In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of Educational and Counselling Psychology, and Special Education

The University of British Columbia
Vancouver, Canada

Date July 25, 2002
ABSTRACT

The purpose of the study was to examine the efficacy of virtual reality exposure therapy (VRET) to treat driving phobia using a multiple baseline across-subjects design. The sequence of events included a pre-treatment assessment, a baseline phase, 8 weekly VRET sessions using a standardized treatment protocol, a post-treatment assessment, and 1- and 3-month follow-up assessments. A sample of seven treatment seeking adults with a primary diagnosis of specific phobia (driving) was recruited. Five completed the treatment and follow-up phases. One individual withdrew after the pre-treatment assessment, and the other, after the first treatment session. It was hypothesized that VRET would reduce driving anxiety and avoidance symptoms between pre- and post-treatment assessments using several outcome measures. Visual and statistical analysis methods were used to assess treatment outcome. Three participants showed clear improvement in driving anxiety and avoidance symptoms between pre- and post-treatment assessments. There was a marginal improvement in these symptoms for one participant. The remaining participant showed very little improvement, and some outcome measures revealed slight deterioration in some of her symptoms. There was negligible change in actual driving frequency in any participant. Some gains were lost at the 1- and 3-month follow-up assessments, but symptoms remained far below pre-treatment results. Possibilities for future research and practice implications are discussed.
TABLE OF CONTENTS

Abstract................................................................................................................................................. ii
List of Tables........................................................................................................................................... vi
List of Figures.......................................................................................................................................... viii
Acknowledgement.................................................................................................................................. x
CHAPTER 1: Introduction............................................................................................................................ 1
CHAPTER 2: Literature Review.................................................................................................................... 11
    Clinical Features of Driving Phobia....................................................................................................... 11
    Theoretical Models of Etiology and Maintenance of
    Driving Phobia.................................................................................................................................... 14
    Assessment and Measurement Issues in Phobia Treatment
    Research................................................................................................................................................ 20
    Driving Phobia Treatment..................................................................................................................... 26
    Summary and Conclusions.................................................................................................................. 37
CHAPTER 3: Method.................................................................................................................................... 39
    Participants.......................................................................................................................................... 39
    Measures............................................................................................................................................. 47
    Apparatus.......................................................................................................................................... 55
    Design............................................................................................................................................... 56
    Procedures......................................................................................................................................... 67
CHAPTER 4: Results.................................................................................................................................... 73
    Stability of Data Points during the Baseline Phase............................................................................... 73
    Subjective Peak Anxiety Ratings during VR Exposure...................................................................... 73
    Treatment Outcome Measures.......................................................................................................... 84
    Summary of Exploratory Measures..................................................................................................... 117
## APPENDICES:

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>Summary of VRET Treatment Outcome Studies</td>
<td>176</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Copy of the Informed Consent Form and Certificate of Ethics Approval</td>
<td>184</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Summary of Research Participants who Withdrew from the Study</td>
<td>189</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Copies of the Instruments Developed for this Study</td>
<td>193</td>
</tr>
<tr>
<td>Appendix E</td>
<td>Copies of the Therapist Treatment Manual, the Research Participant Treatment Manual, and Treatment Adherence Rating Forms</td>
<td>201</td>
</tr>
<tr>
<td>Appendix F</td>
<td>Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations</td>
<td>235</td>
</tr>
<tr>
<td>Appendix G</td>
<td>Summary of Treatment Sessions for Research Participants</td>
<td>246</td>
</tr>
<tr>
<td>Appendix H</td>
<td>Driving Diary Results for Research Participants</td>
<td>252</td>
</tr>
<tr>
<td>Appendix I</td>
<td>Target Driving Fear List Results for Research Participants</td>
<td>275</td>
</tr>
<tr>
<td>Appendix J</td>
<td>Avoidance, Interference, and Distress Ratings for Research Participants</td>
<td>278</td>
</tr>
</tbody>
</table>
Appendix K  Plots of Ipsative Z-Scores for Outcome Measures for Research Participants.........................281

Appendix L  Results of Ipsative Z-Score Statistical Method for Research Participants.............................287
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demographic and Driving History Information of Sample</th>
<th>41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2</td>
<td>Study Measures</td>
<td>49</td>
</tr>
<tr>
<td>Table 3</td>
<td>Driving Situations and Virtual Reality Driving Scenarios</td>
<td>57</td>
</tr>
<tr>
<td>Table 4</td>
<td>Treatment Phase Schedule: Number of Days Between Treatment Sessions Across Research Participants</td>
<td>70</td>
</tr>
<tr>
<td>Table 5</td>
<td>Stability of Data Points for Daily Driving Diary</td>
<td>74</td>
</tr>
<tr>
<td>Table 6</td>
<td>Mean Peak Anxiety Ratings in Treatment Sessions</td>
<td>83</td>
</tr>
<tr>
<td>Table 7</td>
<td>Driving Anxiety Test at Pre-, Post-, 1- and 3-Month Follow-up Assessments</td>
<td>93</td>
</tr>
<tr>
<td>Table 8</td>
<td>Summary: Visual Inspection of Treatment Outcome Ipsative Z-Scores Between Pre- and Post-Treatment Assessments</td>
<td>107</td>
</tr>
<tr>
<td>Table 9</td>
<td>Summary Statistics: Descriptive Results, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Outcome Measures</td>
<td>110</td>
</tr>
<tr>
<td>Table 10</td>
<td>Summary Statistics: Simplified Time Series Analysis (C-Statistic) of Driving Diary Outcome Measures between Baseline and Post-Treatment Assessment Phase</td>
<td>112</td>
</tr>
<tr>
<td>Table 11</td>
<td>Overall Summary of Results Between Pre-and Post-Treatment Assessments: A comparison of Visual Inspection, Ipsative Z-Score, and C-Statistic Methods</td>
<td>114</td>
</tr>
<tr>
<td>Table 12</td>
<td>Results of the Client Satisfaction Questionnaire</td>
<td></td>
</tr>
</tbody>
</table>
at the Post-Treatment Assessment

Table 13 Effect Sizes for VRET Treatment Outcome Studies
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P1)</td>
</tr>
<tr>
<td>2</td>
<td>Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P)</td>
</tr>
<tr>
<td>3</td>
<td>Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P3)</td>
</tr>
<tr>
<td>4</td>
<td>Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P4)</td>
</tr>
<tr>
<td>5</td>
<td>Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P5)</td>
</tr>
<tr>
<td>6</td>
<td>Mean Peak Anxiety of Six Standard Virtual Driving Scenarios</td>
</tr>
<tr>
<td>7</td>
<td>Expected Mean Peak Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations</td>
</tr>
<tr>
<td>8</td>
<td>Driving Diary Results: Mean Driving Frequency (Minutes) at Baseline, Treatment, and 1- and 3-Month Follow-up Phases</td>
</tr>
<tr>
<td>9</td>
<td>Driving Diary Results: Mean Main Target Phobia at Baseline, Treatment, and 1- and 3-Month Follow-up Phases</td>
</tr>
<tr>
<td>10</td>
<td>Driving Diary Results: Mean Global Phobia at Baseline, Treatment, and 1- and 3-Month Follow-up Phases</td>
</tr>
<tr>
<td>11</td>
<td>Driving Target Fear List at Pre-, Post-, 1-Month, and 3-Month Follow-up Assessments</td>
</tr>
<tr>
<td>12</td>
<td>Avoidance Ratings at Pre-, Post-, 1-Month,</td>
</tr>
</tbody>
</table>
and 3-Month Follow-up SCID Interviews

Figure 13 Interference Ratings at Pre-, Post-, 1-Month, and 3-Month SCID Interview Assessments

Figure 14 Distress Ratings at Pre-, Post-, 1-Month, and 3-Month SCID Interviews

Figure 15 Plot of Ipsative Z-Scores for Mean Driving Frequency at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

Figure 16 Plot of Ipsative Z-Scores for Mean Main Target Phobia at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

Figure 17 Plot of Ipsative Z-Scores for Mean Global Phobia at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

Figure 18 Plot of Ipsative Z-Score for Mean Target Fear List at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

Figure 19 Plot of Ipsative Z-Score for Mean Driving Anxiety Test (Peak Anxiety) at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

Figure 20 Driving Concerns Questionnaire at Pre-, Post-, 1-Month, and 3-Month Follow-up Assessments

Figure 21 Presence Questionnaire Results at Pre- and Post-Treatment Assessments
ACKNOWLEDGEMENT

This doctoral dissertation would not have been possible without the support and assistance of many individuals and organizations. First, I am grateful to Dr. Beth Haverkamp for her ongoing guidance, support, and expertise throughout my doctoral program. As a research supervisor and professor, she has shown great commitment to my clinical and academic endeavors. Also, I would like to thank Dr. Steven Taylor, who has had a significant impact on my doctoral training and this research project. He has been extremely supportive and his ongoing assistance and expertise was very much appreciated. Also, I would also like to acknowledge Dr. Kadriye Ercikan and the statistical and measurement expertise, which she brought to my research project. I especially want to thank Community Therapists who provided me with access to the virtual reality driving simulator, office space, and technical assistance. I also want to acknowledge the research staff at the Traumatic Stress Clinic at UBC Hospital for their assistance. The Social Sciences and Humanities Research Council provided me with two-year financial support to undertake this project. I would like to thank Dr. C. Attkisson who kindly donated copies of the Client Satisfaction Questionnaire for my research project. Lastly, I am grateful to the research participants in my study for their time and commitment to this research study.
INTRODUCTION

In North American society today, transportation by automobile is part of everyday life. Many people depend on automobiles for mobility, independence and convenience for performing daily activities. Our popular culture has promoted automobiles as a reflection of one’s identity and status. Given the practical necessities and personal rewards of driving as well as the growing population, more people are driving than ever before. The continued growth in population, urbanization, and increased number of drivers has inevitably led to increased congestion and density on the roads (Greater Vancouver Regional District and the Province of British Columbia, 1993). Drivers are increasingly faced with dealing with the demands and pressures associated with our busy roadways. In the future, public roadways will be forced to accommodate growing numbers of drivers within confined areas, these trends will likely continue to worsen.

Given our current transportation conditions, driving an automobile can sometimes be an unpleasant and anxiety-provoking experience. For some people, driving can become a feared and dreaded event. The fear of driving can range in severity from mild and situation specific to severe and pervasive (Antony, Brown, & Barlow, 1997; Ehlers, Hofmann, Herda, & Roth, 1994; Taylor & Deane, 1999; Taylor & Deane, 2000). Common driving fears (Ehlers et al., 1994; Taylor & Deane, 2000) typically revolve around the potential dangers of driving (e.g., motor vehicle accidents, injury, losing control of the automobile), unpleasant driving situations (e.g., traffic jam), anxiety symptoms while driving (e.g., having a panic attack while driving), and criticism by other people.

The fear of driving often leads to reluctance and avoidance of driving, which in turn can result in functional interference and distress. Severe driving fear may be diagnosed as a specific phobia, situational type by the Diagnostic and Statistical Manual (4th ed., DSM-IV, American Psychiatric Association, 1994). Criteria include: an intense and persistent fear of driving; the fear increases in anticipation or exposure to fear-related driving stimuli; recognition that the fear is
excessive or unreasonable; driving avoidance, or driving with distress; and interference with daily function or heightened distress.

Onset of driving fear usually occurs in early to middle adulthood and are more prevalent in females (Antony et al., 1999; Ehlers et al., 1994; Mathew, Weinman, Semchuk, & Levin, 1982; Munjack, 1984; Taylor & Deane, 1999). Driving fear can develop following a motor vehicle accident, and may be a symptom of posttraumatic stress disorder (Asmundson, Cox, Larsen, Frombach, & Norton, 1999; Blanchard, Hickling, Taylor, Loos, & Gerardi, 1994; Kuch, Evans, Watson, Bubela, & Cox, 1991; Kuch, Cox, Evans, & Shulman, 1994; Kuch, 1997; Mayou, Bryant, & Duthie, 1993; Taylor & Koch, 1995). Driving fear may also arise from other anxiety conditions of panic disorder and agoraphobia (Antony et al., 1999; Ehlers et al., 1994; Kuch et al., 1991, 1994, Taylor & Deane, 1999, 2000; Taylor & Koch, 1995) and social phobia (Ehlers et al., 1994; Herda, Ehlers, & Roth, 1993). In some cases, people cannot recall, or identify, a specific reason for developing the phobia (Taylor & Deane, 1999). Without treatment, driving fear typically does not diminish and may become chronic, leading to further lifestyle restrictions and distress (Koch & Taylor, 1995; Kuch, 1997; Mayou, Tyndel, & Bryant, 1997; Taylor & Koch, 1995).

Few large-scale North American epidemiology studies have examined the prevalence of DSM-IV specific phobias. Surveys based on DSM-III and DSM-III-R, suggest the lifetime prevalence of simple phobia is approximately 11% (Curtis, Magee, Eaton, Wittchen, & Kessler, 1998; Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996). No studies have specifically addressed driving phobia, and the estimated number of people with a DSM-IV driving phobia in the general population remains unknown. Sub-clinical driving fears (driving fear symptoms that fail to meet full criteria for DSM-IV specific phobia) may be more prevalent, however there appears to be little data on their base rates in the community (Taylor & Deane, 1999). Estimates from research on psychiatric complications of motor vehicle accidents have reported driving phobia rates ranging from 2 to 47% of treatment and non-treatment seeking samples (see
Because driving phobia appears to be relatively common, at least in motor-vehicle accident samples and sub-clinical driving fear samples, controlled treatment outcome research is needed to determine the most effective treatments. To date, published driving phobia treatment research has included uncontrolled case reports and case series. Exposure-based treatments, which are considered among the most effective treatment modality for phobias, have been used in driving phobia outcome studies. Systematic desensitization has been found to be effective in several case reports of accident and non-accident related driving fear (Hayes, Hussain, Turneer, Anderson, & Grubb, 1983; Kraft & Al-Issa, 1965; Kushner, 1965; Quirk, 1985). Other case reports successfully used various combinations of in vivo and imaginal exposure (Blonstein, 1988; Fairbank, DeGood, & Jenkins, 1981; Horne, 1993; Kline & Franklin, 1999; Levine & Wolpe, 1980; Lyons & Scotti, 1995; Rovetto, 1983).

An uncontrolled case series included 30 individuals with posttraumatic stress disorder with phobic anxiety of driving (Kuch, Swinson, & Kirby, 1985). All participants met the DSM-III diagnosis of posttraumatic stress disorder and 77% met their criteria for a driving phobia, which was defined as driving avoidance, driving reluctance, or driving with intense discomfort. Twelve received treatment, which included imaginal exposure followed by in vivo exposure. Based upon the criteria of driving resumption, six reported improvements, four improved with further treatment (benzodiazepene and cognitive therapy), and two reported no change. Treatment effects were maintained at follow-up, which ranged from six months to nine years.

Simulation, or virtual reality (VR) technology, has recently attracted interest as an effective medium for exposure therapy (see Glantz, Durlach, Barnett, & Aviles, 1996; Rothbaum, Hodges, & Kooper, 1997, for reviews). It is often termed virtual reality exposure therapy (VRET). VR immerses the user into a real time computer-generated three-dimensional environment that simulates “real” experience. The user interacts with the virtual world through
different sensory modalities including sight, sound, and touch. Immersion into a VR environment creates a sense of realism, as if the person was physically present in the virtual world.

As a therapeutic modality, VRET has several potential advantages (Glantz et al., 1996; Rothbaum et al., 1997). VRET provides a controlled environment for people to be exposed and interact with feared stimuli until the anxiety diminishes. This medium provides greater standardization of exposures, which can be repeatedly practiced, graduated, or prolonged in a standardized manner. It may be particularly effective for in vivo situations that are time-limited, difficult to control, and unpredictable (e.g., merging onto a freeway, driving across a bridge). Because in vivo exposure for driving phobia typically occurs on public roadways, it may be potentially dangerous and embarrassing for the client. In contrast, VRET occurs in the safety of a clinical setting, and does not put the client, clinician, or public at risk. Some people are unable to benefit from imaginal exposure when they are unable to visualize and process anxiety-provoking imagery (Foaf & McNally, 1996). VRET incorporates computer generated stimuli (e.g., visual, auditory) and computer hardware (e.g., driving controls such as a steering wheel, gas and brake pedals), which allows several sensory systems to be involved, making the exposure more realistic than imagined stimuli, yet less threatening than real-life stimuli. Furthermore, some individuals may experience such intense fear that they feel unable, or refuse in vivo treatment. Ideally, VRET could serve as a bridge to in vivo driving, which is the ultimate goal of treating a driving phobia.

A number of case reports have used VRET to treat a wide range of specific phobias including acrophobia (Rothbaum, et al., 1995), flying phobia (Klein, 1999; North, North, & Coble, 1997; Rothbaum, Hodges, Watson, & Odopyke, 1996), spider phobia (Carlin, Hoffman, & Weghorst, 1997), and claustrophobia (Botella et al., 1998). However, the uncontrolled nature of case reports cannot eliminate potential internal and external validity threats, which makes causal inferences about treatment effects more tenuous.

Several experimental treatment studies for specific phobia have also been conducted. A single case experimental design was used to examine the efficacy of treating claustrophobic fears
in four adults (Botella, Banos, Villa, Perpina, & Garcia-Palacios, 2000). Improvement on a number of outcome measures from pre- to post-assessment points supported the efficacy of VRET, and maintenance of treatment effects was observed at the 3-month follow-up. Group designs examining the effectiveness of VRET to a wait list comparison group have been conducted on acrophobia (Rothbaum et al., 1995) and agoraphobia (North, North, & Coble, 1996). Results from these studies indicated that VRET groups showed greater improvement than wait list groups. A controlled treatment study on fear of flying (Rothbaum, Hodges, Smith, Lee, & Price, 2000) compared the effectiveness between VRET, standard in vivo exposure, and wait list comparison group. VRET was found to be equally effective as standard in vivo exposure and both treatments were more effective than the wait list group. Other experimental studies for treating flying phobia (Muhlberger, Herrmann, Wiedemann, Ellgring, & Pauli, 2001; Wiederhold, Gervitz, & Spira, 2002), acrophobia (Emmelkamp, Bruynzeel, Drost, & van der Mast, in press; Emmelkamp, Krijin, Hulsbosch, de Vries, Schuemie, & van der Mast, in press) have also found favorable results in treating phobias with VRET.

Results from general driving phobia treatment research and findings from VRET studies on a range of specific phobias suggest that VRET might be suitable for driving phobia. A pilot study (Wald & Taylor, 2001) completed for this dissertation used a case report design to treat a female with a long-standing DSM-IV driving phobia. Briefly, the design included a seven-day baseline phase followed by three VRET sessions using a treatment protocol developed for the study. Phobic-related symptoms decreased from the pre-treatment assessment, and gains were maintained at 1- and 7-month follow-up assessments. Although it appeared effective in treating her phobic symptoms, further controlled trials are needed to establish it as an empirically supported therapy for driving phobia (Chambless & Hollon, 1997).

For this study, I used a multiple baseline across-subjects design with pre-, post-, and follow-up assessment points to address the research question, is VRET effective for treating driving phobia? Sequence of the design included: a pre-treatment assessment; baseline phase; an
intervention phase consisting of eight weekly treatment sessions; a follow-up assessment one week after the last treatment session; and 1- and 3-month follow-up assessments. Seven adults with a DSM-IV specific phobia diagnosis were recruited. Five individuals completed the treatment and follow-up assessments and two individuals withdrew in the initial phase of the study.

It was hypothesized that VRET (independent variable) would reduce driving anxiety and avoidance (dependent variables) between pre- and post-treatment assessments based on a range of outcome measures, which included self-report inventories, a semi-structured diagnostic interview, and self-monitoring. The Driving Diary (Main Target Phobia and Driving Frequency) assessed driving avoidance. The Driving Diary (General Phobia), Target Driving Fear List, and Driving Anxiety Test (peak anxiety) measured driving anxiety. The Structured Clinical Interview for DSM-IV (SCID) provided additional clinical evidence of anxiety and avoidance symptoms, as well as additional information about phobic-related interference and distress.

Treatment outcome criteria included decreased Main Target Phobia (criterion 1) and Global Phobia (criterion 2) scores, increased driving frequency (criterion 3), completion of a Driving Anxiety Test with low peak anxiety rating (criterion 4), reduced target driving fear severity (criterion 5), and no longer meeting DSM-IV criteria for specific phobia, situational type (driving) at the post-treatment assessment (criterion 6). Maintenance of treatment effects was expected at 1- and 3-month follow-up assessments.

For the statistical hypothesis (Wampold, Davis, & Good, 1990), it was expected that there would be statistically significant differences between ipsative z-scores (Mueser, Yarnold, & Foy, 1991; Yarnold, 1988). Ipsative z-scores are derived from the participant’s own mean and standard deviation) obtained at pre-treatment and post-treatment assessment points. Ipsative z-scores on Driving Diary (Main Target Phobia, Global Phobia), Target Driving Fear List, and Driving Anxiety Test (peak anxiety) were expected to decrease from pre- to post-treatment assessments, and the ipsative z-score on Driving Diary (driving frequency) was expected to
increase. As a secondary analysis, it was expected that the C-statistic (Tyron, 1982), a simple
time series analysis, would reveal statistically significant trends, or systematic changes in Driving
Diary measures (Driving Frequency, Main Target Phobia, and Global Phobia) between pre-
treatment (baseline) and post-treatment assessment phases (1-week monitoring phase). The C-
statistic was also used to examine the stability of baseline phase data.

Many strengths of this study related to methodology. The multiple-baseline design across
subjects design was highly appropriate for investigating the efficacy of a new and experimental
treatment, such as VRET. This design, as compared to uncontrolled treatment research, reduces
many internal and external validity threats thereby allowing more confident inferences about
treatment effects (Barlow, Hayes, & Nelson, 1984; Barlow & Hersen, 1984; Hersen & Barlow,

Unlike case reports, single case experimental research requires that participants typically
record data on target symptoms for a period of time before a treatment is implemented, which is
known as the baseline phase. In this study, participants were randomly assigned to different
baseline lengths (number of days), in which they recorded their Driving Diary (Driving
Frequency, Main Target Phobia, and Global Phobia). With this design, changes from the baseline
pattern as a result of the intervention can be more confidently attributed to the treatment,
particularly when a similar response pattern occurs over several individuals.

