weeks in the future). Although individuals with these types of anxious responses often recognize that their fear is excessive and/or unreasonable, they are unable, without assistance, to change their responses in these situations.

Individuals with public speaking anxiety most often experience a variety of symptoms in a public speaking situation, including palpitations, sweating, gastrointestinal discomfort, diarrhea, muscle tension, and confusion. These individuals may underachieve at work or at school because of anxiety and often avoid speaking in classroom situations. In more severe cases, they may drop out of school rather than face a feared situation, such as a class with mandated oral reports that constitute a significant proportion of the final course grade.

Burnley et al. report that, "Approximately 85 percent of the general population report experiencing some level of anxiety about speaking in public . . ." ⁴ Rossi and Seiler indicate that, "Public speaking or stage fright has been investigated and studied since the mid-1930's. It wasn't until 1973 when the Bruskin Report ⁵ was released, indicating that the number one fear of American people was speaking in public, that researchers and scholars realized how pervasive and powerful was the fear of speaking in public in our society." ⁶

Virtual reality therapy (VRT) is an emerging treatment modality for anxiety reduction. Lamson ⁷ defines virtual therapy as the treatment of phobias and other psychiatric conditions by immersion into computer-generated virtual reality treatment environments. Rothbaum et al. ⁸ report the effectiveness of virtual reality graded exposure in reducing acrophobia in college students. The treatment group, comprised of 12 students, reported significant improvement from pretreatment levels on measures of anxiety, avoidance, and distress related to exposure to heights at 6 weeks post-treatment. The no-treatment group was unchanged. Lamson ⁹ reports a study of acrophobia using a single-session of VRT that consisted of a 50-min session, with two follow-up 30-min sessions. In this study, subjects' heart rates and blood pressures decreased with time and exposure to a computer-generated virtual envi-

ronment with heights. Further, over 90% of the participants in this study reported reaching their self-assigned height goals and the researcher's assigned goal of ascending 15 stories in a glass-enclosed elevator.

Fear of flying has been successfully treated using VRT by Rothbaum et al., ¹⁰ North et al., ¹¹ and Wiederhold et al. ¹² North et al. ¹³ investigated the efficacy of VRT in the treatment of fear of public speaking. Sixteen subjects were assigned to two treatment conditions, a VRT group ($n = 8$) and a comparison group ($n = 8$). The VRT group was exposed to the virtual reality public speaking scene, while the comparison group was exposed to a trivial virtual reality scene, guided by experimenters to manage their phobia either by visualization techniques or self-exposure to the situations they feared. Groups were conducted over a 5-week period. Two self-report measures and heart rate were used to monitor treatment effects. Results indicated that the VRT group showed significant improvement after 5 weeks of treatment on all measures. The comparison group did not show any significant changes. The authors concluded that VRT was successful in reducing the fear of public speaking.

North and Rives ¹⁴ report successful treatment of two subjects after five weekly sessions of VRT for public speaking anxiety.

Wiederhold and Weiderhold ¹⁵ made a preliminary report of a small study at Clark University using virtual reality to treat subjects with a fear of speaking. In the study, subjects were placed in front of a virtual audience and experienced many of the same symptoms reported by subjects when in front of a real audience, such as dry mouth, increased heart rate, and sweaty palms. Researchers used a Subjective Units of Discomfort Scale and an Attitude Toward Public Speaking questionnaire to assess anxiety. Results indicated that self-reported anxiety decreased after the VRT treatment.

MATERIALS AND METHODS

Students in introductory public speaking classes at a large state university were surveyed using the Personal Report of Confidence as a Speaker (PRCS) inventory. ¹⁶ Those

students who volunteered to participate in the study and whose PRCS scores were greater than 16 were randomly assigned to either the VRT group or to a Wait-List (WL) control group. Counselors in the university's counseling service office also referred students for treatment. Four students, those with PRCS scores greater than 16, participated. All referred students were assigned to the WL group. Ten students were assigned to the treatment group, and eight students completed VRT individual treatment. Two students assigned to the VRT group completed pre-testing, but did not return to participate in treatment or post-testing. Six students assigned to the WL group completed both pre-testing and post-testing, and one student assigned to the WL group did not return following pre-testing. Complete data is not available for one student in the WL group who did not complete voice tasks in post-testing to obtain heart rate measurements.