A multiple assessment approach was used to minimize biases (e.g., response styles,
reactivity) associated with individual measurement methods. Several different treatment outcome
measures were used including a standardized diagnostic interview, self-reports, and self-
monitoring techniques. To reduce measurement error, self-report measures with adequate
psychometric properties and sensitivity to treatment effects were included. A further
improvement from previous driving phobia treatment research is to include statistical techniques
to complement visual analysis of change from pre-to post-treatment assessments across the
outcome measures. Maintenance of treatment outcome was examined at 1- and 3- month follow-
up assessments, and a statistical method was used to calculate stability of Driving Diary data at post-treatment and follow-up assessments. A range of exploratory measures was also used to examine potential variables associated with change.

A relatively homogenous sample was recruited to minimize subject characteristics that might differentially affect treatment effects across individuals. A detailed description of the sample was obtained for identifying other potential variables that might be associated with treatment outcome. The direct replication of results across individuals within this sample permits conclusions about the study's generalizability to other samples with similar characteristics.

Another strength pertains to the attention to treatment and assessment fidelity, which are also required for valid conclusions and replications (Barlow et al., 1984; Eifert, Schulte, Zvolensky, & Lau, 1997; Waltz, Addis, & Jacobson, 1993). The current study included a manualized treatment approach and standardized assessment conditions. Treatment sessions were audiotaped and randomly reviewed by a clinical supervisor and a trained research assistant to ensure adherence to the treatment protocol. A supervisor reviewed all audiotaped diagnostic interviews, and they were also blind-rated by a research assistant for inter-rater agreement.

The use of self-monitoring instruments can be associated with non-adherence, inaccurate recording, demand characteristics, and recall biases (Agras & Jacob, 1981; Craske & Tsao, 1999; Trudel, 1979), which can add measurement error to and limit causal inferences regarding treatment efficacy. To improve with self-monitoring adherence, a number of recommendations were followed (Barlow et al., 1984, Craske & Tsao, 1999; Jackson, 1999; Korotitish & Nelson-Gray, 1999): providing a simple recording device; ensuring participants were aware that adherence was monitored; and providing detailed training and instruction (e.g., a research participant treatment manual).

As functioned as both the researcher and therapist, attempts were made to minimize the problems and biases associated with dual roles, such as experimenter expectancies, observer drift, and demand characteristics in participants. Strategies included the use of adherence checks
described above (e.g., the use of adherence ratings, supervision, and standardized treatment). As a way to reduce demand characteristics (e.g., social desirability associated with being evaluated in a research treatment study), participants were required to seal completed self-monitoring and self-report data in envelopes addressed to my research supervisor. I did not access these forms until the treatment phase was over, and participants were notified of this procedure before treatment started.

There were also potential difficulties relating to the recruitment process and inclusion criteria, in order to obtain a homogenous sample. To minimize subject differences, strict admission criteria were used to obtain a sample of individuals with similar characteristics. In anticipation that some participants may withdraw from the study, a minimum of seven individuals was recruited. I attempted to anticipate other “real world” limitations that I might encounter during the treatment study, such as irregular treatment attendance, non-adherence to self-monitoring forms, and technical problems with the VR driving simulator. I hoped to reduce the first two issues by providing verbal and written information about the treatment study to the participants at admissions (e.g., emphasizing the importance of regular treatment sessions and completing self-monitoring forms). For the latter concern, I was fortunate to have on-site technical support by the company who owns the simulator.

Generalizability was limited to other individuals with similar characteristics to the sample's composition (Barlow & Hersen, 1984; Hersen & Barlow, 1976; Hilliard, 1993; Kazdin, 1982, 1999), which included treatment seeking individuals with a primary DSM-IV driving phobia diagnosis with similar subject characteristics (e.g., middle adult aged females). Results cannot be extrapolated to people whose driving fear is associated with a different primary disorder such as agoraphobia with a history of panic disorder, post traumatic stress disorder, or social phobia. Furthermore, it was not known whether similar results would be obtained in samples with different subject characteristics (e.g., males, young adults, people who have driving experience, non-treatment seeking).
Another limitation of external validity relates to the setting, time, and stimulus conditions. Results of this study could only be generalized to a university research setting using this treatment protocol and driving simulator. Follow-up assessment was limited to three months, therefore it was not be known if treatment effects were maintained over a longer duration. The assessment (stimulus) characteristics of this study may also limit the extent to which the results can be generalized to other assessment approaches.

This study addresses the question of treatment efficacy; does it work? and examines possible reasons for a person’s treatment outcome. It was considered as the next phase to the uncontrolled case report previously completed (Wald & Taylor, 2001). This study was not designed to be a complete component analysis nor did it fully address the issue of systematic replication. It was beyond the scope of this study to identify moderating and mediating effects on treatment outcome (e.g. relative effectiveness of various specific and non-specific factors). It was hoped that results from this study would encourage future outcome and process research with larger samples.

Ethical approval for this study was obtained from the UBC Behavioral Research Ethics Committee at the University of British Columbia. With respect to the resources and personnel, I received permission to use the virtual reality equipment and office space at Community Therapists Inc. in Vancouver. The staff at Community Therapists provided office and technical assistance. I received doctoral research funding from the Social Sciences and Humanities Research Council for financial assistance. Dr. Steven Taylor, a licensed clinical psychologist provided clinical supervision over the study. Research assistants from the UBC Department of Psychiatry rated the diagnostic tapes and treatment sessions for adherence to the treatment protocol. I developed the treatment protocol used in this study and was responsible for conducting all aspects of the research project.
LITERATURE REVIEW

The literature review covers four sections: clinical features; theoretical models; assessment and measurement issues; and treatment of driving phobia.

Clinical Features of Driving Phobia

Unlike other specific phobias, driving phobia has received significantly less attention in the research literature. Although consensus on the descriptive features of driving phobia is emerging, its etiology, prevalence, diagnostic classification, and treatment remain controversial. Inconsistent definitions of the driving phobia construct, variations in sampling and measures, and reliance on retrospective data have been problematic methodological issues. As a result, many gaps between theory, research, and practice remain.

Descriptive research (Antony et al., 1999; Ehlers et al., 1994; Taylor & Deane, 1999) suggests that driving phobia is more common in females. Age of fear onset can often be traced to adolescence and early to middle adulthood, and tends to follow a chronic and progressive course. Driving phobia is unlikely to spontaneously remit without treatment. The lifetime prevalence of specific phobia has been estimated as 11%, but no studies have yet examined the prevalence of driving phobia in the general population (Curtis et al., 1998; Magee, et al., 1996). Comorbidity between driving fear with other anxiety disorders and major depressive disorder has also been documented (Ehlers et al., 1994).

Common driving concerns typically revolve around the potential dangers of driving (e.g., motor vehicle accidents, injury, losing control of the automobile), unpleasant driving situations (e.g., traffic jam), and to a lesser degree, anxiety symptoms while driving and criticism by other people (Ehlers et al., 1994; Taylor & Deane, 2000, Taylor et al., 2000). These concerns are comparable to other situational types of specific phobia (e.g., heights, flying, enclosed spaces), in which the primary concerns are related to potential external dangers (Antony et al., 1997; Hugdahl & Ost, 1985; Menzies & Clarke, 1993; Muris, Schmidt, & Merckelbach, 1999). Additional fears indirectly relate with driving may also be present (e.g., fear of enclosed spaces,
fear of speed), however this finding is speculative and requires further research (Hofmann et al., 1997). Ehlers et al. also found that driving phobics learned to drive at a later age and felt greater anxiety while riding in cars as children, as compared to a group of non-phobic individuals. However, these findings are based on small non-clinical samples and generalizability of these findings is limited.

A recent advancement of driving fear research has defined the construct in terms of a "driving phobia" using DSM nomenclature. Early research on driving phobia classified this type of fear as a simple phobia using the DSM-III-R. More current studies employing the DSM-IV have subsumed driving phobia as a specific phobia, situational type. The DSM-IV specific phobia criteria includes: an intense and persistent fear of driving; the fear increases in anticipation or exposure to fear-related driving stimuli; recognition that the fear is excessive or unreasonable; driving avoidance, or driving with distress; and interference with daily functioning or heightened distress. This standardized nomenclature allows for meaningful comparisons of studies and facilitates a clearer distinction between clinical and sub-clinical phobias.

Several studies have described driving fear in terms of an "accident phobia" and "travel or transportation phobia." The former construct emerged from motor vehicle accident research, which found a significant number of people who are involved in car accidents subsequently develop a fear of driving (see Blaszcynski et al., 1998, for a review). Motor vehicle accident-related driving fears may be a symptom within the context of posttraumatic stress disorder, a more serious psychiatric disorder that can develop from trauma exposure.

The definition of accident phobia provided by Kuch et al. (1991, 1994) includes a DSM-III-R simple, or DSM-IV specific phobia diagnosis, its onset is related to an accident, and fear and avoidance revolve around the accident, or its repetition. Accident phobia can also occur in pedestrians, passengers, or cyclists (Kuch et al., 1994; Taylor & Koch, 1995). The term travel or transportation phobia has been used to broaden the driving phobia construct even more to include persons who experience fears of being a passenger in a car, or riding on public transportation.
Accident phobia is relatively common, with reported rates ranging from 2 to 6% (Blanchard et al., 1994, 1995, 1996), 12% (Asmundson et al., 1999), 13% (Mayou et al., 1993), 38% (Kuch et al., 1994), 48% (Kuch et al., 1991), to 60% (Hickling & Blanchard, 1992). Inconsistent definitions and diagnostic thresholds have made it difficult to draw conclusions about the prevalence of this type of driving fear. When complete avoidance is used as a criterion (Blanchard et al., 1994, 1995, 1996) much lower rates are reported. In contrast, when partial avoidance and distress are used as the criteria, the rates increase considerably (Kuch et al., 1991, 1994).

A number of authors (Antony et al., 1999; Ehlers et al., 1994; Taylor & Deane, 1999; Taylor et al., 2000) have suggested that the accident phobia construct is too restrictive as many people who develop a fear of driving have no history of motor vehicle accident involvement. Results from these studies have shown that people with driving related fears are a diverse population and these fears can develop through multiple etiological pathways. For example, Taylor and Deane (1999) reported that 27% of their sample attributed their driving fear to a direct conditioning event (e.g., motor vehicle accident), while 58% were classified to other causal pathways (e.g., non-conditioning traumatic events, vicarious conditioning), and some people are unable to identify a specific reason for their driving fear onset.

One commonly reported pathway for the development of driving fear and avoidance is through other anxiety conditions, specifically panic disorder with agoraphobia (Antony et al., 1999; Ehlers et al., 1994; Herda, Ehlers, & Roth, 1993; Munjack, 1984; Kuch et al., 1991, 1994, Taylor & Deane, 1999, 2000; Sartory, Roth, & Kopell, 1992; Taylor & Koch, 1995) or social phobia (Ehlers et al., 1994). Ehlers et al. (1994), reported that one of the most frequently reported reasons for their non-treatment seeking sample's DSM-III-R driving phobia (n =55) were panic attacks, and 81% of their sample met criteria for DSM-III-R panic attacks. Distinct phobic-related concerns have been found in these different diagnostic groups. For example, people who are primarily concerned with the potential dangers of driving and are less worried
about anxiety symptoms or their consequences may be more likely to be diagnosed with a specific phobia. In contrast, if their concerns mostly focus on anxiety symptoms, a diagnosis of panic disorder with agoraphobia could be considered. Similar etiological and diagnostic heterogeneity has been shown in other phobic disorders (Davey, 1992; Himle, Crystal, Curtis, & Fluent, 1991; Merckelbach et al., 1996; Muris et al., 1999), and these findings raise questions about the theoretical mechanisms underlying the acquisition and maintenance of phobias.

Theoretical Models of Etiology and Maintenance of Driving Phobia

Although numerous etiological theories have emerged, none provide a complete understanding of driving phobia acquisition and maintenance (Craske, 1999). A summary of associative, non-associative, and information processing models, their contributions, and limitations to phobia research are described below.

Associative Models.

Conditioning, or associative models, founded on the principles of Pavlovian conditioning, suggested that phobias are learned behaviors. In strict Pavlovian (1927) terms, this form of conditioning is an innate, automatic, and unconscious process of learning based on direct experiences in the environment. The conditioning paradigm for fear acquisition involves a neutral stimulus (NS, e.g., driving situation) being paired with an aversive event, or unconditioned stimulus (UCS, e.g., car accident), which elicits an unconditioned fear response (UCR, e.g., anxiety). As a result of this pairing, the NS, now a conditioned stimulus (CS) elicits a conditioned fear response (CR) without the UCS. The connection between the between the CS and CR has been learned because of the NS and UCS temporal pairing. The acquisition of a CR is influenced by the contiguity between CS and UCS, the strength of the UCS intensity (minor vs. serious car accident), and strength of UCR (e.g., intensity of the fear response). Within this conditioning paradigm, it was found that the CR is elicited only by CS-related stimuli (e.g., people with driving fears shouldn’t also develop a fear of dogs), also known as discrimination. Stimuli that are similar, but not identical to the CS can also elicit the CR, but these generalized stimuli are not
as strong as the original CS learning (e.g., people with driving fears could develop a fear of non-driving related modes of transportation).

In this model, the aversive stimulus (CS) that predicts the occurrence of the CR (anxiety response) results in instrumental behavioral responses (escape and avoidance) in order to avoid stimuli that will elicit the CR. Further research (Mowrer, 1960) elaborated on how avoidance serves to maintain a conditioned fear response. In Mowrer's two factor theory, he suggested that fear is acquired through classical conditioning and maintained through operant conditioning. Avoidance, or escaping, from a CS negatively reinforces an acquired fear response, because the avoidance behavior prevents feared response from being paired with new stimuli.

Refinement of Pavlovian conditioning theory attempted to identify several factors and processes that influence the acquisition of conditioned responses. Rescorla and Wagner (1972) expanded classical conditioning theory by elaborating on CS and UCS associative processes, such as response strength, rate of learning, effects of other stimuli paired with the CS and UCS (e.g., loud noises, pain), and amount of learning that can occur. It specifically attempted to explain how predictions of a CS through prior learning could influence the strength and rate of CR acquisition. A number of other theorists also focused on different aspects of the associability between CS-UCS pairings (e.g., Guthrie, 1934; Hull, 1943; Mackintosh, 1975). There was also a shift from the traditional mechanistic views of learning by incorporating the role of internal events (e.g., expectations and predictions of future events) within the individual (e.g., Alloy & Tabachnik, 1984; Bolles, 1972; Tolman, 1959). For example, in addition to direct learning experiences with the UCS, a CR can also be learned through vicarious conditioning and informational pathways (Bandura, 1977; Rachman, 1977, 1990), such as developing a fear of driving after a family member was in a car accident.

Associative theories have been widely researched and have contributed to a better understanding of fear and phobia acquisition processes, however they lack the explanatory power to fully account for a number of observations. Direct learning experiences (e.g. CS and UCS
pairings) cannot fully account for fear acquisition and multiple acquisition pathways that have found across different specific phobias (Davey, 1992. Himle et al., 1991). These theories cannot explain why some individuals who have never experienced an aversive direct conditioning event (UCS) with an object or situation go on to develop a phobia. For some people with specific phobia, a direct learning experience cannot be identified. Exposure to such an event (UCS) does not necessarily produce a conditioned fear response. For example, many people are exposed to aversive dangerous driving situations and car accidents, yet only a small sub-group of these individuals develop a driving phobia. Further, learning theories are also unable to explicate the reasons for why some people develop multiple phobias and fears, age and gender differences, and how childhood traumatic experiences (e.g., childhood physical abuse) can influence the development of specific phobia (Fredrikson, Annas, Fischer, & Wik, 1996; Magee, 1999, Merckelbach, de Jong, & van den Hout, 1996). Lastly, phobias are limited to specific types (e.g., people do not usually develop a fear of furniture) and fall into general factors or types (e.g., situational), and these theories cannot explain the non-random distribution, or specificity of the fears across human and other species (Arrindell, Pickersgill, Merckelbach, Ardon, & Cornet, 1991; Kendler, Neale, Kessler, Heath, & Eaves, 1992; Kendler, Walters, Neale, Kessler, Heath, & Eaves, 1995; Taylor, 1998).

To address some of these equivocal issues, there has been a growing interest in cognitive processes in fear acquisition and maintenance in specific phobias and other anxiety disorders (Barlow, 1988; Beck et al., 1985; Chambless & Gillis, 1993; Craske, 1999; Davey, 1997; Rachman, 1990; Rachman, & Richard, 1988; Reiss, 1991; Salkovskis, 1995). As Barlow (1997) stated, “vigilance for future danger is at the core of anxiety and reflects a basic sense of uncontrollability and unpredictability over future potentially dangerous life events” (p. 32). Bandura’s (1977) social learning model of phobia acquisition and maintenance emphasized the role of expectations and perceived consequences about events (stimulus-outcome), and about one’s behaviors (response-outcome). More recently, there has been a growing interest in
expectations and appraisal of potential danger in phobias and other anxiety disorders (Kamphuis & Telch, 2000; Sloan & Telch, 2002).

Non-Associative Models.

Non-associative models attempted to address how phobias develop through non-conditioning pathways by innate influences. In the preparedness hypothesis by Seligman (1971), he elaborated on the evolutionary-based biological basis of acquiring fears in humans and other species. In this model, the predisposition to learn specific fears make it easier and more rapidly for some CR to be learned than others. Furthermore, certain stimuli have more salience, which is evolutionary-based, and this varies across species. It is generally accepted that certain “evolutionary-relevant stimuli” are more likely associated with fear responses and phobias (Menzies & Clarke, 1993; Merckelbach & de Jong, 1997, Merckelbach, et al., 1996).

Hereditary influences on the development of fear responses are well-documented in humans and animals (Marks, 1969; Merckelbach & de Jong, 1997). Support for innate factors comes from animal studies, developmental psychology, the non-random aspect of fears across different species, and the higher prevalence of certain phobias in childhood that decreases in adulthood. For example, children tend to be afraid of stimuli associated with rapid visual movement, animals, and novel stimuli. Furthermore, different fears emerge at different ages in childhood development, as demonstrated in visual cliff and separation anxiety experiments. It is also possible that traumatic experiences which are unpredictable, uncontrollable, or threatening in childhood or adulthood may trigger an innate fear into a phobia (Magee, 1999; Marks, 1969). Menzies and Clarke (1995) proposed that phobias represent a failure to habituate to intrinsic (innate or unlearned) fears. Dishabituation of fear, or an increase of the fear response upon exposure to a new stimulus, may be caused by a lack of safe experiences with related feared stimuli, increased life stresses, and individual differences (e.g., high trait anxiety, neuroticism).

These models appear to account for many limitations of conditioning theories. However, non-associative models have received limited investigation and are difficult to directly test (Fyer,
The role of life experiences, contextual, social-psychological processes, cognitive processes, and other individual differences (e.g., personality) likely interplay with innate influences (Bandura, 1977; Craske, 1999; Macleod & Rutherford, 1992; Magee, 1999, Ohman, 1993). Nonassociative models alone are unable to explain how these interactions contribute to the development and maintenance of phobias. As a result, integrative theories have emerged in attempts to enhance our conceptual understanding of the processes underlying phobia acquisition.

Evidence from information processing studies provide support for non-conscious processes (Cameron, 1997; Ohman, 1996, 1997; Van Den Hout, Tenney, Huygens, & DeJong, 1997), such as pre-attentional fear biases that may be evolutionary or heriditary based (Davey, 1992; Ohman, 1996, 1997; van den Hout, Tenney, Huygens, Merkelbach, & Kindt, 1995; van den Hout, Tenney, Huygens, & DeJong, 1997). These authors speculate that pre-conscious processing biases, or selective processing towards threat-related information over neutral information without conscious awareness or effort, may also help explain fear acquisition and maintenance in phobic disorders.

Information processing models.

Other conceptualizations of phobia etiology have elaborated on early information processing theories to include emotional and cognitive dimensions of fear, such as Lang's (1979) fear network model, which Foa and Kozak (1986) later refined. Foa and Kozak proposed that fears are cognitively represented in long-term memory as fear structures, which contain information about fear stimuli, fear response, and meaning information (e.g., risk probability of being in a car accident). Fear structures, not necessarily in our immediate awareness, are activated when incoming information matches the fear structure, which elicits a fear response. With specific phobias, Foa and McNally (1996) speculated that the fear structure contains representations of excessive and unrealistic responses to fear stimuli, which are resistant to change. Meaning representations typically contain evaluation errors (e.g., over-estimation of motor vehicle accident risk), and the consequences are associated with high negative valence. The
authors suggest that the fear structure is activated when incoming stimuli (e.g., during exposure to fear stimuli) match the stimulus and meaning representations of the fear structure, which in turn elicits the fear response.

The storage of fear memories is referred to as a fear structure, which develop from traumatic or threatening experiences. Exposure to previous traumatic events produces large fear structures and greater generalizations of fears. The theory proposes that larger fear structures are more easily activated than smaller ones. Foa and McNally (1996) suggest that phobias have coherent and simple fear structures, which require minimal matching elements for fear activation to occur. Fear structures with larger number of fear stimuli are more likely to be activated because it is more likely that the person will encounter situations that will match the fear structure’s information. This theory may have potential in illuminating the vulnerability factors associated with the development and course of driving phobias. This model also argues that treatment of phobias require the person to activate the fear structure and replace it with corrective information.

One limitation of this model pertains to its complexity. It is also uncertain what optimal levels of elements are needed for fear activation, nor has it addressed how fear structures develop, how they are modified, or replaced. Nor has it reconciled influences of social-psychological processes involved in forming expectancies and meanings of feared stimuli, or the relationship between conscious and unconscious processes. Foa and McNally suggest that pathological fear structures develop from traumatic or threatening experiences, but the causal mechanisms for other fear acquisition pathways does not appear to be addressed. The strengths of this model lie in its ability to provide a framework for testable theory-driven hypotheses to address fear acquisition and extinction.

Summary

Descriptive articles have shown that the development of driving phobia, like other specific phobias, is associated with multiple pathways that include direct learning experiences
(e.g., motor vehicle accidents and other driving-related trauma exposure). Other pathways in the development of driving fear could be linked to innate or other pre-disposing factors. For example, Ehlers et al. (1994) found that some people with driving fear attributed their fear onset being a "generally anxious person," being a "generally afraid of high speed," and some were unable to specify a reason for developing driving fear. These findings suggest that evolutionary and genetic influences interact with specific environmental and contextual factors, which contribute to individual differences (personality, temperament, cognitive processes) in vulnerability to developing fears and phobias (Eysenck, 1979; Kendler et al., 1992, 1995; Taylor, 1998). Other modulating and protective factors in phobia etiology and maintenance have received limited investigation. The role of these factors and their inter-relationships remains speculative and requires further research. In pursuit of further describing, explaining, and predicting the nature and course of driving phobia, valid and reliable measurement tools must be constructed.

**Assessment and Measurement Issues in Phobia Treatment Research**

The role of assessment in anxiety and fear research serves multiple functions: to establish a baseline, to form a diagnosis, to monitor treatment progress and outcome, and enhance our understanding of clinical problems. It is generally accepted that fear has different response systems, which include behavioral/motor, physiological, and verbal responses (Lang, 1971; Rachman & Hodgson, 1974). However, these systems do not have a parallel relationship and this covariation is known as desynchrony (Rachman & Hodgson, 1974). For example, subjective anxiety, physiological indicators of arousal (e.g., heart rate, skin conductance), and avoidance behavior upon to exposure to fear stimuli may not be consistent.

Measures of a response system (e.g., arousal) using different methods (e.g., self-report, physiological) can yield discrepant results, and the response systems should not be equated to the methods that are used to measure them. The assessment of specific phobias should tap into these systems using different measures and methods as each as its own sources of variability (Agras & Jacob, 1981; Craske & Tsao, 1999). De Beurs, Van Dyck, Van Balkom, Lange, and
Koele (1994) recommended that moderate correlations between measures would avoid redundancy in measures and each could account for unique variance. Furthermore, multiple measures may provide converging evidence to support treatment efficacy and provide a more complete examination of the multi-dimensional aspects of phobic symptoms (Barlow et al., 1984; Craske & Tsao, 1999; Taylor & Agras, 1981).

With respect to assessing treatment outcome, Barlow et al. (1984) distinguished treatment outcome measures on a molecular-molar continuum and advocated the importance of both types. Molecular measures are described by their precision and sensitivity to measuring change, but may lack validity and normative data, and interact with treatment effects. Molar measures include instruments that relate to specific problems and usually have established psychometric properties and normative data, but lack sensitivity to capture change. Anxiety measures also vary in their sensitivity to detect treatment effects (Agras & Jacob, 1980; Craske & Rowe, 1997; Taylor & Agras, 1981). Taylor and Agras found the most sensitive measures to detect change are client ratings of the main target phobia and in vivo behavioral measurements.

There are several sources of variance associated with different fear and anxiety measures, which may increase measurement error and obfuscate treatment effects, such as reactivity, method variance, response biases, situational factors, demand characteristics, and the instability of retrospective accounts of fear (Agras & Jacob, 1981; Craske & Tsao, 1999; Taylor et al., 1998). To reduce measurement error, reliability checks, tests with adequate psychometric properties, sensitive tests, and standardized testing conditions should be used. The number of measures also has implications for assessing treatment effects. Agras and Jacob (1981) noted how too many measures increase the risk of Type I errors (e.g., falsely detecting statistically significant results due to chance variations and redundancies in the measures) and too few can result in higher Type II errors (e.g., failing to detect statistically significant results). A summary of different measurement methods is presented below.
Self-Monitoring.

Self-monitoring is a method that requires individuals to directly record immediate, or very recent, target behaviors, thoughts, or feelings in their natural environment (e.g. subjective intensity of anxiety or escape behavior). Widely used in anxiety and fear studies, numerous self-monitoring devices and formats have been developed, which include self-rating scales and diaries. These methods sample target behaviors based on pre-determined times and events (Craske & Tsao, 1999; Foster et al., 1999). They can be used as an assessment or treatment tool to assess patterns within and across individuals (Craske & Tsao, 1999; Foster, Jackson, 1999; Laverty-Finch, Gizzo, & Osantowski, 1999; Korotitsch & Nelson-Gray, 1999). Self-monitored data typically corresponds moderately well with other outcome measures of clinical improvement that measure similar symptoms (Barlow, Craske, & Cerny, 1989; Craske & Tsao, 1999; Jackson, 1999; Klosko, 1989).

The relationship between self-monitoring and self-report data is not always clear. Craske and Tsao (1999) suggest that self-monitoring and self-report formats are susceptible to different sources of variability and method variance. Reactivity, response demands, attentional and memory biases, and availability heuristics may produce either overestimation or underestimation in self-monitoring (Craske & Tsao, 1999). Missing data and non-adherence are other difficulties encountered with this type of measurement (Craske & Tsao, 1999). Data fabrication or forgetting to self-monitor can be other problems (Foster et al., 1999). Psychometric properties are often unknown and they may be difficult to accurately determine, because it would be expected that behavior would change over time and settings. Inter-observer agreement and observer drift may also be problematic (Foster et al., 1999). When used as an assessment tool in treatment outcome research, self-monitoring can confound treatment effects (Korotitsch & Nelson-Gray, 1999).

Accuracy can be enhanced by comparing self-monitored data with other objective measures to address issues of convergent and discriminant validity, employing unobtrusive accuracy checks by the clinician or a significant other, obtaining data that adequately represents
the target behavior of interest, adequate sampling of the target problem, and operationally defining the target problem (Barlow et al., 1984; Foster et al., 1999; Korotitsch, & Nelson-Gray, 1999; Jackson, 1999). Craske and Tsao (1999) and Foster et al. (1999) emphasize adequate participant training, practice, and ongoing therapist feedback. It is also important to allow reactive effects to stabilize by using an extended baseline (Jackson, 1999). Craske and Tsao (1999) added that reactivity does not typically have a large impact on treatment effects and its effects tend to stabilize relatively quickly.

Common strategies to increase adherence have been recommended by Barlow et al. (1984), Craske and Tsao, (1999), Foster et al. (1999) and Korotitsch and Nelson-Gray (1999), Mahoney (1977), Nelson (1977a,b). These include: providing an obtrusive but easy recording device, using a verbal or written contract, providing rewards, ensuring client knows that accuracy will be monitored, giving tasks in gradually increasing steps, training with explicit instructions, reducing concurrent recordings, recording positive valence target behaviors, and recording only one behavior. They attribute non-adherence to participants lacking knowledge or skills, the tasks lacking relevance, as well as environmental and cognitive interference. Questions about adherence in debriefing may be useful in determining extent to which non-adherence may have influenced results (Foster et al., 1999). Attempts to minimize delays in self-monitoring may reduce memory biases associated with retrospective recall (Craske & Tsao, 1999).

Self-Reports.

Self-reports are commonly used verbal measures to assess a person’s thoughts, feelings, or behaviors. They are particularly useful for evaluating non-observable target symptoms for both assessment and treatment outcome purposes. Individual scores can often be compared to a normative sample before and after treatment to determine extent of change (Barlow et al., 1984; Jacobson, 1988; Jacobson & Truax, 1991). There are numerous self-report measures for phobias, which examine different aspects of phobia symptoms such as anxiety and avoidance, which do not necessarily covary (Marks & Mathews, 1979; Taylor & Agras, 1981). Broad-based
questionnaires or global rating scales used by clients, significant others, or clinicians are often used to assess client change. They are often standardized and have established psychometric properties, but may be influenced by observer bias, require training, and may be insensitive to subtle treatment effects. Self-report inventories of adjustment or quality of life are other important aspects of treatment outcome. If a treatment produces improvement in overall life adjustment, results are more clinically meaningful.

For similar reasons identified with self-monitoring, it is important to not rely solely on self-reports. Memory and response demand biases may be problematic in self-reports. Related anxiety research (Craske & Tsao, 1999; Korotitsch & Nelson-Gray, 1999) has found that individuals will often overestimate panic symptoms in self-reports, and self-reports may be more susceptible to response demand biases than self-monitoring. Psychometric properties, normative data, sensitivity to treatment effects, and relevancy to a target problem and research hypothesis should also be considered when choosing self-reports in phobia assessment.

**In Vivo Behavioral Measures.**

In vivo behavioral measures, sometimes referred to as behavioral avoidance tests, are direct measures of behavior and are highly sensitive to treatment effects (Agras & Taylor, 1981). Commonly used in phobia studies, in vivo behavioral tests require an individual to be exposed to a feared stimulus and interact with it, either in analog or naturalistic settings. These tests are usually repeated at different points to assess change in avoidance and anxiety. They are very sensitive to demand characteristics (Agras & Taylor, 1981; Barlow et al., 1984; Miller & Bernstein, 1972), therefore it is important to standardize instructions and test conditions. Results may not have a parallel relationship with other measures and may not predict actual behavior. For example, Lang and Lazovik (1963) noted moderate correlations between results from a behavioral avoidance test and a fear thermometer measure ($r = 0.40$). De Beurs et al. (1994) also reported moderate correlations between a self-report inventory and the behavioral test ($r = 0.31$).
and between a therapist rating score and a behavioral test ($r = 0.37$). They can also confound
treatment effects and should be used infrequently (Agras & Taylor, 1981).

Summary

The research literature has demonstrated the complexity and heterogeneity of fear responses and has emphasized the importance of a multi-method assessment approach. However, there are relatively few phobic measures specifically designed to assess driving phobia. The Driving History Interview, Driving Concerns Questionnaire, and Driving Situations Questionnaire (Ehlers, 1990) have the potential to provide in-depth information about different descriptive aspects of driving fear. However, caution must be exercised in using these measures because only limited psychometric data has been obtained.

Kuch et al. (1995) developed the Accident Fear Questionnaire, specifically designed to assess motor-vehicle accident related driving fear. It is a screening instrument consisting of a 10-item accident profile and 10-item phobic avoidance profile directly relating to car accident involvement. It would not be suitable for the entire driving phobia population. Other general phobia measures, which could be used for descriptive and outcome driving phobia research, such as the Fear Questionnaire (Marks & Mathew, 1979), Phobics Origins Questionnaire (Ost & Hugdahl, 1981), and Origins Questionnaire (Menzies & Clarke, 1993). However, these measures are limited in their diagnostic value when they are used alone.

Comparability of measures with the DSM nomenclature is ideal, as it offers an objective standard to compare diagnostic rates, conduct a differential diagnosis, and documents symptoms across studies. The Structured Clinical Interview (SCID) for DSM-IV (First, et al., 1996) was designed to assess Axis I and II disorders. It enables clinicians to conduct a reliable and comprehensive examination of current and lifetime disorders. The SCID has been under utilized in driving phobia research. Without standardized diagnostic instruments, driving fear researchers are unable to quantify the clinical severity of the driving fears and identify concurrent and lifetime psychopathology, which may influence the onset, course, and severity of the driving fear.
Given the idiosyncratic nature of phobias, idiographic assessments can offer unique and clinically useful information (Cone, 1998; Kazdin, 1982). As Koch and Taylor (1995) noted, idiographic methods of assessment can be used to observe individual fear responses, avoidance behaviors, and situational influences on symptoms. Ideally, idiographic and nomothetic data can be used to complement one another in order to optimize individualized treatment planning and measure outcome. Standardized client satisfaction questionnaires (Attkisson & Zwick, 1982; Larsen, Attkisson, Hargreaves, & Nguyen, 1979) should be incorporated into treatment outcome research, as it has been shown to be associated with outcome.

Based on the current literature, treatment outcome research for driving phobia should include measures that are sensitive to treatment effects, have sufficient psychometric properties, and provide potentially useful descriptive information. An ideal assessment battery would include a structured diagnostic interview, (e.g., SCID), general self-report measures (e.g., Fear Questionnaire), specific driving fear inventories (e.g., Driving Concerns Questionnaire), an in vivo behavioral test, and self-monitoring data (e.g., driving frequency, severity of driving fear), as well as exploratory measures, which may provide insight to other variables associated with outcome (e.g., client satisfaction).

Driving Phobia Treatment

Only a minority (20 to 30%) of people seek treatment for specific phobias (Fyer, 1998; Zimmerman & Mattia, 2000) and treatment-seeking may be related to level of severity, functional impairment, or presence of other psychological difficulties. It is conceivable that these findings may apply to driving phobia, but no research has specifically examined treatment-seeking behavior in driving phobia. Despite being a relatively common condition, the treatment of driving phobia has received considerably less attention than other phobias. It is possible that driving phobias related to motor vehicle accidents are both under-reported and under-detected because more problematic symptoms, such as post-traumatic stress, pain, or depressive disorders overshadow phobic symptoms (Craske, 1999). In other cases, it is possible that people with
driving phobia do not experience enough distress or impairment to seek treatment, or perhaps, are too embarrassed or fearful (Deane & Chamberlain, 1994; Deane & Todd, 1996).

Overview of Driving Phobia Treatment Outcome Research

There has been relatively little driving phobia treatment research. Existing research appears to be limited to uncontrolled research and conclusions of treatment efficacy have often been based on descriptive interpretations. In most reports, the authors do not report numerical data, so it is impossible to look at the magnitude of change (e.g., effect sizes) or statistically significant change. No randomized controlled or comparative efficacy studies to treat driving phobia have yet been conducted.

Systematic desensitization has been found to be effective in treatment of driving fear and avoidance in a limited number of case reports (Hayes et al., 1983; Kraft & Al-Issa, 1965; Kushner, 1965; Quirk, 1985). Kraft and Al-Issa successfully treated an adult male with an accident-related phobia over 22 desensitization sessions spanning a three-month period. In another case of "posttraumatic phobia," Kushner used a combination of desensitization and relaxation over six sessions, followed by a three-month follow-up. Hayes et al. used an alternating treatment design to treat an adult female with a long-standing driving phobia of 12 years over six, 45 minute sessions and found that coping statements allowed her to progress through a systematic desensitization hierarchy faster than without coping statements. Other case reports have successfully used various combinations of in vivo and imaginal exposure (Blonstein, 1988; Fairbank, DeGood, & Jenkins, 1981; Horne, 1993; Kline & Franklin, 1999; Levine & Wolpe, 1980; Lyons & Scotti, 1995; Rovetto, 1983). In a case of motor vehicle accident-related DSM-IV posttraumatic stress disorder with driving fear and avoidance, Kline and Franklin (1999) used graded in vivo exposure in conjunction with marital therapy sessions over 28 sessions. The largest uncontrolled case series included 30 individuals with posttraumatic stress disorder with phobic anxiety of driving (Kuch et al., 1985).
Overview of Phobia Treatment Modalities.

Systematic Desensitization. The principles of classical conditioning was applied in the development of a behavioral treatment of fear reduction known as systematic desensitization (Wolpe, 1958). From animal research, Wolpe coined the term reciprocal inhibition, which suggested that animals could only experience one emotional state at a time. He used counter-conditioning to eliminate a conditioned fear response by introducing a different emotional response, which would inhibit the fear response (CR). The underlying mechanism of change in systematic desensitization is thought to be the counter-conditioning process.

In this treatment, Wolpe used relaxation (UCS) as a competing response to phobic anxiety (CR). First, clients would be trained to relax using a standardized relaxation training procedure (progressive muscular relaxation), which involves alternating tensing and relaxing major muscle groups. With training and practice, clients are able to induce a conditioned relaxation response very quickly. An anxiety hierarchy of phobic target scenes (CSs) would then be constructed, which would be graded in difficulty from low anxiety to high anxiety scenes. The next step in treatment is to have the client relax and imagine the lowest anxiety scene. If the client begins to feel anxious, the imagined scene is immediately stopped, and a relaxed state is induced. This process is repeated until the person can imagine the scene with no anxiety. Once this is achieved, the client moves on to the next scenario, and the process is again repeated, and is continued until the person can imagine the highest anxiety scene without anxiety. Wolpe (1958) completed a large uncontrolled case series (n = 210) for a wide range of phobias, and reported that 90% of the sample showed significant improvement.

The use of systematic desensitization to treat phobias, as well as its active elements, was widely researched in the 1960s (Lang & Lazovik, 1963; Marks, 1969; Wolpe, 1958). Early desensitization research during that time was largely based on volunteer college students using small sample sizes and short follow-up assessments. Marks (1969) concluded that desensitization was more effective than other treatments, such as exposure alone or relaxation alone, but
combined elements seemed to produce better effects. Several research studies have since shown that relaxation is not an essential active ingredient in eliminating phobic anxiety, and that graded exposure alone appeared sufficient (see Craske, 1999, for a review). Difficulties frequently encountered with systematic desensitization include being easily distracted, becoming drowsy while using relaxation, continuing to feel subjectively anxious despite using relaxation, problems generating anxiety-evoking or relaxing imagery, changing imagery scenes to avoid anxiety, or using irrelevant hierarchies (Marks, 1969).

Exposure Therapy. Exposure therapy involves repeated exposure to fear stimuli until the fear diminishes, and has been administered through a number of different mediums (imaginal, in vivo, computer-aided, and virtual reality) using a number of different formats, rates, and durations (see Craske, 1999, for a review). Exposure can involve varying degrees of therapist involvement from minimal to therapist-guided. It may be administered in a graduated manner from least to most anxiety provoking feared stimuli or through intensive and prolonged exposures. A key element of this therapeutic approach is eliciting the anxiety response upon initial exposure and prevention of escape or avoidance behaviors. Although exposure has been considered to be a primary active ingredient in fear reduction treatment, its underlying mechanisms of change remains unclear.

Imaginal exposure, similar to systematic desensitization involves exposure to a hierarchy of imagined fear stimuli until the anxiety response diminishes. As with systematic desensitization, this procedure can be ineffective when people are unable to create and process visual imagery. Imagined material may also lack the realism to sufficiently evoke an anxiety response (Foa & McNally; 1996). Because of the covert nature of the exposure, it can be difficult for the clinician to detect avoidance behaviors. In vivo exposure involves confronting "real life" feared stimuli. However individuals may experience such intense fear that they are unable, or refuse, to participate in vivo therapy. In vivo situations for certain phobia types (e.g., driving phobia) are often time-limited, difficult to control, or unpredictable. Since exposure often occurs in public it
can also be potentially embarrassing or dangerous for the individual.

The most common formats of imaginal and in vivo exposure have included graded exposure and flooding. Graded exposure therapy allows clients to gradually confronting fear stimuli of increasing difficulty on a hierarchy. With this approach, clients start the exposure with the target fear that is expected to be the least anxiety provoking on the hierarchy. Once their anxiety diminishes, they proceed to the next target fear. This procedure allows for progressive exposure towards more anxiety-provoking fear stimuli, and gives clients a greater sense of control over the exposure. Flooding requires clients to be exposed to the fear stimuli over a prolonged period of time. Ost (1989) developed one-session treatments using intensive and prolonged in-vivo exposure for a range of circumscribed phobias (e.g., spider, animal, injection). A review of outcome studies is provided by Ost (1997), which indicates that different components of rapid treatment may be more effective for these phobias. This procedure involves exposure to the entire hierarchy within one session. Clients need to be motivated and be willing tolerate a high level of anxiety and remain in the situation until the fear subsides (e.g., 2 to 3 hours). The graded approach is often preferred to flooding because it is often less threatening and involves less intense anxiety levels, which is more tolerable by clients.

Bandura’s theory of self-efficacy and social learning has been applied to exposure-based treatments, which includes graduated modeling, guided mastery, and participant modeling (e.g., Bandura, Adams, & Beyer, 1997; Bandura, Reese, & Adams, 1982, see Williams, for a review). Typically, these approaches involve exposure with the aid of a therapist, who may model approach behavior. A number of studies have suggested its efficacy for phobias (see Williams, 1996; Williams, Dooseman, & Keifield, 1984, for reviews). Research has shown that it is not necessary for the clinician to accompany clients, as it does not produce stronger results than self-exposure (see Craske, 1999, for a review). Although not yet definitive, the effects of spouse or another individual accompanying the client appears to have little benefit (Marks, 1987).
More recently other mediums for exposure therapy have emerged. Virtual reality is one modality that involves exposure to computer-generated fear stimuli. Unlike computer-aided exposure, virtual reality technology provides more a more realistic and interactive exposure experience, which may be comparable to in vivo exposure. Unlike in vivo exposure, this medium involves a safe and private environment for people to confront and interact with feared stimuli. It also offers greater control over presentation of fear stimuli, which can be repeatedly practiced, graduated, or prolonged. However, equipment expense and the limited number of clinical settings that offer VRET, make it less accessible to the general population (Marks, 1999). The efficacy of this treatment modality will be discussed further in a following section.

Computer-aided exposure involves interactive software (e.g., point and click method) involving 2-dimensional images on the computer screen. To date, treatment outcome research has been limited to the treatment of spider phobia (Dewis, Kirkby, Martin, Daniels, Gilroy, & Menzies, 2001; Gilroy, Kirkby, Daniels, Menzies, & Montgomery, 2000; Smith, Kirkby, Montgomery, & Daniels, 1997). Results to date suggest superiority of in vivo exposure over computer-aided exposure (Dewis et al., 2001; Smith et al., 1997), and it has been speculated that the computer images lack realism and are not perceived as a threat. This medium would offer the advantage of being more cost-effective than virtual reality systems (e.g., driving simulators), and would make treatment more accessible to clinicians and clients. No studies to date have examined the comparative efficacy between VRET and computer-aided exposure.