Initial interview

Prior to beginning the VRT or WL group, an initial interview was conducted to determine the appropriateness of treatment for each student. The Beck Inventory¹⁷ was used to eliminate students with depression, who were given alternate treatment. Students with severe motion sickness or seizure disorder were eliminated. A signed informed consent was obtained. In addition to the PRCS, pre-testing consisted of these self-report instruments: Self-Evaluation Questionnaire, STAI Form X-1 (STAI);¹⁸ Liebowitz Social Anxiety Scale (LSAS),¹⁹ and Attitudes Towards Public Speaking Questionnaire (ATPS).¹³ In addition, a two-part voice test sample recording, in which subjects were asked an open-ended question and asked to read a paragraph, was administered. Physiological measures of heart rate during the voice sample and resting heart rate during a brief relaxation exercise were taken using a pulse oximeter, and heart rate was measured throughout treatment. Two comparisons utilizing heart rate measures were analyzed. The first compared heart rate during pre-testing speaking tasks and heart rate during post-testing speaking tasks for subjects in

both VRT and WL groups. The second analysis compared heart rate over the trough (resting heart rate) of VRT subjects at the end of the 2nd session compared to the end of the 4th session. Subjective Units of Distress Scale (SUDS) ratings (0–100) were taken before, during, and at the end of each session. A comparison of SUDS ratings at the end of the 2nd and 4th sessions were analyzed. A separate analysis of the five items comprising factor 2 of the Liebowitz Social Anxiety Scale, Public Speaking,²¹ was conducted.

Treatment

Following the initial interview, including pre-testing, students in the VRT group received four sessions of individual treatment, using software of an auditorium scene (developed by the third author and Dennis Becker, Ph.D. of the Speech Improvement Company, Brookline, MA) and a head-mounted display with head-tracker (Virtual-I/O). Each session of exposure was 12–15 min. The therapist for all students in VRT treatment was the first author, a clinical psychologist with over 20 years of experience in conducting psychotherapy with students for public-speaking anxiety.

Session 1. Each student was acclimated to the virtual reality equipment. A headgear was fitted to the head while the student stood at a podium with a microphone. The pulse oximeter was taped to a finger. In a darkened room, the student viewed the empty auditorium scene and experienced looking around the virtual auditorium for approximately 15 min. With the empty auditorium scenario on the computer screen, the student was asked to talk about his or her anxiety when giving speeches. After the headgear was removed, an assignment to prepare a 2-min speech for the session in 2 weeks was made.

Session 2. Heart rate and SUDS ratings were noted prior, during, and after the client says the Pledge of Allegiance while standing at the podium with a live microphone. (The therapist assisted with the pledge for some subjects less familiar with it.) The therapist manipulated the scenario by gradually filling

the auditorium with people and used applause to encourage the subject. The pledge was repeated a second time, with applause used at the end of the recitation.

Session 3. Heart rate and SUDS ratings were noted prior, during, and after client reads a 2-min speech with a small light on the clipboard. Prior to the speech, the therapist gradually filled the room with audience. Other manipulations include members of the audience speaking to each other (i.e., not paying attention to the speaker); members of the audience laughing; members continuously asking the speaker to speak louder; and audience applause, consistently used at the end of the speech. The speech was repeated, and the student was reminded to look up to see the audience as needed.

Session 4. The student gave the same brief speech or a different speech while heart rate and SUDS levels were monitored. Manipulations were made as in session 3. Immediately following this session, post-testing was conducted using the same measures as in pre-testing.

Wait-list

The WL group had pre-testing and post-testing 4 weeks later, with no intervention. Two subjects were participating in a speech class in which they were giving and listening to speeches. Two subjects had already completed a public speaking class, and two others had not yet enrolled in a public speaking class.

RESULTS

On the paired samples test comparing the pre-testing and post-testing of the VRT group, there were significant differences on the PRCS ($p < 0.000$), on the ATPS ($p < 0.05$), on the heart rate during speaking tasks ($p < 0.01$), and on the heart rate over the trough (resting heart rate) at the end of the 2nd session compared to the heart rate over the trough at the end on the 4th session ($p < 0.001$). On the LSAS, results approached significance ($p < 0.054$). There were no significant differences on the STAI, on the SUDS ratings at the end of the 2nd session compared to the end of the 4th session, nor on