Another recent variant of exposure therapy, Eye Movement Desensitization and Reprocessing (EMDR) has been used to treat specific phobias, particularly for spider phobia (see De Jongh, Broeke, & Renssen, 1999, Shapiro, 1999, for reviews). A series of uncontrolled and controlled studies suggest that it is a potentially effective treatment for circumscribed specific phobias. Results from controlled spider phobia treatment have reported the superiority of in vivo exposure over EMDR, but EMDR was more effective than computer aided exposure (Muris & Merckelbach, 1997; Muris, Merckelbach, Holdrinet, & Sijsenaar, 1998). In this treatment, the
purpose of the treatment is to activate and reprocess traumatic memories. De Jong et al. (1999) has suggested that EMDR may be more effective for specific phobias with a trauma-related etiology. The mechanism of change of EMDR remains controversial. Although it has been suggested that the mechanism of change is different than for exposure therapy, EMDR involves an imaginal exposure component within its treatment protocol (De Jongh, et al., 1999), and it is likely that this element is a key active ingredient in the treatment. Similar to the potential advantages of VRET, this type of therapy could be used for situations, in which in vivo exposure would be difficult to implement or control. No published studies to date have appeared to use EMDR for driving phobia. Conclusions regarding efficacy must be interpreted cautiously given the number of methodological limitations that have been identified in several studies (e.g., lack of standardized treatment and assessment procedures).

Although exposure therapy has been shown to be an effective treatment for specific phobias, there is considerable variation in the degree of treatment response. It is common for people to still have residual phobic fears following exposure treatment. The return of fear symptoms after treatment, or the reemergence of fear that has previously subsided is another problematic issue (Rachman, 1979). As a result, recent research has shifted towards manipulating elements of exposure therapy, identifying the mechanisms of change, and promoting the maintenance of change to further enhance treatment outcome. A number of authors (Lang & Craske, 2000; Rowe & Craske, 1998) have shown that spaced treatment sessions (e.g., lengthening the time intervals between sessions) and exposure to a wide range of fear stimuli in different contexts facilitates greater generalizability of treatment gains and helps prevent the reemergence of fear. Spaced sessions may also be more acceptable to clients and have lower attrition rates (Barlow, 1988; Chambless, 1990).

**Cognitive interventions.** Over the last few decades, there has been growing recognition that cognitive processes may have a pivotal role in fear reduction treatment in anxiety disorders (Bandura, 1977; Barlow, 1988; Craske, 1999; Rachman, 1990; Salkovskis, 1995), which revolve
around expectations of external danger and cognitive biases (e.g., anticipatory anxiety, prediction of fear, overestimation of threat or harm, misinterpretation of information, see Craske, 1999, for a review). Often exposure or other behavioral interventions are included in cognitive treatments, and it is difficult to discern their relative treatment effects. It is not known whether behavior or cognitive change occurs first. Treatment studies using cognitive interventions alone with specific phobia are limited, and their efficacy awaits further research (see Craske, 1999, for a review). Identification of specific driving concerns and other cognitive processes (Kamphuis & Telch, 2000; Sloan & Telch, 2002; van den Hout et al., 1995, 1997) could be addressed in treatment, and in turn lead to more positive outcomes.

Mechanisms of Change.

The mechanisms of change across different phobia treatment modalities remain equivocal. Classical conditioning theory described the process of extinguishing fears and phobias with extinction and habituation. Extinction is a type of learning that was thought to occur when the CS (e.g., driving situation) is repeatedly presented without the occurrence UCS (e.g., car accident). Through this process, the CS eventually no longer predicts the occurrence of the USC, which in turn results in the extinction of the CR (e.g., the driving situation no longer elicits the conditioned fear response). Rate of extinction is influenced by strength of CR, length of exposure to the CS, and predictability of the CS occurring with the UCS.

In strict Pavlovian terms, habituation is an adaptive and innate process whereby the individual learns to ignore, or not respond, to the CS when it is repeatedly presented without the UCS. The process of habituation has been replicated in many exposure therapy outcome studies, either through subjective arousal (e.g., peak anxiety ratings) or physiological measures. The response pattern involves an initial increase in anxiety upon initial exposure to the fear stimuli, which is followed by a gradual decrease in anxiety upon repeated and prolonged exposure (e.g., within and between session habituation). Although habituation has been considered to be a primary causal agent in exposure therapy, it does not fully account for desynchrony of habituation.
across the different response systems (e.g., physiological, behavioral, subjective anxiety), spontaneous relapses or dishabituation (e.g., return of fear response to a novel stimulus), a reduction of fear that can occur without habituation, or the variation in treatment response across individuals (see Craske, 1999, for a review). Whether repeated pairings of fear inhibitory stimuli result in replacement of the CS or represent new CS associations also remains unknown.

Rachman (1980) suggested that the common underlying mechanism of change across the different fear reduction techniques (exposure therapy, modeling, and systematic desensitization) is emotional processing (Lange, 1979). Foa and Kozak's (1986) theory have elaborated the concept of emotional processing in exposure therapy. Emotional processing is thought to occur through exposure to the fear stimuli, which results in the activation of the fear structure (fear stimuli, fear responses, and meanings). Exposure treatment provides incompatible or corrective information (e.g., the UCS does not occur with the CS), which replace its pathological elements (Foa & McNally, 1996). The corrective experience of exposure therapy is also thought to modify evaluation errors (e.g., over-estimation of motor vehicle accident risk), and the consequences are associated with high negative valence (e.g., the consequences of making a mistake while driving are interpreted as aversive and catastrophic).

Several studies have attempted to facilitate the effects of exposure therapy by manipulating variables that are thought to enhance or inhibit emotional processing. Based on Foa and Kozak's (1986) theory, Kamphuis and Telch (2000) found that having participants deliberately focus their attention on fear stimuli and response elements of their core threats and test the accuracy of those threats facilitated emotional processing, which resulted in improved treatment outcomes (e.g., threat disconfirmation acts as corrective information to modify the fear structure). Conversely, Rachman (1980) indicated that distraction prevents emotional processing. Foa and Kozak (1986) suggested that distraction inhibits the activation of the fear structure by disrupting the matching process because of competing information, and prevents adequate processing of corrective information, which is needed for modification of the fear structure.
Several studies (Borkovec & Grayson, 1980; Craske, Street, & Barlow, 1989; Grayson, Foa, & Steketee, 1986; Kamphuis & Telch, 2000) have shown that distraction during exposure interferes with fear reduction.

Although not entirely consistent, there is some evidence to suggest that the level of arousal and rate of habituation during exposure therapy is a key variable in treatment outcome (e.g., Lang, 1977; Michelson, Mavissakalian, & Marchione, 1985; Mueser, et al., 1991). Foa and Kozak (1986) and Foa and McNally (1996) suggested that moderate arousal during initial exposure is essential for optimal emotional processing. Insufficient arousal may result in failure to activate the fear structure, whereas too high of arousal inhibits information processing capacities. For example, results from computer-aided exposure treatment for children with spider phobia have suggested that the fear-stimuli are not realistic enough to elicit sufficient arousal to activate emotional processing and may explain the superiority of in vivo exposure over computer-aided exposure (Smith et al., 1997).

Williams (1996) suggested that self-efficacy is the primary causal mechanism of change across fear reduction techniques. However, these claims seem to be based on correlational evidence between self-efficacy and actual behavior. Self-efficacy theory cannot reconcile the large body of evidence to support the role of non-conscious processes in phobias, desynchrony of the fear response systems, or the role of possible third variables. It is more likely that the mechanism of change across treatments are multi-component (Craske, 1999) and further research regarding other mediating processes is needed to enhance our understanding of why these therapies are effective.

**Efficacy of VRET for Phobias**

Efficacy studies into VRET for phobias is still in its infancy. A summary of outcome studies is provided in Appendix A. Most outcome studies have used uncontrolled case reports for a variety of phobias. A number of case reports have used VRET to treat a wide range of phobias including acrophobia (e.g., North & North, 1995), flying phobia (e.g., North, et al., 1997;
Rothbaum, et al., 1996; Klein, 1999), spider phobia (Carlin, et al., 1997), and claustrophobia (Botella et al., 1998). As these are uncontrolled, many internal and external validity threats cannot be ruled out and it is difficult to draw conclusions about the causal mechanisms of improvement or generalizability. The major limitations of these studies is the failure to control for internal validity threats including history, maturation, multiple treatment intervention effects, testing, instrumentation, and reactivity (Kazdin, 1982). Furthermore, without controlled replication, it is premature to draw conclusions regarding generalizibility.

Limited experimental treatment outcome studies have been conducted. Rothbaum et al. (1995) compared 12 college students with DSM-III-R acrophobia randomly assigned to VR treatment and eight to a wait list control group. From the pre-treatment assessment, there was a statistically significant decrease in all measures for the VR group and no statistically significant change for the control group. Two individuals withdrew from the VR group and one withdrew from the wait list group. In another sample of college students randomly assigned to an eight week treatment (n =30) or control group (n=30), North et al. (1996) used VR to treat DSM-IV agoraphobia. No participants dropped out of the study. Post-treatment assessment revealed that 80% if the participants showed improvement in symptoms on treatment outcome measures, whereas the control group did not improve.

A controlled treatment study on fear of flying (Rothbaum, Hodges, Smith, Lee, & Price, 2000) compared the effectiveness between VRET, standard in vivo exposure, and wait list comparison group. VRET was found to be equally effective as standard in vivo exposure and both treatments were more effective than the wait list group. Other experimental studies for treating flying phobia (Muhlberger, et al., 2001; Wiederhold et al., in press), acrophobia (Emmelkamp, et al., in press; Emmelkamp, et al., in press) have also found favorable results in treating phobias with VRET.

To date, the only published VRET treatment study for DSM-IV driving phobia appears to be an uncontrolled case report (Wald & Taylor, 2001), which was completed as a pilot study for
this dissertation research. Phobic-related symptoms decreased from the pre-treatment assessment, and gains were maintained at 1- and 3-month follow-up assessments. Although it appeared effective in treating her phobic symptoms, further controlled trials are needed.

To date, evidence from these treatment studies across a wide range of phobic disorders support the efficacy of VRET. Controlled clinical trials have only recently been completed, and these findings suggest possible comparability between VRET and in vivo, superiority of VRET over wait list comparison groups, and possibly superiority of VRET over relaxation. No VRET treatment outcome research to date has examined optimal variable of VRET, such as the spacing of sessions and number of sessions. Typically these treatment studies have either used one or two sessions a week and both seem to produce similar treatment effects. Although this could suggest the possible robustness of the treatment regardless of the actual timing of sessions, additional research is needed. The role of the therapeutic relationship and other non-specific factors in the process and outcome of VRET has yet to be examined. Further investigations of treatment efficacy and replication studies are needed to establish VRET as an empirically supported treatment for specific phobias.

**Summary and Conclusions**

Driving phobia as compared to other specific phobias has received considerably less attention in the research literature. Although descriptive information about the clinical characteristics of this type of phobia is emerging, further research efforts are needed to clarify etiological, measurement, and treatment issues. Driving fear and phobia appears to be relatively common and tends to be chronic and unremitting without treatment. Research suggests multiple acquisition pathways in the onset of driving phobia, yet the theoretical models of etiology in fear acquisition and maintenance are unable to fully account for the development of this phobia in some people. Exposure-based therapy is considered to be the treatment of choice for specific phobia. However treatment outcome studies for driving fear and phobia has been limited to uncontrolled case reports and case series. VRET is a recent treatment advancement and this
modality has been shown to be effective for treating a wide range of phobic disorders. A pilot study (Wald & Taylor, 2001) found VRET to be effective in treating an adult female with a long-standing driving phobia, and this finding provided initial support to continue with a larger treatment outcome study in this dissertation.
METHODOLOGY

For this study, I used a multiple baseline design across-subjects design with pre-, post-, and follow-up assessments to address the research question, is VRET effective for treating driving phobia?

Participants

Description of Target Population and Recruitment

A sample of voluntary treatment-seeking adults was recruited from the metropolitan region of Vancouver, British Columbia through community media advertisements, advertisements posted on the university campus, and bulletin boards in the community. Prospective participants contacted me by telephone for information about the study’s purpose and requirements. A telephone screen was arranged with individuals who expressed an interest in continuing. The interview consisted of questions to ensure individuals met admission criteria. A face-to-face diagnostic interview, conducted by myself, was subsequently arranged to ensure a primary DSM-IV diagnosis of specific phobia (driving). The informed consent form was signed at that time (see Appendix B for a copy). Interviews were audiotaped and reviewed by a supervisor (S. Taylor). Treatment referral information was offered to those not eligible to participate.

Inclusion criteria included: a primary DSM-IV diagnosis of specific phobia (driving); 18 years of age or older; possessed a valid driver’s license; owned or had access to a motor vehicle; and availability for treatment. Exclusion criteria consisted of: a primary disorder other than specific phobia; a history of medical conditions, specifically brain injury or other neurological disorder, visual disorders, or vestibular disorders; moderate to high simulator sickness susceptibility; receiving other psychological or psychiatric treatment; and taking medication with uncontrolled visual or vestibular side-effects.
Description of Sample

A minimum of seven individuals was recruited for treatment, in anticipation that some might withdraw their participation during the study. A total of ten individuals (nine females and one male) received the SCID admissions interview; seven (six females and one male) met criteria for specific phobia, situational type (driving), and one did not meet full criteria for this disorder. The remaining two individuals' primary disorders were panic disorder with agoraphobia and social phobia. Out of the seven individuals who met the criteria and agreed to participate, five completed the treatment and follow-up assessments. One individual withdrew after the pre-treatment assessment, and the other, after Treatment Session 1. Table 1 presents demographic and driving history information of the five participants who completed the study. No participant had received prior treatment for the driving phobia. A summary of the participants who completed the treatment is described below. Names and identifying information for all participants were changed to ensure confidentiality. Appendix C includes a summary of the two individuals who withdrew.

Research participant (P1). P1 was a 37 year-old married female with one child, employed as a nurse clinician. Onset of her driving fear began when she was learning to drive at age 16. Her fear lessened after she obtained her driver’s license, and she regularly drove without significant distress. At age 23, P1 was involved in a motor vehicle accident and subsequently developed marked driving fear and avoidance symptoms. P1 never drove after the car accident and the fear remained relatively constant since that time. For many years, P1 did not feel restricted or bothered by her fear, and for transportation, she walked, used public transit, or relied on others to drive. P1 began feeling inconvenienced by not driving after she had a baby at age 35. Over the next couple of years, P1 became more distressed by driving fear and avoidance, as it increasingly interfered with daily functioning (e.g., shopping, taking her child to medical appointments). With regards to other aspects of her driving history, she did not report any
Table 1
Demographic and Driving History Information of Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37</td>
<td>46</td>
<td>57</td>
<td>46</td>
<td>38</td>
</tr>
<tr>
<td>Ethnicity&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Marital Status&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Years of Education</td>
<td>26</td>
<td>12</td>
<td>13</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td><strong>Driving History</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety in car in childhood (0 -10)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Age: received first learner’s permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>16</td>
<td>21</td>
<td>22</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>received first driver’s permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: received first learner’s permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver’s license - Number of times obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: received first learner’s permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of driving tests failed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear of driving (0 -10)&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>first time driving a car</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>while learning to drive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criticism by others while learning to drive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning to drive (0 -10)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

(table 1 continued)
Table 1 (continued)

Demographic and Driving History Information of Sample (n = 5)

<table>
<thead>
<tr>
<th>Variable</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving History</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving skills after receiving license (0 – 10)</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>first noticed fear of driving</td>
<td>16</td>
<td>21</td>
<td>18</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>first started to avoid driving</td>
<td>23</td>
<td>21</td>
<td>22</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>first noticed interference</td>
<td>35</td>
<td>44</td>
<td>54</td>
<td>44</td>
<td>37</td>
</tr>
<tr>
<td>Number of motor vehicle accidents</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of models (family or friends)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>afraid to drive</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Note. Variables under Driving History are from the Driving History Interview (Ehlers, 1990).

*aEthnicity code: 1 = Caucasian, 2 = African American.

*bMarital Status code: 1 = married or common-law, 2 = single, 3 = divorced/separated.

*cChildhood driving anxiety, fear of driving for first time driving, and fear of driving for first time driving rated on a scale from 0 to 10 (0 = not at all afraid; 10 = extremely afraid).

*dCriticism by others while learning to drive rated on a scale from 0 to 10 (0 = not at all critical; 10 = extremely critical).
Driving skills after receiving license rated on a scale from 0 to 10 (0 = very bad; 10 = very good).
other traumatic driving-related events, except for involvement in a car accident at age 3, in which she sustained minor injuries. P1 recalled that her father was very critical of her driving skills as she was learning to drive. Her mother and mother-in-law were also fearful of driving, and avoided driving as much as possible. In summary, she believed that traumatic driving experiences, observing others who are afraid to drive, and being criticized for poor driving performance contributed to the onset of her driving fear.

Research participant (P2). P2 was a 46-year old, married female, who worked as a bank manager. She learned to drive and obtained her driver’s license at age 21. P2 recalled being quite afraid the first time she drove a car and the fear did not abate with additional practice. She began to avoid driving approximately three months after she received her driver’s license, and her fear and avoidance of driving remained fairly constant up to present time. For several years, the fear did not significantly restrict daily functioning; she lived in an area where services and public transit were easily accessible, and her husband did all of the driving. In the last few years, the fear gradually caused greater distress and interference, and she acknowledged embarrassment and frustration by not being able to drive.

P2 has no history of motor vehicle accident involvement. Shortly after getting her driver’s license, she was almost hit by a large truck when she changed lanes. In another incident at age 39, she was riding as passenger when the driver lost control of the vehicle after it hit black ice. Certain informational or instructional aspects about the potential dangers of driving (e.g., accidents in the news) would temporarily exacerbate the fear. Her mother and best friend reportedly also had a long history of driving fear and avoidance. She believed that traumatic experiences, not enough training, and observing others who are afraid to drive, were the main factors that contributed to the fear onset.

Research participant (P3). P3 was a 57 year-old, single female, who worked as a salesperson. She learned to drive at age 17, and passed the learner’s and first driver’s permit examination at age 22. She was extremely afraid the first time she drove a car, and the fear
diminished as she continued driving. She recalled that her mother and other family members were very critical of her driving skills. She became markedly fearful of driving subsequent to being involved in a motor vehicle accident as a passenger at age 18. After obtaining her driver’s license, P3 was involved in a second car accident as a passenger at age 22. In this accident, a drunk driver hit the car that she was riding in and she sustained a number of soft tissue injuries to her neck and back. Her driving fear and avoidance intensified after this event and she developed a fear of being in a car as a passenger. She did not need to drive for the next several years and her driver’s license eventually expired. After moving to Canada at age 30, P3 took several driving lessons and her driving fear abated. She obtained the provincial driver’s license on her second attempt. P3’s fear gradually returned as she tried driving on her own, and was exacerbated after she witnessed a motor vehicle accident, in which a person was killed outside her home.

For the next several years, her driving fear remained relatively constant, but would often be temporarily increased by hearing about the dangers of driving (e.g., news reports about car accidents, drinking and driving etc.). During this time, her fear of driving did not interfere with daily functioning, and did not cause significant distress. P3 adjusted her lifestyle without driving and relied on public transportation for mobility. Approximately three years ago, P3 obtained employment in a position that required her to visit different companies. Over time, her inability to drive interfered with work and she became increasingly distressed by the fear, yet remained too fearful to take driving lessons. P3 indicated that the three most important reasons that contributed to her driving fear were traumatic experiences, being a generally anxious person, and information about the dangers of driving.

Research participant (P4). P4 was 46-year old, married female, who worked as a college instructor. At age 25, P4 recalled feeling anxious as a passenger in certain driving situations (e.g., highway and congested traffic conditions), but she could not recall any specific events that contributed to this fear. She learned to drive at age 31 through a driving school, and recalled
feeling moderately afraid when she drove for the first time. The fear abated somewhat after P4 learned to drive but she remained concerned about her driving skills.

For the next few years, she did not have access to a vehicle and did not need to drive. At age 34, she moved and the transit commute to work became very inconvenient. P4 decided to purchase a car and was nearly involved in a car accident during a test drive. This event was extremely distressing and she completely avoided driving for the following year. In a subsequent attempt to buy a car, she became very anxious during the test drive and the salesperson had to drive back to the dealership. After these events, her driving fear increased and she experienced heightened fear as a passenger.

Out of necessity for work, P4 purchased a car a year later. Initially her anxiety was very intense, but with practice, her driving fear diminished slightly. At age 37, she met her future husband and she increasingly relied on him to drive. P4 continued to feel anxious as a passenger in certain driving situations. Over the next few years, P4's driving avoidance increased, and by age 41, she was rarely driving. She continued to regularly feel anxious as a passenger. At age 44, P4 started to feel more distress over the driving fear. Although the fear and avoidance only moderately interfered with daily functioning, she felt increasingly bothered by her dependency on other people to drive. P4 believed that information about the dangers of driving, not enough training, and heredity (genes) were the primary causes of her driving fear.

Research participant (P5). P5 was a 38-year old who owned her own business. She learned to drive and obtained her driver's permit at age 16. P5 was quite afraid of driving when she drove a car for the first time and did not diminish as she continued to practice driving. For the next few years, P5 had limited driving opportunities (e.g., she only drove during the summer months in a rural area, and lived in a different country for approximately four years). At age 22, she returned to live in a rural region in Canada and rarely drove during the following year. She remained fearful of driving during this time. P5 started to avoid driving after an incident, in which she was driving on a logging road and was nearly hit by a semi-truck that swerved into her lane.
She recalled other near accidents during occasional driving trips, which she attributed to her poor driving skills.

She later moved to a city and used public transportation and cycling for mobility, and the fear did not interfere with daily activities for many years. In the few years prior to the study, P5 had driven only a few times in rural areas. In the last year, she became more distressed and restricted by her inability to drive in the city. P5 indicated that the main causes of her driving fear were not enough training, observing others who are afraid to drive, and being a generally anxious person. She noted that her mother and step-mother were very afraid to drive and they avoided driving whenever possible.

Measures

Measures were grouped as screening, driving information, treatment outcome, and exploratory. A summary of the measures is provided in Table 2. Copies of instruments developed for this study (Driving Diary, Target Driving Fear List, Driving Anxiety Test, Research Participant Feedback Questionnaire, Adverse Events Checklist, and Self-Monitoring and Motivation Checklist) are provided in Appendix D.

Screening Measures

Structured Clinical Interview for DSM-IV. The Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996) is a widely used semi-structured diagnostic interview to establish current and lifetime diagnoses in study samples. Test-retest reliability studies of the SCID for the DSM-III-R have reported good inter-rater levels of agreement (Segal, Hersen, & Van Hasselt, 1994; Williams et al., 1992). In this study, the SCID (current and lifetime Axis I disorders) was administered to all potential research participants to confirm a primary disorder of specific phobia. Interviews were administered by myself and audiotaped for supervision purposes. For diagnostic accuracy, a clinical supervisor (S. Taylor) reviewed all interviews to confirm the primary diagnosis at admissions. Interviews were later blind rated by a trained and experienced research assistant and an inter-rater agreement was calculated for the
primary disorder at admissions (these results were not available at the time of writing the dissertation).

Motion History Questionnaire. The Motion History Questionnaire (Kennedy, Fowkles, Berbaum, & Lilienthal, 1992) includes 16 questions designed to assess risk for simulator sickness. It was administered in the face-to-face screening interview to identify individuals who would be at moderate to high risk for simulator sickness. Data from this questionnaire were not included in the dissertation results.

Simulator Sickness Questionnaire. The Simulator Sickness Questionnaire (Kennedy, Lane, Berbaum, & Lilienthal, 1993) was designed for quick screening of simulator sickness symptoms (See Kennedy et al. for descriptive statistics and percentiles of the norms). This instrument includes a pre- and post-exposure checklist was completed immediately before and after VR exposure in every session. It also includes six pre-exposure questions to assess current illness, alcohol and medication consumption during past 24 hours, and hours slept the previous night. These questions were administered at the beginning of each session. If contraindications (e.g., flu or head cold, sleep deprivation the previous night, use of certain medications) for VR exposure were identified, the therapist and participant jointly decided whether to reschedule the session. Results of this screening measure were not included in the dissertation.

Treatment Outcome Measures

Structured Clinical Interview for DSM-IV (Specific Phobia Section). As an outcome measure of clinical improvement, the specific phobia portion of the SCID was administered by telephone interview at post-treatment and follow-up assessments. To confirm the diagnostic status of specific phobia (driving) at these assessment points, audiotaped interviews were reviewed by a clinical supervisor (S. Taylor). The research assistant blind rated the interviews and inter-rater agreement on diagnosis was calculated (these results were not available at the time of writing the dissertation).
Table 2

Study Measures

<table>
<thead>
<tr>
<th>Screening Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured Clinical Interview for DSM-IV</td>
</tr>
<tr>
<td>Diagnostic interview to identify primary disorder at admissions</td>
</tr>
<tr>
<td>Motion History Questionnaire</td>
</tr>
<tr>
<td>Self-report measure of motion sickness susceptibility</td>
</tr>
<tr>
<td>Simulator Sickness Questionnaire</td>
</tr>
<tr>
<td>Self-report measures of simulator sickness risk and symptoms in treatment sessions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Descriptive Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving History Interview</td>
</tr>
<tr>
<td>Semi-structured interview for obtaining information about driving history, etiology, onset and course of driving fear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment Outcome Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured Clinical Interview for DSM-IV</td>
</tr>
<tr>
<td>Diagnostic interview to assess specific phobia diagnosis at post-, and follow-up assessments</td>
</tr>
<tr>
<td>Driving Diary</td>
</tr>
<tr>
<td>Self-monitoring form to examine driving frequency and two items (Main Target Phobia and Global Phobia) from the Fear Questionnaire</td>
</tr>
</tbody>
</table>

(table 2 continued)
Table 2 (continued)

**Study Measures**

---

**Target Driving Fear List**

Self-report form to assess severity and change of three target driving fears

**Driving Anxiety Test**

Behavioral driving test to assess peak anxiety and ability to complete a pre-established driving route

**Exploratory Measures**

**Driving Concerns Questionnaire**

Self-report questionnaire to examine severity of driving concerns

**Presence Questionnaire**

Self-report questionnaire to assess the experience within a virtual environment

**Client Satisfaction Measure**

Self-report questionnaire to determine general satisfaction with treatment

**Research Participant Feedback Questionnaire**

Open-ended questions for additional qualitative feedback on treatment study

**Adverse Events Checklist**

Open-ended checklist for determining the occurrence of adverse events outside the treatment study

**Self-Monitoring and Motivation Checklist**

Self-report measure of adherence with self-monitoring and motivation level

---

**Note.** Results from the Motion History Questionnaire and Simulator Sickness Questionnaire were not included in the dissertation.
Driving Diary. The Driving Diary form consisted of three treatment outcome measures: The Main Target Phobia and Global Phobia items from the Fear Questionnaire (Marks & Mathews, 1979), and driving frequency. The Main Target Phobia and Global Phobia measures were taken from the Fear Questionnaire (Marks & Matthews, 1979), which was developed to evaluate a range of phobias, including the phobia an individual wants treatment for.

For the Main Target Phobia (the phobia the individual wants treated), participants rated their degree of driving avoidance because of fear or unpleasant feelings (0 = “would not avoid it”; 8 = “always avoid it”). For the General Phobia item, participants rated the present state of driving phobia symptoms (0 = no phobia present; 8 = very severely disturbing/disabling). The rationale for using these items from the Fear Questionnaire, is its sensitivity to detecting clinical improvement, strong psychometric properties, brevity, and meaningful comparisons across studies. The FQ has very high test-retest reliability; 0.93 for Main Target Phobia and 0.79 for General Phobia.

Participants were also asked to record their driving exposure on the Driving Diary form. When driving trips were made, they would indicate the date, driving time (minutes), time of day, whether they drove alone or accompanied, description of driving route and conditions, and peak anxiety while driving (0 = no anxiety; 100 = extreme anxiety). Driving frequency (minutes) was used as the outcome measure. The Driving Diary was recorded daily during the baseline and treatment phases. Each week during treatment, they returned their completed forms in a sealed envelope addressed to my research supervisor (B. Haverkamp). As part of the post-treatment assessment, participants recorded the diary for a 1-week probe (seven days) after the last treatment session. Participants recorded the diary for 1-week probes at the 1- and 3-month follow-up assessments.

Target Driving Fear List. The use of target symptoms, or complaints, were originally used by Battle, et al. (1966) and are sensitive to treatment effects. On a form developed for this
study, participants listed three of their most severe fears associated with driving, and rated the severity of each fear on a five-point scale from absent to severe (1 = absent, 2 = trivial, 3 = mild, 4 = moderate, 5 = severe). The instrument was administered at the pre-treatment assessment, and severity ratings of the target fears were obtained at the post-treatment and follow-up assessments. An outcome score was calculated based on the total score of all three fears (maximum score = 15).

**Driving Anxiety Test.** Participants were asked to complete a Driving Anxiety Test, a type of behavioral avoidance test (Lang & Lazovik 1963), which have been widely used in anxiety research and are sensitive in detecting treatment effects (Haynes & Wilson, 1979; Taylor & Agras, 1981).

In this study, participants were asked to drive a pre-determined route on their own. The instructions included choosing a route that participants would rate as fairly anxiety provoking (e.g., between 60 and 70 on an anxiety scale from 0 to 100). They were encouraged to choose a route that they would likely be able to complete and one that could be repeated under similar conditions. Participants were told that they could remove themselves from the situation at anytime or could refuse to do it.

Results were recorded on a form developed for this study to obtain pre-test information of the route description, estimated distance and completion time, and estimated peak anxiety (0 = no anxiety; 100 = extreme anxiety). After attempting the test, participants completed post-test section on the form, which included the date, time of day, description of weather and driving conditions, driving time (minutes), whether they drove alone or accompanied, peak anxiety rating (0 = no anxiety; 100 = extreme anxiety), and success (0 = unable to complete test route or partially completed test route; 1 = completed test route). If incomplete, participants estimated percent of distance completed. Peak anxiety and success were used as the outcome variables. The Driving Anxiety Test was completed at four time points: after the pre-treatment assessment; after the last treatment session (post-treatment); the 1-month; and 3-month follow-up assessments.
Exploratory Measures

Several measures were also included in this study to provide other information on variables that may have contributed to treatment outcome.

Driving Concerns Questionnaire. The Driving Concerns Questionnaire (Ehlers, 1990) is a 13 item self-report instrument that measures concerns (e.g., accident, loss of control over car, no control over other people’s driving) that may occur while driving. Participants were asked to rate the severity of each concern on a ten-point scale (0 = not at all concerned; 10 = extremely concerned). In a factor analysis, Ehlers et al. (1994) identified five factors among these concerns (anxiety symptoms while driving, danger in driving situations, unpleasant driving situations, being criticized, and losing control). No psychometric data is available for this measure, but it was included to examine potential patterns of driving concerns that may have influenced treatment outcome. Raw scores are summed to give a total score (maximum score = 130), with higher scores representing greater severity of driving concerns.

Presence Questionnaire. The Presence Questionnaire (PQ: Version 3.0, Singer & Witmer, 1996; Witmer & Singer, 1998) is a self-report measure designed to assess the extent of subjective involvement in a virtual environment. It contains 19 items using a seven-point semantic differential scale (e.g., How much did the visual aspects of the environment involve you? 0 = not at all, 7 = completely). Only limited psychometric data is available; Chronbach’s alpha of 0.88 has been reported as its internal consistency (Witmer & Singer, 1998). The PQ was administered at the pre- and post-treatment assessments, and items were summed to give a total raw score of 133, with higher scores representing more positive experiences with the virtual environment.

Client Satisfaction Measure. The Client Satisfaction Measure, originally developed by Larsen, Attkinson, Hargreaves, and Nguyen (1979) was included as a general measure of client satisfaction of mental health treatment for a wide range of populations. It contains eight items rated on a four-point scale (i.e., “How would you rate the quality of service you have received?” 1 = poor; 4 = excellent). Internal consistency alpha coefficients range from .86 to .94. Psychometric
and normative data are provided by the author and other investigators (Attkisson & Zwick, 1982; Larsen et al., 1979; see Attkisson & Greenfield, 1999, for a review) and is correlated with client and therapist ratings of improvement, and treatment attrition. Raw scores are summed to give a total score (maximum raw score = 32), with higher scores suggesting greater treatment satisfaction. This measure was administered at the post-treatment assessment.

**Research Participant Feedback Questionnaire.** This questionnaire was designed to gather additional qualitative data to further evaluate the treatment. It included three open-ended questions: What were the most helpful aspects of the treatment you received? What were some aspects of the treatment, which you believe could be improved? What were some aspects of the treatment, which you believe contributed to the change (or lack of change) in your driving fear symptoms? It was administered at the post-treatment assessment.

**Adverse Events Checklist.** This form was developed for this study to examine the occurrence of adverse events that occurred outside of the treatment study. This form was administered at the end of the baseline phase, at each treatment session, and at both follow-up assessments. It consisted of a list of driving-related (e.g., witnessed a car accident, heard about a car accident in the news) and non-driving related events (e.g., work stress, relationship difficulties), and participants were asked to check those events that occurred and write a brief description of the event.

**Self-Monitoring and Motivation Checklist.** During the treatment phase (at weeks 2, 4, 6, and 8), an additional checklist was included with the Driving Diary forms. This checklist asked participants to rate how often they forgot or neglected to record their Driving Diary forms on a five-point scale (0% = I never forgot or neglected to complete the forms; 25% = I forgot or neglected to complete the forms about 25% of the time, 50% = I forgot or neglected to complete the forms about 50% of the time, 75% = I forgot or neglected to complete the forms about 75% of the time, or 100% = I always forgot or neglected to complete the forms). Another question asked participants to rate their motivation as a research participant in this treatment study on a 5-point
scale with higher numbers representing greater levels of motivation (1 = very unmotivated to 5 = very motivated). Participants were instructed to return the checklist in a sealed envelope addressed to my research supervisor (B. Haverkamp).

Apparatus

**VR Driving Simulator: The driVRII™**

The driVRII™ was designed and developed by Imago Systems Inc. based in Vancouver, British Columbia, Canada (Imago Systems Inc., 1996). Driver controls include a low-cost PC based computer (166 MHz Pentium chip and 32 MB RAM) with 3D graphics accelerator driving controls, steering wheel mount, as well as gas and brake pedals. For visual display, the head tracker (Virtual I/O I-glasses) provide a 360-degree horizontal field of view. A sound blaster sends audio input (e.g., traffic noise) to the head tracker earphones.

**Virtual Driving Scenarios**

The driVRII™ software includes several driving scenarios (e.g., residential, urban, highway routes) that can be modified to simulate a range of different situations with various driving and weather conditions (e.g., fog, nighttime, rain, snow). For the purposes of this study, the goal was to include a wide variety of different situations for the VRET. A total of 18 driving situations were chosen (see list shown in Table 3). Two different driVRII™ scenarios were used to simulate each driving situation, resulting in a total of 36 different VR driving scenarios available for practice during treatment.

Six scenarios were used and modified as needed to accommodate the different driving and weather conditions. Each scenario takes approximately three to five minutes to complete, depending on the driver’s speed. The six standard driving scenarios are described below.

**Rural Residential Scenario.** The participant drives through rural residential area with minimal traffic. The route consists of a two-lane road with curved and straight sections, houses on both sides of the road, a two-way stop sign, and traffic light intersection.
Residential Scenario. The participant drives through a residential area with light traffic in both directions. The features include a two-lane road with straight and curved sections, a stop sign, a traffic light intersection, and yellow signs to direct the driver to turn left or right at intersections. Other components of the route include driving through a school zone, driving behind a bus, having a car pull onto the road in front of the driver, and passing by several houses.

Highway with Bridge Scenario. The participant drives on a two-lane highway in a rural area with light traffic in both directions. The route includes several stop signs, straight and curved sections, and a bridge.

Highway Merging Scenario. This route consists of a two-lane highway in a rural area with straight and curved that eventually merges onto a four-lane highway with heavy traffic volume. Other features include driving through a traffic light intersection, passing by a road construction barricade, and yellow signs to direct the driver to turn left or right at intersections.

Urban Intersections Scenario. In this scenario, the participant drives on a two-lane road through an urban area with light traffic in both directions. Other features include several traffic lights, stop sign intersections, and high-rise office buildings on both sides of the road.

Urban Industrial Scenario. The route starts as a two-lane road in an urban area with light traffic. A yellow sign directs the driver to turn onto a four-lane road that goes through an industrial area (e.g., warehouses on both sides of the road). Additional features include a stop-sign, a right hand turn onto four-lane road; red pylons that direct the driver to change lanes; a semi-truck pulls in front of the driver, and a person walks onto the road in front of the driver.

Design

A single case experiment using a multiple baseline across-individuals design with pre-treatment, post-treatment, and follow-up assessment points was used. Sequence of the design included a pre-treatment assessment, a baseline phase, an 8 weekly session intervention phase; a post-treatment assessment; and 1- and 3-month follow-up assessments.
<table>
<thead>
<tr>
<th>Driving Situation (n = 18)</th>
<th>Virtual Reality Driving Scenario (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime Residential Driving</td>
<td>Scenario 1: Day Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Day Residential</td>
</tr>
<tr>
<td>Night Residential Driving</td>
<td>Scenario 1: Night Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Night Residential</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>Scenario 1: Day Rain Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Day Rain Residential</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>Scenario 1: Night Rain Fog Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Night Rain Fog Residential</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>Scenario 1: Day Snow Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Day Snow Residential</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>Scenario 1: Night Snow Ice Rural Residential</td>
</tr>
<tr>
<td></td>
<td>Scenario 2: Night Snow Ice Residential</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>Scenario 3: Day Highway with Bridge</td>
</tr>
<tr>
<td></td>
<td>Scenario 4: Day Highway Merging</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>Scenario 3: Night Highway with Bridge</td>
</tr>
<tr>
<td></td>
<td>Scenario 4: Night Highway Merging</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>Scenario 3: Day Rain Highway with Bridge</td>
</tr>
<tr>
<td></td>
<td>Scenario 4: Day Rain Highway Merging</td>
</tr>
</tbody>
</table>

(table 3 continued)
Table 3 (continued)

Driving Situations and Virtual Reality Driving Scenarios

<table>
<thead>
<tr>
<th>Driving Situation (n = 18)</th>
<th>Virtual Reality Driving Scenario (n = 36)</th>
</tr>
</thead>
</table>
| Night highway driving with rain and fog | Scenario 3: Night Rain Fog Highway with Bridge  
Scenario 4: Night Highway Merging |
| Day highway driving with snow | Scenario 3: Day Snow Highway with Bridge  
Scenario 4: Day Snow Highway Merging |
| Night highway driving with snow and ice | Scenario 3: Night Snow Ice Highway with Bridge  
Scenario 4: Night Snow Ice Highway Merging |
| Daytime urban driving | Scenario 5: Day Urban Intersections  
Scenario 6: Day Urban Industrial |
| Night urban driving | Scenario 5: Night Urban Intersections  
Scenario 6: Night Urban Industrial |
| Day urban driving with rain | Scenario 5: Day Rain Urban Intersections  
Scenario 6: Day Urban Industrial |
| Night urban driving with rain and fog | Scenario 5: Night Rain Fog Urban Intersections  
Scenario 6: Night Rain Fog Urban Industrial |
| Day urban driving with snow | Scenario 5: Day Snow Urban Intersections  
Scenario 6: Day Snow Urban Industrial |
| Night urban driving with snow and ice | Scenario 5: Night Snow Ice Urban Intersections  
Scenario 6: Night Snow Ice Urban Industrial |
Overview of Design and Rationale

Single case experimental designs are well suited for the initial validation of experimental treatment modalities such as VRET. Given that very little is known about the treatment of driving phobia, or the efficacy of VRET for this phobia, it would be premature to conduct a costly and time consuming group design study at this time. There should be sufficient initial support for the efficacy of VRET for driving before research questions about comparative treatment efficacy, optimal levels and elements of VRET, and change mechanisms are addressed with larger sample sizes (Hayes, 1981).

The multiple baseline across-individuals design typically involves demonstrating the effects of a treatment on two or more participants. Before the intervention is administered, participants record data on the target problem (or symptom), for a period of time, which is known as the baseline phase. Cause-effect relationships can be inferred between treatment (independent variable) and outcome (dependent variable) when the target problem improves only after the intervention is administered. When this effect is replicated across individuals, causal inferences become more reliable and generalizable. The multiple baseline design across-individuals is a type of controlled case series that can provide evidence of treatment efficacy, allows the intervention to be improved, increases reliability of results, and allows generalizability on a case-by-case basis (Barlow & Hersen, 1984; Hersen & Barlow, 1976; Hilliard, 1993; Kazdin, 1982, 1999). Barlow et al. (1984) defined clinical replication as,

“a process wherein practitioners accumulate a series of cases in a particular problem area, treated with a specific intervention, while observing individual successes and failures, and analyzing, where possible, the reasons for this individual variation” (p. 39).

A multiple baseline design across-individuals, unlike uncontrolled single case designs, can reduce potential internal validity threats (Kazdin, 1982, 1999). Increased control over these threats permits stronger causal inferences regarding treatment effects, and is summarized below.
History. This potential threat occurs when events outside treatment study influence or confound the treatment effects. A multiple baseline design across individuals design reduces the effects of history through the recruitment of one or more participants, as it would be unlikely that the same external events would occur for all individuals in the study.

Maturation. This problem occurs with physical or psychological changes within a research participant, which could obfuscate true treatment effects. Recruitment of more than one research participant with this type of design can minimize this threat because these types of events are unlikely to occur in all individuals at the same time point.

Testing. This effect can arise when the measures (e.g., self-monitoring) used in a study causes the target symptom being treated to change. The multiple baseline design utilizes a repeated assessment approach during the baseline phase to determine whether target symptoms are reactive to the measure, prior to implementing the treatment. The risk of this threat is minimized if the symptoms do not change or become stable during the baseline phase.

Instrumentation. This potential threat arises when the instruments or recording systems are unreliable or change over time (e.g., observer drift). The multiple baseline design cannot itself reduce this threat, but additional integrity checks can be built into the design to reduce this problem (e.g., using a standardized treatment protocol).

Statistical regression. This statistical effect occurs when extreme scores regress toward the mean when measurements are repeated a second time. Typically in a multiple baseline design, a large number of data points are assessed using repeated measures, so that extreme scores will have less of an impact on the data.

Selection biases. This problem arises when characteristics of the sample and selection processes confound the treatment results. Multiple baseline across individuals designs typically recruit a homogenous sample who are similar on demographic and other descriptive variables (e.g., diagnosis) to minimize subject characteristics that could differentially influence treatment outcome.
Attrition. This problem occurs when individuals who withdraw from a treatment study change the sample's characteristics, and in turn, affect treatment outcome. The design itself cannot control for this potential threat, but a range of strategies can be incorporated to minimize attrition and examine its effect (e.g., anticipate attrition rate and recruit additional participants) across individuals).

Multiple Intervention. This threat occurs when more than one treatment is used, and it becomes difficult to separate their respective influence on treatment outcome. With a multiple baseline design, one treatment is implemented following a baseline (no-treatment) phase. If more than treatment is used, specific techniques can be used to distinguish their unique contribution to outcome (e.g., cross over design).

Instability of Data. Unstable or natural variations in data points that occur because of repeated measurements (e.g., serial dependency) can be mistakenly interpreted as treatment effects. This problem cannot be ruled out by use of a multiple baseline design, but can be addressed through specific statistical procedures (e.g., time series analysis).

Reactive Interventions. This problem arises when a treatment produces a sudden change in the target symptoms after treatment begins is associated with some aspect of the intervention (e.g., novelty, time of onset) rather than to the treatment itself. This design addresses this problem by administering the treatment to more than one individual at specific time points, and closely monitoring target symptoms over time.