TABLE 1. VRT PRE-TREATMENT AND POST-TREATMENT SCORES

	Mean	n	Standard deviation	Standard error mean
PRCS Pre-test	22.63	8	4.66	1.65
PRCS Post-test	12.63	8	4.96	1.75
STAI Pre-test	40.25	8	10.59	3.75
STAI Post-test	34.75	8	8.21	2.90
LSAS Pre-test	52.25	8	18.61	6.58
LSAS Post-test	37.75	8	23.29	8.23
ATPS Pre-test	31.88	8	7.61	2.69
ATPS Post-test	17.13	8	9.99	3.53
Voice HR Pre-test	88.00	8	10.94	3.87
Voice HR Post-test	76.50	8	6.05	2.14
HR over trough, 2nd session	21.50	8	11.30	4.00
HR over trough, 4th session	9.63	8	7.50	2.65
SUDS 2nd session	30.00	8	17.53	6.20
SUDS 4th session	26.25	8	16.85	5.96
LSAS Pre-Fear	7.00	8	3.66	1.30
LSAS Post-Fear	6.00	8	3.78	1.34
LSAS Pre-Avoid	6.38	8	3.50	1.24
LSAS Post-Avoid	4.50	8	2.98	1.05

PRCS, Personal Report of Confidence as a Speaker; STAI, State-Trait Anxiety Inventory-State; LSAS, Liebowitz Social Anxiety Scale; Voice HR, heart rate during speaking tasks; HR over trough, heart rate compared to resting heart rate; SUDS, Subjective Units of Discomfort Scale.

TABLE 2. VRT PAIRED SAMPLES TEST (N = 8)

	Mean	Standard deviation	Standard error mean	t	df	Significance (two-tailed)
PRCS Pre-test– PRCS Post-test	10.00	4.41	1.56	6.417	7	0.000 ^d
STAI Pre-test– STAI Post-test	5.50	10.54	3.73	1.476	7	0.184
LSAS Pre-test– LSAS Post-test	14.50	17.75	6.28	2.310	7	0.054 ^e
ATPS Pre-test– ATPS Post-test	14.75	13.23	4.68	3.153	7	0.016 ^a
Voice HR Pre-test– Voice HR Post-test	11.50	8.86	3.13	3.670	7	0.008 ^b
HR over trough, 2nd Session–HR over trough, 4th session	11.88	5.96	2.11	5.633	7	0.001 ^c
SUDS 2nd session– SUDS 4th session	3.75	10.94	3.87	0.970	7	0.365
LSAS Pre-Fear– LSAS Post-Fear	1.00	4.14	1.46	0.683	7	0.516
LSAS Pre-Avoid– LSAS Post-Avoid	1.88	3.48	1.23	1.523	7	0.172

^a*p* < 0.05.

^b*p* < 0.01.

^c*p* < 0.001.

^d*p* < .000.

^e*p* < 0.10.

analyses of the five LSAS items related to public speaking fear and avoidance.

On the paired samples test comparing the Wait-List group on pre-testing and post-testing measures, there was a significant difference on the ATPS (*p* < 0.05) and no differences on others measures.

On data analysis of the independent samples test comparing VRT and WL groups at post-testing, equal variances are not assumed

because of the uneven and small sample size. Results indicate significant differences on the PRCS (*p* < 0.01). Results approach significance on the ATPS (*p* < 0.056), on the heart rate during speaking tasks (*p* < 0.093), and on the avoidance items of the LSAS specifically pertaining to public speaking (*p* < 0.060).

Data that approach significance are included, to show the trends, as a larger sample size in subsequent studies would most likely result in significant differences at greater statistical levels. There were no significant differences on other measures.

TABLE 3. WAIT LIST PRE-TREATMENT AND POST-TREATMENT SCORES

	Mean	n	Standard deviation	Standard error mean
PRCS Pre-test	24.33	6	3.93	1.61
PRCS Post-test	22.83	6	6.37	2.60
STAI Pre-test	45.17	6	6.31	2.57
STAI Post-test	42.50	6	9.85	4.02
LSAS Pre-test	61.17	6	20.36	8.31
LSAS Post-test	57.67	6	28.24	11.53
ATPS Pre-test	39.00	6	13.24	5.40
ATPS Post-test	31.17	6	14.96	6.11
Voice HR Pre-test	91.80	5	14.91	6.67
Voice HR Post-test	86.80	5	10.38	4.64
LSAS Pre-Fear	9.67	6	3.20	1.31
LSAS Post-Fear	9.33	6	3.83	1.56
LSAS Pre-Avoid	9.33	6	3.08	1.26
LSAS Post-Avoid	8.83	6	4.17	1.70

DISCUSSION

University students recruited from introductory public speaking classes to participate in a treatment program investigating the effectiveness of VRT appear to have benefitted from the brief treatment. Results of four 12–15-min sessions of VRT appear to have helped students reduce anxiety and avoidance of public speaking, as measured by self-report inventories and physiological measurement of heart rate.