Baseline Phase Schedules

In the multiple baseline design across individuals, participants usually begin recording baseline data at the same time point, which is also referred to a concurrent design schedule. In this design, treatment is administered in a time-lagged manner, so as the first person begins treatment, the other participants continue recording baseline data. After a pre-determined point, or when stability of the target problem is achieved, the next person begins treatment and others
remain in the baseline condition. Each successive participant is subjected to longer baseline conditions until all participants receive the treatment.

However, in clinical settings, this schedule can be problematic. Participants may drop out of treatment if treatment is withheld for a long period of time, and lengthy baselines raise ethical concerns over withholding treatment. Practical constraints (e.g., scheduling appointments) may also arise. An equally valid and flexible alternative is the non-concurrent design schedule, which was used in this study. With this schedule, individuals begin their baseline phase sequentially at different time points (Watson & Workman, 1981). Participants are randomly assigned to different predetermined baseline lengths (e.g., 9, 12, or 15 days), and begin the baseline based upon availability for treatment (Botella et al., 2000; Watson & Workman, 1981). Regardless of the baseline schedule (concurrent or nonconcurrent), it should include sufficient repeated assessments (data points) to allow for a stable pattern of the target problem to emerge. If the baseline data is unstable or insufficient before an intervention is administered, it is difficult to separate treatment effects from other sources of variation in the data (e.g., measurement effects).

Data Analysis

Visual analysis complemented with statistical analysis (Barlow & Hersen, 1984; Hersen & Barlow, 1976; Kazdin, 1982, 1999; Krishef, 1991; Richards et al., 1999) were used to draw conclusions regarding the efficacy of VRET to treat driving phobia for the five research participants.

Visual analysis is commonly used in single case research to measure patterns, stability, trends, and levels of individual performance over time (Barlow et al., 1984). Visual analysis provides information about treatment efficacy when similar changes obtained across or within individuals (e.g., baseline-treatment phase comparisons). The main problems (Busk & Marascuilo, 1992; Kazdin, 1982; Krishef, 1982; Parsonson & Baer, 1992; Richards et al., 1999) associated with relying solely on this procedure are its subjectivity, lack of standardized rules of improvement, unreliability, and failing to separate treatment effects from serial
dependency (systematic patterns in the data over time). Even standardized methods of visual analysis (e.g., regression line, split middle, and celeration line, see Barlow et al., 1984; Barlow & Hersen, 1984; Hersen & Barlow, 1976, Franklin, Gorman, Beasley, & Allison, 1996; Kazdin, 1982; Krishef, 1991; Richards et al., 1999) often have specific requirements and limitations (e.g., are unable to detect or take serial dependency into account).

For the purposes of this study, visual inspection was based on converting the raw data into figures (e.g., histograms, line graphs) and subjectively examining the results. As a secondary form of visual analysis, raw scores were converted into ipsative z-scores (see statistical analysis section below) and plotted as line graphs. Cut-off scores for the z-scores, although not empirically based, were established to provide a conservative standardized index of outcome from pre-to post-treatment assessment points for each outcome measure. These indices were based on standard deviation cut-off scores for the each outcome measure. First, the absolute difference in ipsative z-score for each measure between pre- and post-treatment assessment points was calculated. If this change score was less than +/- 1 standard deviation units (SD), it was considered as “not improved.” If the change score was equal to or greater than +/- 1 SD, it was classified as “marginally improved” Change scores that were equal to or greater than +/- 2 SD were described as “clearly improved.”

**Statistical analysis.** There are several statistical techniques available for single case experimental research, but have been infrequently utilized in small-n psychotherapy treatment outcome research. Since these methods have not been widely used, there are several controversies and problems associated with their use. Due to repeated assessment points over time, data from single case research are often serially dependent, or autocorrelated (Matyas & Greenwood, 1996). Autocorrelations are the correlations between successive data points (Kratochwill, 1992). When successive data points are serially dependent on each other, this can result in systematic statistical variations (e.g., linear trends) that can be mistaken for treatment effects. Lag-one autocorrelations, ACF(1), should be sufficient to establish whether data is serially dependent.
(Krishef, 1991), but there is no consensus on the number of data points needed to accurately
determine an autocorrelation.

Serially dependent data precludes the use of parametric statistics, as the nature of this
type of data will typically violate the statistical assumption of error independence and normality
of the distribution (Matyas & Greenwood, 1996). In rare cases when the data from single case
research is not serially dependent, parametric group statistics (e.g., t-tests, ANOVAs) could be
used provided the data meets the other test statistic assumptions (Kazdin, 1982). However, this
would be highly unlikely because single case designs do not typically meet the assumptions of
random sampling and random assignment (Krishef, 1991). Non-parametric tests (e.g., Mann-
Whitney U Test, Fisher's Exact Test, randomization tests) could be also considered, but they have
less power than parametric tests and many still require the assumptions of random sampling and
random assignment.

Time series analyses are one of the most frequently used techniques used in single case
research, as they take serial dependency into account and have less restrictive assumptions than
parametric tests. These types of analyses provide statistical data on the changes in level and
direction of data points between phases (e.g., between baseline and treatment phase). However,
many time series analysis procedures require a large number of data points per phase (e.g., Box
Jenkins method requires 100 data points per phase). The C-statistic, or simplified time series
analysis (Krishef, 1991, Suen & Ary, 1989; Tripoldi, 1994; Tyron, 1982), requires a minimum of
8 data points (in each phase) to detects trend changes, or treatment effects, from one phase (e.g.,
baseline) to another (e.g., treatment). It can used to determine the stability of data points in the
baseline phase, as well as whether treatment effects have stabilized (e.g., at follow-up
assessments). If less than 8 data points are available, the C-statistic may be unable to detect
statistically significant trends.

Ipsative z-scores is another option for assessing statistical change in single case research.
(Mueser, Yarnold, & Foa, 1991; Nishith, Hearst, Mueser, & Foa, 1995; Yarnold, 1988). It allows
for comparisons across all outcome measures used in a study, even where there are few
assessment (data) points. If population or sample reliability coefficient of a measure is not
available, then the lag-one autocorrelation, or ACF(1) score, can be used (Mueser et al., 1991). It
reduces Type I error by taking into account serial dependency by using a lag-one autocorrelation
and the number of comparisons (J). In this analysis, raw data is converted into ipsative z-scores,
then the absolute differences among the z-score comparisons (e.g., pre- to post-treatment scores)
are required to exceed a Critical Difference (CD) value. The CD value for a directional
hypothesis (one-tailed, α = 0.05), is calculated by the formula, \( CD = 1.64(J[1-ACF(1)])^{1/2} \)
(Yarnold, 1988). When differences in unique ipsative z-score pairs exceed a critical threshold,
they are considered statistically significant, and the change score is considered to statistically
reliable.

For example, PI completed the Driving Anxiety Test four times (n = 4, number of test
points). Her raw peak anxiety (PA) scores were 85 (pre-treatment), 10 (post-treatment), 10 (1-
month follow-up), and 15 (3-month follow-up). The mean (\( M_{PA} = 18.38 \)) and standard deviation
\( SD_{PA} = 36.74 \) of the four test points are used to convert the individual peak anxiety raw scores
into ipsative z-scores (\( z_{PAj} = \text{raw}_{PAj} - M_{PA} / SD_{PA} \)). The respective sequence of ipsative z-scores
for the four assessment points are \( z_{PA1} = 1.81, z_{PA2} = -0.23, z_{PA3} = -0.23, \) and \( z_{PA4} = -0.09 \). All
unique pairs of z-scores (\( J[J-1]/2, J = 2 \)) are compared to the CD score (for pre- and post-
treatment comparison). To determine whether there is a statistically significant difference
between the scores obtained at the two assessment points, a critical difference (CD) score is
calculated. First, the ACF (1) is calculated using Bartlett's r approximation, which was found to
be -0.10, which is then applied to the formula \( CD = 1.64 (2[1-(0.10)])^{1/2} = 2.43 \). The number of
unique comparisons of the ipsative z-scores at pre- and post-treatment is one. Therefore, the
absolute difference between this pair of scores must at least be 2.43 ipsative z-units in absolute
magnitude. The absolute difference between the pre-treatment z-score (\( z_{PA1} = 1.81 \)) and post-
treatment score ($z_{PA2} = -0.23$) equals 2.04, which does not meet the CD criterion (2.43) for statistical significance.

Other statistical approaches have attempted to integrate the need for addressing clinical and statistical significance in drawing conclusions regarding treatment efficacy. However, these approaches (e.g., Jacobson & Truax, 1991; Jacobson, Follette, & Revenstorf, 1984; Jacobson, Wilson, & Tupper, 1988) require normative data and test-rest reliability coefficients of the outcome measures, which are used to establish cut-off scores for statistical significance. When this information is not available, other criteria can be established to determine the extent of change, but they tend to be arbitrary, unreliable, and not empirically based.

After considering the requirements and limitations of each statistical option, it was determined that the use of ipsative z-scores and simplified time series (C-statistic) would be most appropriate for analyzing score changes between pre- and post-treatment assessment points. The primary reasons for choosing the ipsative z-score approach was that many of the measures used in this study had a limited number of scores or data points, which would preclude use of most time series analysis methods. Parametric requirements (e.g., random sampling, random assignment to treatment, normality, and error independence) prevented use of these statistics. Although non-parametric tests have less restrictive assumptions, many of these tests require assumptions that could not be met (e.g., random assignment to treatment). It was not possible to use methods to assess clinically significant changes (e.g. Jacobson et al., 1988) given that normative data and test-retest coefficients were not available for the majority of the outcome measures.

As a secondary analysis, the C-statistic was also used to determine whether consistent results would be obtained with divergent statistical methods. The C-statistic was used to determine statistically significant trends ($\alpha > .05$) for Driving Diary outcome measures (Driving Frequency, Main Target Phobia, and Global Phobia) between pre- and post-treatment assessments. The C-statistic could not be used on other measures because of insufficient data points. The C-statistic was also used to statistically examine the stability of Driving Diary data
during the baseline phase. Results from the visual analysis will also be compared to findings obtained through the statistical methods.

Procedures

Setting

VR treatment and pre-and post-treatment assessments took place at Community Therapists Inc., a private practice of occupational therapists in Vancouver. Diagnostic interviews were completed at Community Therapists or the University of British Columbia, depending on which location was most convenient for potential participants.

Therapist

The therapist was myself, a 3rd year doctoral student in counselling psychology, who had received training on exposure therapy prior to the study. Clinical training and supervision was provided by S. Taylor, a Ph.D. level and licensed clinical psychologist. Treatment sessions were audio-taped and randomly reviewed by the supervisor. A trained research assistant listened to the randomly chosen audiotaped treatment sessions for each participant and rated adherence to the treatment protocol (Waltz et al., 1993).

Pre-Treatment Assessment

The pre-treatment assessment was scheduled after the clinical supervisor confirmed the primary disorder. This assessment took approximately two to three hours. The therapist reviewed the purpose and procedures of the study, as well as the rationale for VRET (see Emmelkamp, 1982, Foa & Kozak, 1986; Foa & McNally, 1996; Lindemann, 1996). Information about simulator sickness was reviewed and participants then received an orientation to the driVRII™ system.

Participants proceeded to attempt the six VR driving scenarios, which were described in the above section. Peak anxiety ratings (0 = no anxiety; 100 = extreme anxiety) and success (0 = incomplete or partially complete; 1 = complete) were recorded by the therapist. Following this, participants completed the Hierarchy of Virtual Driving Scenarios (see Appendix F). They were
asked to rate the degree of anxiety (anxiety scale 0-100: 0 = no anxiety; 100 = extreme anxiety) that they would expect to experience for the 18 different driving situations in a virtual environment. Next, they were asked to rank order the situations from least to most difficult based on their anxiety ratings.

Pre-assessment questionnaires Target Driving Fear List, Driving Anxiety Test, and Presence Questionnaire) were reviewed. Participants were given instructions regarding the baseline phase (e.g., length, purpose) and were given a set of Driving Diary forms to record on a daily basis. A portion of the Driving History Interview was administered, and Treatment Session 1 was scheduled based on the pre-determined assigned baseline length for each individual. Participants were asked to return the questionnaires and Driving Diary forms at the initial treatment session.

Appendix E provides copies of the Research Participant Treatment Manual (provided to all participants) and the Therapist Treatment Manual, which contains the pre-treatment assessment instructions and record forms.

Baseline Phase

Before the pre-treatment assessment, as shown in Table 4, participants were randomly assigned to three different baseline lengths: 9, 12, or 15 days (P1 = 9 days, P2 = 12 days, P3 = 9 days, P4 = 15 days, P5 = 12 days). Given the long-term nature of driving phobia symptoms (anxiety and avoidance), it was expected that baseline data would be fairly consistent and extended baseline periods beyond 15 days would not be necessary to establish stability of these symptoms. In consideration of the practical time constraints on this project, participants began their treatment based on their availability. The therapist randomly telephoned each participant to verify adherence with self-monitoring during the baseline phase. For various reasons (e.g., scheduling constraints, cancelled appointments, vacations), none of the participants were able to exactly adhere to their pre-designated baseline length. The actual baseline lengths for P1 to P5 were respectively 9, 7, 6, 16, and 8 days.
Treatment Phase

The treatment phase consisted of eight weekly treatment sessions 40 to 60 minutes in length), and participants were encouraged to attend sessions as close to a week apart as possible. However, due to similar problems that were encountered in the baseline phase, only P2 and P4 were able to consistently attend one treatment session each week. In many cases, participants had to attend two sessions a week at times, in order to complete the eight sessions before the study ended. Table 4 provides a summary of the treatment phase schedule.

A standardized treatment protocol was used (see Appendix E for a copy). Strict decision points for deviating from the standard protocol were followed (Eifert et al., 1997) as described in the therapist treatment manual. A modified protocol was used only for P2 in the initial sessions because of simulator sickness symptoms that she experienced during the pre-treatment assessment. By the third session, the symptoms had abated, and the standard protocol was resumed.

The protocol used in this study involved participants gradually progressing through the various scenarios, based on their ratings on the Hierarchy of Virtual Driving Scenarios completed at the pre-treatment assessment. In Treatment Session 1, participants began their VR exposure with the virtual driving scenario that they had rated as the least anxiety-provoking on the hierarchy. At the end of the scenario, participants verbally reported their peak anxiety (Anxiety Scale 0 to 100: 0 = no anxiety; 100 = extreme anxiety). They would repeat the scenario over a series of trials until their peak anxiety dropped to 10 or less. Once this rating was obtained, they would then be introduced to the next scenario on the hierarchy (e.g., the scenario rated as the next least anxiety provoking). At each subsequent session, participants would start the exposure with the last two scenarios that were practiced in the previous session. They would repeat these scenarios until their reported peak anxiety dropped to 10 or less. Once this was achieved, participants would proceed to the next scenario. For the remainder of treatment, participants continued to move through the different scenarios at their own pace. Progression to a new
Table 4

Treatment Phase Schedule: Number of Days Between Treatment Sessions Across Research Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Treatment Session</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1&amp;2</td>
</tr>
<tr>
<td>P1</td>
<td>6</td>
</tr>
<tr>
<td>P2</td>
<td>7</td>
</tr>
<tr>
<td>P3</td>
<td>5</td>
</tr>
<tr>
<td>P4</td>
<td>7</td>
</tr>
<tr>
<td>P5</td>
<td>9</td>
</tr>
</tbody>
</table>

Note. P1 did not attend Treatment Session 8.
scenario was ultimately under their control and they could stop the exposure at any time.

The exposure time gradually increased over sessions, which was built into the study to minimize simulator sickness (e.g., 25 minutes for Treatment Session 1, 30 minutes for Treatment Session 2 etc.). The maximum exposure time per session was 50 minutes, as longer exposure lengths are associated with increased simulator sickness. Initial sessions typically lasted 40 minutes and toward the end of treatment were 60 minutes in length. The sequence of events within each treatment sessions consisted of: (1) a brief review of Driving Diary forms, completion of the Adverse Events Checklist, and discussion of session plan; (2) completion of the Simulator Sickness Questionnaire (pre-exposure); (3) VR exposure for the designated time length; (4) completion of Simulator Sickness Questionnaire (post-exposure); (5) a brief review of session and Driving Diary forms for following week. The therapist documented the session using treatment session forms developed for the study (see Therapist Treatment Manual in Appendix E. Post-Treatment Assessment

One week after the last session, a post-treatment assessment was scheduled. Participants recorded their Driving Diary for this time period. At the post-treatment assessment, the specific phobia section of the SCID and Adverse Events Checklist was administered. Participants also completed the six standard VR driving scenarios using the same format employed in the pre-treatment assessment. The questionnaire package (Driving Anxiety Test, Target Driving Fear List, expected anxiety ratings for the Hierarchy of Virtual Driving Scenarios, Client Satisfaction Questionnaire, Research Participant Feedback Questionnaire, Presence Questionnaire, and Driving Concerns Questionnaire) was reviewed. They were asked to complete these questionnaires in week following the post-treatment assessment, and return them to the therapist by mail. At the end of the assessment, participants were offered monetary compensation of $30 if they attended both follow-up assessments.
1-Month Follow-up Assessment

A follow-up assessment was arranged one month after the last treatment session. A questionnaire package (Adverse Events Checklist, Driving Diary, Driving Anxiety Test, Target Driving Fear List, and Driving Concerns Questionnaire) with instructions was mailed to participants a week prior to the assessment, and they were contacted to schedule a telephone interview. In the telephone interview, the specific phobia section of the SCID was administered and audiotaped. Participants were asked to mail the questionnaire results to the therapist.

3-Month Follow-up Assessment

Three months after the last treatment session, participants were contacted regarding another follow-up assessment. A questionnaire package (Adverse Events Checklist, Driving Diary, Driving Anxiety Test, Target Driving Fear List, Driving Concerns Questionnaire) with instructions was mailed to participants a week prior to the assessment. In the telephone interview, the specific phobia section of the SCID was administered and audiotaped. Participants were asked to mail questionnaire results to the therapist.
RESULTS

The findings of this project are presented in following sections: stability of data points during the baseline phase; subjective peak anxiety ratings during VR exposure; treatment outcome measures; exploratory measures; and outcome summary of participants at the post-treatment assessment.

Stability of Data Points during the Baseline Phase

A simplified time series (C-statistic) was used to examine the stability of data points at the baseline phase across Driving Diary outcome measures (Driving Frequency, Main Target Phobia, and Global Phobia). As shown in Table 5, the only C-statistic that revealed a statistically significant trend in the positive direction (p < .05) was for P4 on Main Target Phobia. All of the other measures were found to be horizontally stable during the baseline phase (p > .05).

Subjective Peak Anxiety Ratings During VR Exposure

Peak Anxiety Ratings on the Standard Virtual Reality Driving Scenarios at Pre- and Post-Treatment Assessments.

The peak anxiety results for the six scenarios for pre- and post-treatment assessments, by research participant, are shown in Figures 1 to 5. Figure 6 provides a summary of the mean peak anxiety for the scenarios for all participants. These figures reveal considerable variability in the pattern of peak anxiety ratings for the scenarios across participants. At pre-treatment, all participants, except for P3, reported moderate to high peak anxiety ratings across the different VR driving scenarios, and P4's mean peak anxiety for the six scenarios was slightly higher than the other participants. P2 experienced mild nausea during the first three scenarios. The nausea worsened and the exposure was stopped following the fourth scenario. She did not attempt the remaining two scenarios. At post-treatment, there was a considerable decrease in the peak anxiety levels across the six scenarios for all participants. However, P3's and P4's mean peak anxiety remained higher than the other participants. No post-treatment data was obtained for P1, as she was unable to attend the assessment.
Table 5

Stability of Data Points for Daily Driving Diary (Driving Frequency Main Target Phobia, and
Global Phobia Measures) During Baseline Phase, by Research Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>n</th>
<th>C-Statistic</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Driving Frequency</td>
<td>19</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>19</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>19</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td>P2</td>
<td>Driving Frequency</td>
<td>7</td>
<td>0.42</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>7</td>
<td>0.42</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>7</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td>P3</td>
<td>Driving Frequency</td>
<td>6</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>6</td>
<td>0.40</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>6</td>
<td>0.40</td>
<td>horizontally stable</td>
</tr>
<tr>
<td>P4</td>
<td>Driving Frequency</td>
<td>16</td>
<td>0.34</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td><strong>Main Target Phobia</strong></td>
<td>16</td>
<td><strong>0.43</strong></td>
<td>trend evident&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>16</td>
<td>0.18</td>
<td>horizontally stable</td>
</tr>
<tr>
<td>P5</td>
<td>Driving Frequency</td>
<td>8</td>
<td>0.00</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>8</td>
<td>0.23</td>
<td>horizontally stable</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>8</td>
<td>0.42</td>
<td>horizontally stable</td>
</tr>
</tbody>
</table>

Note. Bold font indicates statistically significant trend in baseline data (p < 0.05). n = number of
data points in baseline phase for each participant.

<sup>a</sup>Direction of trend was in positive direction.
Figure 1. Pre-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P1). Anxiety Scale (0–100): 0 = no anxiety; 100 = extreme anxiety. Post-treatment data was not obtained (see text for explanation).
Figure 2. Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P2). Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety. Pre-treatment data on the last two scenarios was not obtained (see text for explanation).
Figure 3. Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P3). Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.
Figure 4. Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P4). Anxiety Scale (0 – 100): 0 = no anxiety; 100 = extreme anxiety.
Figure 5. Pre- and Post-Treatment Results of Peak Anxiety Ratings on Standard Virtual Reality Driving Scenarios (P5). Anxiety Scale (0–100): 0 = no anxiety; 100 = extreme anxiety.
Figure 6. Mean Peak Anxiety of Six Standard Virtual Driving Scenarios (Rural Residential, Residential, Highway with Bridge, Highway Merging, Urban Intersections, and Urban Industrial). Anxiety Scale (0-100): 0 = no anxiety; 100 = extreme anxiety. Post-treatment data not available for P1 and pre-treatment mean peak anxiety for P2 was based on first four scenarios only (see text for explanation).
Expected Peak Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations at Pre- and Post-Treatment Assessments.

At the pre-treatment assessment, after participants completed the six standard VR scenarios, they constructed an individualized fear hierarchy (Fear Hierarchy of Virtual Driving Situations) based on 18 virtual driving situations. On the hierarchy, they rated their expected peak anxiety for each situation. Figure 7 shows the mean expected peak anxiety ratings for the virtual driving situations at pre- and post-treatment assessments. At pre-treatment, all participants expected to experience moderate to high levels of anxiety across the different situations. Expected peak anxiety ratings were markedly lower at the post-treatment assessment, except for P3, who showed little change. Appendix F provides a summary of the expected peak anxiety ratings for each participant at pre- and post-assessment points.

Peak Anxiety Ratings Across Treatment Sessions and Progression Through Fear Hierarchy.

During treatment, all participants gradually progressed through the virtual reality scenarios, but the rate of progression and the total number of scenarios completed by end of treatment varied considerably. P1, P2, and P5 completed the most scenarios by the end of treatment. Even though P1 was unable to attend Treatment Session 8, she actually had completed all the scenarios by the end of Treatment Session 7. Appendix G provides further information on the treatment sessions for each participant.

Table 6 provides a summary of the mean peak anxiety across trials completed in each session. In Treatment Session 1, P1, P2, and P3 had the highest mean peak anxiety ratings. In the following session, the mean peak anxiety decreased in all participants, with the greatest decrease occurring in P1, P2, and P5. Anxiety ratings continued to decrease slightly, or remain low for subsequent sessions. In the last session, everyone, except for P4, had a session mean peak anxiety of 10 or less. P4 showed the least amount of change in her anxiety ratings. In Session 5, P5 reported that she had been using an anxiety scale from 0 to 10 for the three previous sessions.
Figure 7. Expected Mean Peak Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations. Anxiety Scale (0-100): 0 = no anxiety; 100 = extreme anxiety. Mean peak anxiety ratings based on 18 virtual driving situations.
Table 6

Mean Peak Anxiety Ratings in Treatment Sessions

<table>
<thead>
<tr>
<th>Participant</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>27.50</td>
<td>16.67</td>
<td>16.50</td>
<td>21.00</td>
<td>10.00</td>
<td>10.42</td>
<td>10.00</td>
<td>-</td>
</tr>
<tr>
<td>P2</td>
<td>26.67</td>
<td>19.00</td>
<td>7.14</td>
<td>7.86</td>
<td>5.00</td>
<td>6.38</td>
<td>11.50</td>
<td>3.29</td>
</tr>
<tr>
<td>P3</td>
<td>27.50</td>
<td>25.00</td>
<td>14.00</td>
<td>12.50</td>
<td>11.25</td>
<td>7.50</td>
<td>20.83</td>
<td>7.00</td>
</tr>
<tr>
<td>P4</td>
<td>15.00</td>
<td>10.00</td>
<td>13.12</td>
<td>15.56</td>
<td>19.17</td>
<td>15.00</td>
<td>17.78</td>
<td>15.38</td>
</tr>
<tr>
<td>P5</td>
<td>15.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.82</td>
<td>8.40</td>
<td>6.11</td>
</tr>
</tbody>
</table>

Note. Anxiety scale (0 - 100): 0 = no anxiety; 100 = extreme anxiety. P1 did not complete Treatment Session 8. Data was not available for P5 in Sessions 2, 3, 4, and 5 (see text for explanation). The calculation of the mean peak anxiety for each session was based on the total number of trials completed within each session.
After reviewing the scale with the therapist, she proceeded to use the correct scale (0 – 100) for the remainder of the session. As a result, her anxiety ratings for Sessions 2, 3, 4, and 5 may not accurately reflect her true subjective anxiety, and were not included in the analysis.

Treatment Outcome Measures

Results from visual inspection of raw data for the outcome measures are presented first followed by results of the statistical analyses.

Driving Diary at Baseline, Treatment, and 1- and 3-Month Follow-up Phases.

Driving Frequency. The driving frequency results across participants are summarized in Figure 8. Refer to Appendix H for a visual presentation of the results for each participant.

Overall, there was considerable variation in the participants' mean weekly driving frequencies across treatment, and it was difficult to visually detect trend changes across phases (baseline, treatment, post-treatment assessment, and follow-up assessments). During the baseline, three participants (P1, P3, and P5) made no driving trips. P2 made one driving trip (10 minutes in length). P4 had the highest driving frequency mean score and she made six short trips for a total of 55 minutes.

When baseline, treatment, and the post-treatment assessment phases were compared, there was no marked trend of increasing mean weekly driving frequency for any of the participants. Although P1 had a substantial increase in her driving frequency after Treatment Session 4, and continued to make driving trips almost weekly for the remaining treatment weeks, her driving tapered off in the post-treatment phase (see Week 8 in the figure). Week 8 data is missing for P1 because she only completed seven treatment sessions; her post-treatment data was collected the week following Session 7 (see Week 7 in the figure). P2's driving frequency also fluctuated throughout treatment, but her post-treatment mean score was slightly higher than her baseline mean score. P3 did not drive until the post-treatment phase and during that time, she made one short trip in a rural area. P4's mean weekly scores also varied from week to week with no clear trend of improvement by the end of treatment. There was little increase in P5's driving
frequency during treatment and the post-treatment assessment phase. From post-treatment to 1-month follow-up assessments, only P5 showed a slight increase in her mean driving frequency scores. In contrast, P2, P3 and P4 showed a pattern of decreasing mean driving frequency scores at the first follow-up assessment. At the subsequent assessment, the mean driving frequency continued to marginally increase for only two participants (P2 and P5). There was no change in P1’s mean driving frequency at either follow-up probe.

Main Target Phobia. Figure 9 illustrates the mean weekly results of the Main Target Phobia. Refer to Appendix H for a visual presentation of the results for individual participants. At baseline, P1 (M = 8.00, SD = 0.00), P3 (M = 7.67, SD = 0.82), and P5 (M = 6.63, SD = 0.75), had the highest mean scores, and P2 had the lowest (M = 3.74, SD = .76). In the initial weeks of treatment, two participants (P2 and P3) showed a similar pattern of decreasing mean scores, and little change occurred in the other participants during this time. P3’s mean scores gradually increased after Treatment Session 3, whereas there was a sharp drop in mean weekly scores for P1 (Week 8 data is missing for P1 because she only completed seven treatment sessions). Weekly mean scores, albeit to a less dramatic degree, also decreased for P5 and P2. There was little change in P4’s mean scores across treatment sessions. At the end of treatment, the mean weekly ratings were noticeably lower for all participants, with P4 showing the least amount of change. At the post-treatment assessment, mean ratings were lowest for P1 (M = 2.00, SD = 1.00), P2 (M = 1.86, SD = 0.38), and P5 (M = 2.29, SD = 0.49). At the follow-up assessments, there was a slight increase in mean scores, particularly for P3 and P4.

Global Phobia. The Global Phobia results of the participants are summarized in Figure 10. Refer to Appendix H for a visual presentation of the results for individual participants. At baseline, P3 (M = 7.83, SD = 0.41), P1 (M = 6.00, SD = 0.00), and P5 (M = 5.88, SD = 0.35), had the highest mean scores, and P2 had the lowest (M = 3.86, SD = 0.38). In the initial weeks of treatment, there was a gradual decrease in weekly ratings across all participants. During Treatment Weeks 3 and 4, there was further decrease in weekly scores for P1, P4, and P5, a slight
increase of P3’s scores, and minimal change in P2’s scores (Week 8 data is missing for P1 because she only completed seven treatment sessions). For the remaining treatment weeks, P3’s weekly mean scores fluctuated and showed minimal improvement, although her score did decrease in the post-treatment week after the last session. P4 also showed little improvement in her weekly scores. At post-treatment week, P3 and P4 had the highest mean Global Phobia ratings, which continued to increase at both follow-up assessments. In contrast, the other participants (P1, P2, and P5) showed a gradual decrease in their mean weekly ratings and by the post-treatment assessment, their scores were quite low, and showed a minimal increase at the follow-up assessments but remained well below their respective baseline mean scores.

Driving Target Fear List Results at Pre-, Post-, 1-, and 3-Month Follow-up Assessments

As shown in Figure 11, all participants rated their target fears as severe at the pre-treatment assessment. At the post-treatment assessment, the total score of target fear severity marginally decreased for all participants except P4, whose score did not change. There was no change in her score at the follow-up assessments. For the other participants at the 1-month follow-up assessment, the total score was minimally lower for three participants (P1, P2, and P3), and was slightly higher for P5. At the 3-month follow-up, there was little change in the participants’ total scores. The results of the Target Driving Fear List for individual participants are presented in Appendix I.

Driving Anxiety Test Results at Pre-, Post-, 1-, and 3-Month Follow-up Assessments

Only two participants (P2 and P4) were able to complete the Driving Anxiety Test at the pre-treatment assessment. Both individuals experienced high peak anxiety during the test. P1 and P5 were unable to complete any portion of the test because of heightened anxiety. P3 declined to attempt the test. At the post-treatment assessment, only P1, P2, and P4 completed the test. There was a noticeable decrease in expected peak anxiety ratings for P1, P2, and P4. At the 1-month
Figure 8. Driving Diary Results: Mean Driving Frequency (Minutes) at Baseline, Treatment, and 1- and 3-Month Follow-up Phases. Treatment Phase = Weeks 1 to 8. Each weekly data point in the figure represents the mean driving frequency (minutes) for the time period (days) between treatment sessions (e.g., the data point for Week 1 = mean driving frequency based on the number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling constraints and treatment interruptions, the time period in between weekly data points varies across participants. Week 8 represents the post-treatment phase for participants. PI's post-assessment phase was Week 7 (see text for further information).
Figure 9. Driving Diary Results: Mean Main Target Phobia at Baseline, Treatment, and 1- and 3-Month Follow-up Phases. Main Target Phobia Rating Scale (0 - 8): 0 = no avoidance, 8 = complete avoidance. Treatment Phase = Weeks 1 to 8. Each weekly data point in the figure represents the mean driving frequency for the time period (days) between treatment sessions (e.g., the data point for Week 1 = mean driving frequency based on the number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling constraints and treatment interruptions, the time period in between weekly data points varies across participants. Week 8 represents the post-treatment phase for participants. P1’s post-assessment phase was Week 7 (see text for further information).
Figure 10. Driving Diary Results: Mean Global Phobia at Baseline, Treatment, and 1- and 3-Month Follow-up Phases. Global Phobia Rating Scale (0 - 8): 0 = no driving phobia symptoms present; 8 = very disturbing/disabling driving phobia symptoms present. Treatment Phase = Weeks 1 to 8. Each weekly data point in the figure represents the mean driving frequency for the time period (days) between treatment sessions (e.g., the data point for Week 1 = mean driving frequency based on the number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling constraints and treatment interruptions, the time period in between weekly data points varies across participants. Week 8 represents the post-treatment phase. P1’s post-assessment phase was Week 7 (see text for further information).
Figure 11. Driving Target Fear List at Pre-, Post-, 1-Month, and 3-Month Follow-up Assessments. Sum of Three Target Fears. Maximum score = 15. Each target fear rated on 5-point scale: 1 = absent; 2 = trivial; 3 = mild; 4 = moderate; 5 = severe.
follow-up assessments, only P1 and P2 completed the test and their peak anxiety ratings remained low. At the 3-month follow-up three participants (P1, P2, and P5) repeated the test. P3 and P4 declined to attempt the test at both follow-up assessments. It is also important to note that P3 did not attempt the test at any of the assessment points because she felt incapable of driving anywhere in the city, and added that even sitting in her parked car was too overwhelming at times. Given the individual nature of the Driving Anxiety Test, a summary of the results for each participant is described below, and presented in Table 7.

At the pre-treatment assessment, P1 chose to drive around the block in her residential neighbourhood (driving time approximately 5 minutes), accompanied by her husband during the afternoon with good driving conditions. Her estimated peak anxiety was 75. When she went to attempt the test, her reported peak anxiety increased to 85 before she started driving. At that point, P1 stopped the test and was unable to complete any portion of it. At post-treatment, P1 was able to complete the test with low anxiety. At the 1-month follow-up, she completed the route again with minimal expected and actual peak anxiety. P1 repeated the test at the 3-month follow-up, and there was a slight increase in her reported expected and peak anxiety.

For her Driving Anxiety Test, P2 chose to drive around a quiet residential area with a passenger (driving time approximately 10 minutes) during the afternoon with sunny weather. At the pre-treatment assessment, her estimated peak anxiety was 60 and her reported peak anxiety during the test was 40. At the post-treatment assessment, she expected to experience a peak anxiety of 10. She repeated the route under the same conditions, and continued driving in the area for a total of 25 minutes, with a peak anxiety of 20. At the 1- and 3-month follow-up assessments, she completed the driving test with low expected and peak anxiety ratings.

At the pre-treatment assessment, P4 chose to drive an urban driving route estimated at five miles long accompanied by a passenger in daytime driving conditions. Her estimated peak anxiety and actual peak anxiety during the trip was 70. At the post-treatment her estimated peak
anxiety for this route was 40 and she was able to complete the route alone with a peak anxiety of 35. She declined to repeat the tests at the one- and three-month follow-up.

At the pre-treatment assessment, P5 chose to drive alone in the evening around her neighbourhood block in a residential area estimated at 10 minutes and expected a peak anxiety of 60. As she sat in the driver’s seat of the car, her anxiety increased to 50 and she was unable to continue with the test. At the post-treatment and one-month follow-up, she was unable to repeat the test because her car insurance had expired. At the three-month follow-up, she completed the test with a passenger with a peak anxiety of 35.

SCID (Specific Phobia Portion) Results at Post-, 1-, and 3- Month Follow-up Assessments.

At the post-treatment assessment the SCID indicated the driving phobia was now in partial remission, as current criteria were not fully met for three participants (P1, P2, and P5). At the 1- and 3-month follow-up assessments, the driving phobia continued to remain in partial remission for these participants. Although there was some improvement, P3 and P4 still met full criteria at post-treatment and follow-up assessments. Summaries of the interviews for each participant are described below. In addition to the qualitative information obtained from the SCID, participants were also asked to rate their avoidance, interference, and distress on scale (1 to 10) at all assessment points (e.g., avoidance scale: 1 = would not avoid driving; 10 = always avoid driving). These results are visually presented in Figures 12, 13, and 14 and summarized numerically in Appendix J.

At the post-treatment assessment, P1 was able to drive in the city with much less anxiety and she was no longer going out of her way to avoid driving. Interference and distress symptoms had also decreased. At the 1-month follow-up, she was driving infrequently because of work and family obligations, but did not feel more anxious and was not deliberately avoiding driving. P1 took a stress-related medical leave from work that coincided with the 3-month follow-up. At that assessment, P1 indicated that she had not been driving because of health problems, but there was
Table 7
Driving Anxiety Test

<table>
<thead>
<tr>
<th>Participant</th>
<th>Variable</th>
<th>Assessment Point</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre- Treatment</td>
</tr>
<tr>
<td>P1</td>
<td>Expected Anxiety</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Peak Anxiety</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Completion</td>
<td>0</td>
</tr>
<tr>
<td>P2</td>
<td>Expected Anxiety</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Peak Anxiety</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Completion</td>
<td>1</td>
</tr>
<tr>
<td>P3</td>
<td>Expected Anxiety</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Peak Anxiety</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Completion</td>
<td>0</td>
</tr>
<tr>
<td>P4</td>
<td>Expected Anxiety</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Peak Anxiety</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Completion</td>
<td>1</td>
</tr>
<tr>
<td>P5</td>
<td>Expected Anxiety</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Peak Anxiety</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Completion</td>
<td>0</td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0-100): 0 = no anxiety, 100 = extreme anxiety. Completion: 0 = Incomplete, 1 = Complete.
little change in her driving phobia symptoms.

With respect to P2, symptoms of anxiety, avoidance, interference, and distress had diminished at the end of treatment. She was now driving in particular areas of the city that she would have avoided before treatment. She no longer went out of her way to avoid driving, except for a few situations (e.g., freeway driving, driving in busy areas at night when it's raining). Her inability to drive in these situations was still interfering with her independence (e.g., relying on other people to drive) and she continued to feel somewhat embarrassed by it. P2 reported further improvements at the 1-month and 3-month follow-up assessments. At the first follow-up, she was driving slightly more with less anxiety, and had registered for a driver education course (in-class and on-road training). By the 3-month follow-up, P2 reported having more confidence and was regularly driving in her neighbourhood (e.g., shopping, and errands). She completed the in-class portion of the driving course, and the on-road portion was to begin shortly. She continued to feel somewhat embarrassed and frustrated by her remaining driving fears.

At the post-treatment assessment the SCID revealed minimal change in P3's driving phobia symptoms. Although she was less fearful of driving in rural areas (e.g., she could sit in the car and make attempts to drive in a nearby rural community), she remained fearful and avoided city driving. She felt less distress about the driving phobia than before treatment, but continued to be frustrated by her dependence on other people. She acknowledged ongoing interference with daily activities (e.g., work, visiting friends, shopping). At the 1-month follow-up, there was little change in her anxiety and avoidance, and she endorsed higher interference and distress. She had recently quit her job because of a change in her job description, which now required her to drive. She still felt incapable of driving in the city and was very upset by the loss of employment. P3 was involved in a minor car accident as a passenger shortly before the 3-month follow-up. After this event, her anxiety and avoidance for city driving increased slightly, but she still felt it was lower than before treatment. She added that she had been recently driving in a rural community
with minimal fear. Interference and distress symptoms remained high, and she was particularly bothered by her lack of independence.

At the post-treatment and follow-up assessments the SCID indicated some improvement in P4’s driving phobia symptoms, but they were still severe enough to warrant the specific phobia diagnosis. At the post-treatment assessment, she felt slightly less anxious about driving and was driving more frequently as compared to the last several years. However, she continued to avoid driving when possible. At the one-month assessment, she was trying to drive but continued to be quite fearful. She drove very little in between assessments, and continued to completely avoid certain situations (e.g., bridges, freeways, night and rainy driving conditions, busy city areas) but felt the fear was embarrassing and restricted her lifestyle. At the 3-month follow-up, she was driving even less because of winter driving conditions, and she continued to report heightened anxiety, distress, and interference.

At the post-treatment assessment, P5 indicated that she felt noticeably less anxious about driving in many situations (e.g., residential and low traffic areas in the city) as compared to before treatment and was now seeking out opportunities to drive. She indicated that she would have been driving more if it were not for mechanical problems in her car. P5 reported lower interference and distress, but admitted that there were still some activities (e.g., social, recreation) that she unable to do. At the 1-month follow-up, she was still slightly hesitant to drive in certain situations (e.g., busy areas in the city, unfamiliar areas), her overall fear, avoidance, distress, and interference remained low. At the 3-month follow-up, her avoidance increased slightly after an driving incident that occurred shortly after the initial follow-up assessment; the car she was driving hit a large rock in a driveway). Although, she continued to endorse some symptoms, they were not severe enough to warrant the specific phobia diagnosis.
Summary: Visual Inspection of Treatment Outcome Ipsative Z-Scores at Pre-, Post-, 1-Month, and 3-Month Follow-up Assessments.

To systematically compare the visual data from the different treatment outcome measures across participants, raw scores were transformed to a standardized scale using ipsative z-scores at each assessment point. Overall a converging pattern of results indicated that P1, P2, and P5 showed the greatest improvement across many of the outcome measures between pre- and post-treatment assessments. There was little change in P3 and P4’s scores, and some of P4’s suggested a worsening of symptoms from the pre-treatment assessment. These results are presented in Figures 15 to 19 and are summarized as a group in Table 8. Appendix K provides visual summaries for the outcome measure results for each participant separately.

With regards to driving frequency (see Figure 15), increased ipsative z-scores at the post-treatment assessment suggested minimal improvement in driving frequency in three participants (P1, P2, and P3). There was no change in P5’s driving frequency at the post-treatment. P4’s score was actually lower, which indicated decreased driving frequency at post-treatment, and no further change occurred at subsequent assessment points. For three participants (P1, P2, P3), ipsative z-scores were lower at the 1-month follow-up. There was negligible change in their z-scores at the 3-month follow-up, except for P3’s score, which showed further decline. P5’s ipsative z-score increased at both follow-up assessments.

There was a reduction in the Main Target Phobia ipsative z-scores for all participants between pre-and post-treatment assessments (see Figure 16). At the follow-up assessments, the scores were minimally higher for P1, P2, and P5, but they remained below their respective pre-treatment values. There was a substantial increase in ipsative z-scores for P3 and P4’s scores at the follow-up assessments.

The ipsative z-scores for Global Phobia were noticeably lower at post-treatment for all participants except P4 (see Figure 17), whose post-treatment score increased and was further
Figure 12. Avoidance Ratings at Pre-, Post-, 1-Month, and 3-Month Follow-up SCID Interviews.

Avoidance scale (1–10): 1 = would not avoid driving; 10 = would always avoid driving.
Figure 13. Interference Ratings at Pre-, Post-, 1-Month, and 3-Month SCID Interview Assessments. Interference scale (1 – 10): 1 = no interference; 10 = extreme interference.
Figure 14. Distress Ratings at Pre-, Post-, 1-Month, and 3-Month SCID Interviews. Distress Scale (1-10): 1 = not bothered/distress at all; 10 = very bothered/distressed at all.
elevated at the 1-month follow-up. At the follow-up assessments, ipsative z-scores were slightly higher for P1, P2, P3, and P5 but they remained below their respective pre-treatment scores. There were minor fluctuations in the ipsative z-scores for these individuals at the 3-month follow-up, except for P3, which showed a small increase. P4’s score further increased, and at the 3-month follow-up, her score had returned to the pre-treatment level.

All participants, except for P4, showed a decline in their ipsative z-scores on the Target Driving Fear List from pre- to post-treatment assessment points (see Figure 18). At the follow-up assessments, scores for four participants (P1, P2, P3, and P5) were slightly higher but remained much lower than their respective pre-treatment scores. There was no change in P4’s ipsative z-scores at the follow-up assessments.