TABLE 4. WAIT-LIST PAIRED SAMPLES TEST ($N = 6$)

	Mean	Standard deviation	Standard error mean	<i>t</i>	<i>df</i>	Significance (two-tailed)
PRCS Pre-test– PRCS Post-test	1.50	2.74	1.12	1.342	5	0.237
STAI Pre-test– STAI Post-test	2.67	6.89	2.81	0.948	5	0.387
LSAS Pre-test– LSAS Post-test	3.50	13.17	5.38	0.651	5	0.544
ATPS Pre-test– ATPS Post-test	7.83	7.25	2.96	2.646	5	0.046 ^a
Voice HR Pre-test– Voice HR Post-test	5.00	4.74	2.12	2.357	4	0.078
LSAS Pre-Fear– LSAS Post-Fear	0.33	3.14	1.28	0.260	5	0.805
LSAS Pre-Avoid– LSAS Post-Avoid	0.50	4.23	1.73	0.289	5	0.784

^a $p < 0.05$.

Students in the WL group showed significant pre-testing and post-testing differences on one measure, the ATPS. However, VRT students showed greater improvement on the other self-report measures and on physiological measures than those who did not receive VRT.

From an analysis of the LSAS on five items pertaining to public speaking anxiety, it appears that avoidance changed to a greater extent than fear of public speaking. Ten of the students were participating in speech classes, and VRT students were practicing giving

speeches to virtual audiences during treatment. These subjects were not engaged in avoidance during the 4-week time of treatment or waiting for treatment. Perhaps they were helped to overcome the tendency to avoid, which is a typical behavior pattern of those with anxiety problems. Future researchers may wish to study subjects who are avoiding speaking in classes or social situations to evaluate whether VRT would assist them to increase public speaking behavior.

Students appeared to be comfortable using computer technology to address their fear of

TABLE 5. INDEPENDENT SAMPLES TEST, VRT ($N = 8$), AND WAIT LIST ($N = 6$)

	<i>t</i>	<i>df</i>	<i>t</i> -test for equality of means		Significance (two-tailed)
			Mean difference		
PRCS Pre-test	−0.743	11.759	−1.71		0.472
PRCS Post-test	−3.256	9.214	−10.21		0.010 ^a
STAI Pre-test	−1.082	11.564	−4.92		0.301
STAI Post-test	−1.562	9.684	−7.75		0.150
LSAS Pre-test	−0.841	10.330	−8.92		0.419
LSAS Post-test	−1.406	9.616	−19.92		0.191
ATPS Pre-test	−1.180	7.456	−7.13		0.274
ATPS Post-test	−1.990	8.247	−14.04		0.081 ^b
Voice HR Pre-test	−0.493	6.712	−3.80		0.638
Voice HR Post-test	−2.016	5.731	−10.30		0.093 ^b
LSAS Pre-Fear	−1.448	11.628	−2.67		0.174
LSAS Post-Fear	−1.621	10.841	−3.33		0.134
LSAS Pre-Avoid	−1.677	11.609	−2.96		0.120
LSAS Post-Avoid	−2.166	8.652	−4.33		0.060 ^b

^a $p < 0.01$.^b $p < 0.10$.

public speaking. All students who began VRT completed the four sessions and post-testing. The brevity of the time commitment for this program could also be an important factor in students' compliance with treatment.

It may be that students in VRT did not improve on SUDS ratings to a significant degree because the tasks of the 2nd session were less demanding than those of the 4th session, that is, reciting the Pledge of Allegiance compared to giving an actual speech. The mean scores at the completion of treatment for students in VRT treatment were less than at the end of the 2nd session, although not significantly so. They were able to maintain a level of comfort similar to their reported feelings in less demanding tasks.

At the end of post-testing, they were asked if they wished to comment on the VRT. Among their comments are as follows: "At first I did not understand about it, but doing the speech today, a speech I haven't given yet, helped to know what I have to do for tomorrow." "Helpful. Taken away some anxiety. At least now I don't dread it like I used to." "Practice was key. It helped me a lot. Not sure at first if it would simulate a real audience. I was surprised I got the same kind of anxiety, just not as much." "It was helpful. Gives you a better perception of how good speech will go. Doing it over and over limits the anxiety." "Good practice. Good outlet for additional practice."

Results of this study lend support for using VRT to help persons overcome fear of public speaking. Additional research appears warranted which may address the use brief VRT on younger populations of students to assess the effectiveness of treatment in earlier intervention to help students overcome fear of public speaking.

ACKNOWLEDGMENTS

We thank Howard Bliman, M.D., for serving as advisor for the physiological aspects of the study, Brenda Wiederhold, Ph.D., for her research consultation, and Patricia O'Donnell-Brummett for serving as statistical consultant. Dennis Becker, Ph.D. of the Speech Improvement Company in Boston, MA and Max North,

Ph.D., Professor at Kennesaw State University, GA developed the software used in this study and gave permission for its use.

REFERENCES

1. *Diagnostic and statistical manual of mental disorders*, 4th ed. (1994). Washington, DC, American Psychiatric Association, 411.
2. *Diagnostic and statistical manual of mental disorders*, 4th ed. (1994). Washington, DC, American Psychiatric Association, 414.
3. Antony, M. (1997). Assessment and treatment of social phobia. *Canadian Journal of Psychiatry* 42:826-834.
4. Burnley, M., Cross, P., & Spanos, N. (1993). The effects of stress inoculation training and skills training on the treatment of speech anxiety. *Imagination, Cognition and Personality* 12:355-366.
5. Bruskin Associates. (1973). What are Americans afraid of? *The Bruskin Report* 53:27.
6. Rossi, A., & Seiler, W. (1989). The comparative effectiveness of systematic desensitization and an integrative approach in treating public speaking anxiety: a literature review and a preliminary investigation. *Imagination, Cognition and Personality* 9:49-66.
7. Lamson, R. (1994). *Virtual Therapy*, Montreal: Polytechnic International Press.
8. Rothbaum, B., Hodges, L., Kooper, R., et al. (1995). Effectiveness of computer-generated (virtual reality) graded exposure in the treatment of acrophobia. *American Journal of Psychiatry* 152:626-628.
9. Lamson, R. (1997). Virtual therapy of anxiety disorders. *CyberEdge Journal* 4:1-28.
10. Rothbaum, B., Hodges, L., Watson, B., et al., (1996). Virtual reality exposure therapy in the treatment of fear of flying: a case report. *Behavior Research and Therapy* 34:477-481.
11. North, M., North, S., & Coble, J. (1997). Virtual reality therapy for fear of flying, *American Journal of Psychiatry* 154:130.
12. Wiederhold, B., Gevirtz, R., & Spira, J. (2001-3). In: Riva, G., & Galimberti, C. (eds.), *Towards cyberpsychology: mind, cognition and society in the Internet age*. Amsterdam: IOS Press.
13. North, M., North, S., & Coble, J. (1997). Virtual reality therapy: an effective treatment for the fear of public speaking. *International Journal of Virtual Reality* 3:2-7.
14. North, M., & Rives, J. (2001). Virtual reality therapy in aid of public speaking. Personal communication.
15. Wiederhold, B., & Wiederhold, M. (1998). A review of virtual reality as a psychotherapeutic tool. *CyberPsychology & Behavior* 1:45-52.
16. Paul, G. (1966). *Insight vs. desensitization in psychotherapy*. Stanford, CA: Stanford University Press.
17. Beck, A. (1978). *Beck Depression Inventory*. San Antonio, TX: The Psychological Corporation/Harcourt Brace Javanovich.

18. Spielberger, C., Gorsuch, R., & Lushene, R. (1970). Manual for the State-Trait Anxiety Inventory (Self-Evaluation Questionnaire). Palo Alto, CA: Mind Garden.
19. Liebowitz, M. (1987). Social phobia. In: *Modern problems of pharmacopsychiatry*. pp. 141–173.
20. North, M., North, S., & Coble, J. (1997). Virtual reality therapy for fear of flying. *American Journal of Psychiatry* 154:130.
21. Safran, S, Heimberg, R., Horner, K., et al. (1999). Factor structure of social fears: the Liebowitz Social Anxiety Scale. *Journal of Anxiety Disorders* 13:253–267.

Address reprint requests to:

Sandra R. Harris, Ph.D.
University Counseling Services
California State University
18111 Nordhoff St.
Northridge, CA 91330–8217

E-mail: srhphd@earthlink.net