Figure 19 presents the ipsative z-scores for the Driving Anxiety Test. Post-treatment peak anxiety ratings decreased for all participants who were able to complete the test. P3 did not attempt this test at any of the assessment points, P4 declined taking this test at both follow-up assessments, and P5 was unable to complete the post-treatment and 1-month follow-up tests because her car insurance had expired. P2’s scores continued to decrease at both follow-up assessments and there was little change in P1’s scores. P5 was able to complete the test at the 3-month follow-up, and her ipsative-z-score had noticeably decreased from the pre-treatment value.

To standardize the visual inspection process (see Table 8), cut-off scores for the z-scores were established to provide a descriptive index of the magnitude of change from pre-to post-treatment assessment points for each outcome measure. These indices were based on standard deviation cut-off scores for the each outcome measure. First, the absolute difference in ipsative z-score for each measure between pre- and post-treatment assessment points was calculated. If this change score was less than +/- 1 SD, it was considered as “not improved.” If the change score was equal to or greater than +/- 1 SD, it was classified as “marginal improvement.” Change scores that were equal to or greater than +/- 2 SD were described as “clearly improved.”
Based on these criteria, P1 and P2 showed a similar pattern of change that included clear improvement on Main Target Phobia and Global phobia measures, and no change in Driving Frequency. A marginal trend towards improvement was obtained on the Target Driving Fear List and Driving Anxiety Test for these two participants. Overall, P3 showed less improvement across the measures, as there was marginal improvement on Main Target Phobia and the Target Driving Fear List. Clear improvement occurred on Global Phobia and no change was detected on Driving Frequency or the Driving Anxiety Test. For P4, marginal improvement was revealed on the Main Target Phobia and the Driving Anxiety Test. There was no change in her Driving Frequency, Global Phobia, or Target Driving Fear List scores. Her score on Global Phobia actually increased from pre- to post-treatment assessments, which suggested worsening of the phobia severity. There was clear improvement in P5’s Main Target Phobia, Global Phobia, and Target Driving Fear List scores. The extent of change on the Driving Anxiety Test could not be determined as she did not complete the test at the post-treatment assessment. There was no change in her Driving Frequency.

Summary: Statistical Significance of Treatment Outcome Scores Measures at Pre- and Post-Treatment Assessments.

Table 9 presents descriptive statistics, ACF(1) estimates, and critical difference (CD) scores for pre- and post-treatment scores on the outcome measures (Driving Frequency, Main Target Phobia, Global Phobia, Target Fear List, Driving Anxiety Test) for each participant. Appendix L provides a summary of the results for each participant. Statistically significant differences (p < .05) were found for four participants (P1, P2, P3, and P5) between pairs of ipsative z-scores for Main Target Phobia and Global Phobia. The only statistically significant difference between pre- and post-treatment ipsative z-scores for P4 was Main Target Phobia.
Figure 15. Plot of Ipsative Z-Scores for Mean Driving Frequency at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.
Figure 16. Plot of Ipsative Z-Scores for Mean Main Target Phobia at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.
Figure 17. Plot of Ipsative Z-Scores for Mean Global Phobia at Baseline, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.
Figure 18. Plot of Ipsative Z-Score for Driving Target Fear List at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.
Figure 19. Plot of Ipsative Z-Score for Driving Anxiety Test (Peak Anxiety) at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.
Table 8

Summary: Visual Inspection of Treatment Outcome Ipsative Z-Scores Between Pre- and Post-Treatment Assessments

<table>
<thead>
<tr>
<th>Research Participant</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driving Frequency</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Main Target Phobia</strong></td>
<td>+</td>
<td>+</td>
<td>0+</td>
<td>0+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Global Phobia</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Target Fear List</strong></td>
<td>0+</td>
<td>0+</td>
<td>0+</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td><strong>Driving Anxiety Test</strong></td>
<td>0+</td>
<td>0+</td>
<td>a</td>
<td>0+</td>
<td>a</td>
</tr>
</tbody>
</table>

Note. The summary table was based on the following method. First, the absolute difference in ipsative z-score for each measure between pre- and post-treatment assessment points was calculated. These change scores were then classified based on the following criteria:

Zero (0) = change score was less than +/-1 SD = no clear improvement.

Zero plus positive subscript (0+) = change score was equal to or greater than +/-1 SD = marginal improvement (trend toward positive outcome).

Zero plus negative subscript (0-) = change score was equal to or greater than +/-1 SD = marginal deterioration (trend toward worse outcome).

Positive sign (+) = change score was equal to or greater than +/-2 SD = clear improvement.

*a Missing data.
As a secondary statistical analysis for Driving Diary data, the C-statistic found statistically significant trends between pre- and post-treatment assessments for P1, P2, P3, and P5 only on Main Target Phobia and Global Phobia measures. These trends occurred in the positive direction (based on visual inspection of raw data). For P4, a statistically significant trend was obtained for Global Phobia, however this was in the negative direction (based on visual inspection of raw data), suggesting reduced driving frequency. The C-statistic could not be calculated for the Driving Anxiety Test and Target Driving Fear List because of an insufficient number of data points.

Overall Summary of Results Between Pre-and Post-Treatment Assessments: A comparison of Visual Inspection, Ipsative Z-Score, and C-Statistic Methods Based on Treatment Outcome Criteria

Table 11 presents an overall summary of the visual and statistical methods used to assess change from pre- to post-treatment assessment points based on the treatment outcome criteria.

Treatment Outcome Criterion 1: Decreased Main Target Phobia. A similar pattern of results was found on Main Target Phobia across the different methods. The visual method showed clear improvement for P1, P2, and P5. Both statistical techniques identified that these changes were statistically significant. The visual method suggested a trend towards marginal improvement for P3 and P4. Both statistical methods revealed identical results for P3 and suggested that her change score was statistically significant. For P4, statistical significance was only shown with the ipsative z-score method. It is important to note that her pre-treatment (baseline) data was shown to be unstable, as the C-statistic identified a statistically significant trend in the positive direction. As a result, the statistical and visual results for this measure for P4 may not be entirely accurate.

Treatment Outcome Criterion 2: Decreased Global Phobia. On Global Phobia, clear improvement using the visual method was shown for P1, P2, P3, and P5. This was supported by both statistical methods which revealed that their score changes were statistically significant. The
visual method found no improvement for P4, and the C-statistic identified a statistically significant trend in the negative direction, suggesting worsening of her phobia symptoms.

**Treatment Outcome Criterion 3: Increased Driving Frequency.** All three methods suggested no significant change in driving frequency.

**Treatment Outcome Criterion 4: Driving Anxiety Test with Low Peak Anxiety.** The visual inspection method suggested marginal improvement for P1, P2, and P4, and no improvement in P3, as she declined from the test. Outcome for P5 could not be determined as no post-treatment data was available. The ipsative z-score method did not find these changes in P1, P2, and P4 to be statistically significant.

**Treatment Outcome Criterion 5: Reduced Target Fear Severity.** The visual inspection method found clear improvement for P5, marginal improvement for three participants (P1, P2, and P3), and no improvement for P4. The changes that occurred in the four participants were not found to be statistically significant using the ipsative z-score technique.

**Treatment Outcome Criterion 6. No Longer Meeting DSM-IV Specific Phobia Criteria.** This criterion was included as an overall indicator of clinical significance and the visual or statistical methods of assessing change were not used. Three participants (P1, P2, and P5) no longer met full criteria at the post-treatment assessment. These individuals also showed the strongest outcomes on the different measures. P3 and P4 continued to meet full criteria for the disorder, and this finding is fairly consistent with the other outcome measures that showed marginal or no change.
# Table 9

Summary Statistics: Descriptive Results, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Outcome Measures, by Research Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>ACF(1) or $r^a$</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Driving Frequency</td>
<td>39</td>
<td>1.13</td>
<td>7.12</td>
<td>-0.03</td>
<td>2.35</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>39</td>
<td>5.53</td>
<td>2.91</td>
<td>0.93</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>39</td>
<td>4.00</td>
<td>1.99</td>
<td>0.79</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>4</td>
<td>10.75</td>
<td>1.99</td>
<td>0.05</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>4</td>
<td>18.38</td>
<td>36.74</td>
<td>-0.10</td>
<td>2.43</td>
</tr>
<tr>
<td>P2</td>
<td>Driving Frequency</td>
<td>27</td>
<td>4.26</td>
<td>12.22</td>
<td>-0.13</td>
<td>2.46</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>27</td>
<td>2.19</td>
<td>1.07</td>
<td>0.93</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>27</td>
<td>2.26</td>
<td>1.06</td>
<td>0.79</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>4</td>
<td>13.00</td>
<td>1.41</td>
<td>0.17</td>
<td>2.12</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>4</td>
<td>21.25</td>
<td>13.15</td>
<td>0.11</td>
<td>1.55</td>
</tr>
<tr>
<td>P3</td>
<td>Driving Frequency</td>
<td>26</td>
<td>0.62</td>
<td>2.25</td>
<td>-0.09</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>26</td>
<td>5.65</td>
<td>2.21</td>
<td>0.93</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>26</td>
<td>5.85</td>
<td>1.06</td>
<td>0.79</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>4</td>
<td>13.25</td>
<td>1.26</td>
<td>0.04</td>
<td>2.27</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P4</td>
<td>Driving Frequency</td>
<td>33</td>
<td>1.52</td>
<td>6.55</td>
<td>-0.02</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>33</td>
<td>5.93</td>
<td>1.22</td>
<td>0.93</td>
<td>0.61</td>
</tr>
</tbody>
</table>

(table 9 continued)
Table 9 (continued)

Summary Statistics: Descriptive Results, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Outcome Measures, by Research Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>ACF(1) or r^a</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4</td>
<td>Global Phobia</td>
<td>33</td>
<td>5.76</td>
<td>1.09</td>
<td>0.79</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td></td>
<td>15.00</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>2</td>
<td>52.5</td>
<td>24.75</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P5</td>
<td>Driving Frequency</td>
<td>29</td>
<td>0.93</td>
<td>2.83</td>
<td>-0.11</td>
<td>2.45</td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>29</td>
<td>3.48</td>
<td>2.13</td>
<td>0.93</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Global Phobia</td>
<td>29</td>
<td>3.03</td>
<td>1.95</td>
<td>0.79</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>12.75</td>
<td>1.71</td>
<td>-0.32</td>
<td>2.66</td>
<td></td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td>2</td>
<td>42.50</td>
<td>10.61</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Note. n = total number of data points (sum of the number of data points in baseline, post-treatment, and follow-up phases). Mean and standard deviation based on total number of data points for each participant.

*Test-retest reliability coefficients were used for Main Target Phobia and Global Phobia (Marks & Mathews, 1979). For all other measures, lag 1 autocorrelations (Bartlett’s r approximation) were calculated since reliability coefficients were not available.

For the Driving Anxiety Test (P4 and P5), the ACF(1) cannot be calculated when n = 2.

For the Target Fear List (P4), the ACF(1) cannot be calculated when numbers are constant.
Table 10

Summary Statistics: Simplified Time Series Analysis (C-Statistic) of Driving Diary Outcome Measures (Driving Frequency, Main Target Phobia, and Global Phobia) between Baseline and Post-Treatment Assessment Phase, by Research Participant.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>C-Statistic</th>
<th>Trend</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Driving Frequency</td>
<td>-0.04</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Main Target Phobia</td>
<td>0.92</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P1</td>
<td>Global Phobia</td>
<td>0.91</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P2</td>
<td>Driving Frequency</td>
<td>-0.11</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Main Target Phobia</td>
<td>0.91</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P2</td>
<td>Global Phobia</td>
<td>0.85</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P3</td>
<td>Driving Frequency</td>
<td>-0.10</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Main Target Phobia</td>
<td>0.69</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P3</td>
<td>Global Phobia</td>
<td>0.72</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P4</td>
<td>Driving Frequency</td>
<td>0.34</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>Main Target Phobia</td>
<td>0.25</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>Global Phobia</td>
<td>0.36</td>
<td>trend evident</td>
<td>negative</td>
</tr>
<tr>
<td>P5</td>
<td>Driving Frequency</td>
<td>0.00</td>
<td>horizontally stable</td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>Main Target Phobia</td>
<td>0.83</td>
<td>trend evident</td>
<td>positive</td>
</tr>
<tr>
<td>P5</td>
<td>Global Phobia</td>
<td>0.87</td>
<td>trend evident</td>
<td>positive</td>
</tr>
</tbody>
</table>

Note. Bold font indicates statistically significant trends baseline and post-treatment assessment data (p < .05). Direction of trend was based on visual inspection of the data. Trend in the positive
direction = change towards improved outcome. Trend was in the negative direction = change towards worse outcome.
Table 11

Overall Summary of Results Between Pre-and Post-Treatment Assessments: A comparison of Visual Inspection, Ipsative Z-Score, and C-Statistic Methods.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>Visual Inspection</th>
<th>Ipsative Z-Score</th>
<th>C-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Driving Frequency</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>0, b</td>
<td>0</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>0, b</td>
<td>0</td>
<td>b</td>
</tr>
<tr>
<td>P2</td>
<td>Driving Frequency</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>0, b</td>
<td>0</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>0, b</td>
<td>0</td>
<td>b</td>
</tr>
<tr>
<td>P3</td>
<td>Driving Frequency</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>0, b</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>0, b</td>
<td>0</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>a</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>P4</td>
<td>Driving Frequency</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>0, b</td>
<td>+</td>
<td>0</td>
</tr>
</tbody>
</table>

(table 11 continued)
Table 11 (continued)

Overall Summary of Results Between Pre-and Post-Treatment Assessments: A comparison of Visual Inspection, Ipsative Z-Score, and C-Statistic Methods.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Measure</th>
<th>Visual Inspection</th>
<th>Ipsative Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4</td>
<td>Global Phobia</td>
<td>0-</td>
<td>0-</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>0</td>
<td>0\textsuperscript{b}</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>0\textsuperscript{b}</td>
<td>0\textsuperscript{b}</td>
</tr>
<tr>
<td>P5</td>
<td>Driving Frequency</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Main Target Phobia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Global Phobia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Target Fear List</td>
<td>+</td>
<td>0\textsuperscript{b}</td>
</tr>
<tr>
<td></td>
<td>Driving Anxiety Test</td>
<td>a\textsuperscript{a}</td>
<td>0\textsuperscript{b}</td>
</tr>
</tbody>
</table>

Note. Results from this summary table was based on findings in Tables 8, 9, and 10. Change scores were classified as the following (see specific tables for additional information):

Zero (0): change score unchanged = no clear improvement.

Zero plus positive subscript (0+): change score = marginal improvement (trend toward positive outcome).

Zero plus negative subscript (0-): change score = marginal deterioration (trend toward worse outcome).

Positive sign (+): change score = clear improvement.

\textsuperscript{a}Missing data.
C-statistic was not calculated due to insufficient data points.
Summary of Exploratory Measures

Driving Concerns Questionnaire Results at Pre-, Post-, 1- and 3-Month Follow-up Assessments.

At pre-treatment, scores on this questionnaire were elevated for all participants, ranging from 66 to 110 out of a maximum score of 130. P2 had the highest score. In general, the most predominant driving concerns endorsed by participants were those relating to potential danger expectancies (accident, injury, dangerous road conditions, fear of losing control over the car, and no control over other people's driving). As a whole, they were less concerned about anxiety expectancies (very intense anxiety or the consequences of anxiety, physical crisis). As shown in Figure 20, the total score decreased at the post-treatment assessment for all participants but P4.

Client Satisfaction Questionnaire Results at Post-Treatment Assessment.

Four of the participants' (P1, P2, P3, and P4) scores fell within one standard deviation of the normative data (M = 27.09, SD = 4.01). Table 12 provides the raw scores for the participants at the post-treatment assessment. These findings suggest that these individuals were quite satisfied with the treatment. All of their responses to individual items (e.g., quality of services received, extent to which needs have been met) were favorable; they were either a 3 or 4 on the four point scale, with higher numbers reflecting more positive evaluations. P4 was least satisfied with the treatment.

Research Participant Feedback Questionnaire Results at Post-Treatment Assessment.

A summary of the responses to the open-ended feedback question is provided below.

..."VR simulator gave good early exposure to driving before driving real thing."

(P1)

..."VR quite realistic, but expect it will get more so as technology improves, especially handling of vehicle's steering. Adding manual transmission (which I drive) would also be an improvement." (P1)
Figure 20. Driving Concerns Questionnaire at Pre-, Post-, 1-Month, and 3-Month Follow-up Assessments. Maximum score = 130
…“Using the driving simulator really helped with putting me into ‘real life’ driving situations without actually having to be out on the road.” (P2)

…“I actually became less uptight even as a passenger in a car, as I was always nervous. I think this was because I was using the simulator and this gave me the perspective that I could be in control as a driver or as a passenger.” (P2)

…“Repetition of the driving routes helped immensely.” (P2)

…“Although my fear has diminished somewhat I still have quite a bit. My shame about being fearful of driving has lessened. Driving more has helped reduce my fear. Facing my fear and having to address it gives me some hope that I may overcome it.” (P4)

…“The treatment I believe is helpful, I just need more support.” (P4)

…“Repetition of driving scenarios” (was the most helpful aspect of the treatment) (P5)

…”I feel driving is a possibility instead of a blackhole.” (P5)

Presence Questionnaire Results at Pre- and Post-Assessments.

Figure 21 illustrates the results of the Presence Questionnaire at pre- and post-assessment points. At pre-treatment, all the participants’ scores, except for P4, fell within one standard deviation of the normative data ($M = 98.11$, $SD = 15.78$). These findings suggest that four individuals (P1, P2, P3, and P5) found the simulator to be moderately realistic, and were able to become somewhat involved with different aspects of the simulated driving environment. At post-treatment, scores for three participants (P1, P2, and P5) increased, which suggests that their experiences with the driving simulator became even more realistic, natural, and involving with weekly practice. In contrast, the scores for P3 and P4 decreased at the post-treatment assessment.
Table 12

Results of the Client Satisfaction Questionnaire at the Post-Treatment Assessment

<table>
<thead>
<tr>
<th>Participant</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>27</td>
</tr>
<tr>
<td>P2</td>
<td>30</td>
</tr>
<tr>
<td>P3</td>
<td>27</td>
</tr>
<tr>
<td>P4</td>
<td>22</td>
</tr>
<tr>
<td>P5</td>
<td>30</td>
</tr>
</tbody>
</table>

Note. Maximum score = 32
Summary of Adverse Events during Baseline, Treatment, and Follow-up Phases.

Qualitative descriptions of adverse events experienced by participants were obtained during baseline, treatment, and follow-up phases. All participants, except for P2, reported a range of driving and non-driving related events. During all phases of the study, P1 reported ongoing stresses relating to her child with special needs. Towards the end of treatment and at the post- and 1-month follow-up assessments, she reported additional stress from a recent workload increase. At the 3-month follow-up, she took a stress-related medical leave from work. At both follow-up assessments, P1 indicated that she wasn’t driving, or thinking about driving, because of her recent health difficulties.

P3 experienced a number of adverse events during baseline period (e.g., hearing about motor vehicle accident on the news, which increased her anxiety, work stress, moving). During treatment P3 reported ongoing concurrent stresses related to work, and health problems during treatment. Towards the end of treatment, she also experienced significant relationship difficulties with her partner, and reported increased anxiety, fatigue, and loss of energy. These problems continued to be described at the 1-month follow-up assessment. At the 3-month, she reported a minor car accident that she was involved in as a passenger. She had also left her job (due to her inability to drive) and was experiencing financial difficulties.

During the different phases of the treatment, P4’s adverse events primarily consisted of regularly hearing about car accidents in the news, which would exacerbate her driving anxiety. No other non-driving related events were reported. P5 also frequently indicated exposure to hearing about, or witnessing car accidents, which also caused an increase in her anxiety. For example, during the baseline period, P5 heard the collision noise of a nearby accident involving a cyclist and car. During the time period between Treatment Session 1 and 2, she witnessed a car nearly hit a cyclist. Between the sixth and seventh session, she witnessed emergency
Figure 21. Presence Questionnaire Results at Pre- and Post-Treatment Assessments. Maximum raw score = 133.
vehicles at the scene of a car/motorcycle accident. During the time between follow-up assessments, she experienced a very stressful driving situation while she was driving. Her car hit and became stuck after it hit a large rock when she was backing up on a steep hill.

Self-Monitoring and Motivation Checks During Treatment.

With regards to checking adherence to completing their daily Driving Diary during treatment, most participants indicated that they missed recording the form to varying degrees. When their Driving Diaries were checked, there was actually very little missing data for all of the participants except for P3.

P1 noted at the Week 2 and 8 checkpoints, she did not fill out the Driving Diary forms about 50% of the time because there was no change in her ratings. At the Week 4 and 6 checkpoints, P1 indicated that she did not record the forms about 75% of the time. However, with regards to the actual number of missed forms, there was no missing data. P2 indicated that she did not complete the forms about 50% of the time across the four checkpoints. However, with regards to the number of actual missing Daily Diary forms, there were only seven days that she missed. P4 acknowledged that she forgot or neglected to complete the forms from 25% to 75% of the time. She did not complete the forms for a total of 31 days during the treatment phase. P5 indicated that she did not complete the forms 25% of the time at three of the checkpoints (Weeks 2, 6, and 8), and did not forget any at the Week 4 checkpoint. She missed recording her Driving Diary data three days over the course of the treatment phase. The discrepancy between self-report self-monitoring adherence and the actual number of missing forms, suggests that participants may have completed the forms retrospectively (e.g., in one sitting prior to an appointment).

Out of all the participants, P4 and P3 were least motivated as research participants. The degree of motivation by the other participants (P1, P2, and P5) varied from moderately motivated (4 on a 5-point scale with higher numbers representing greater motivation) to very motivated (5 on a 5-point scale) at four checkpoints. (Week 2, Week 4, and Week 6). P3 indicated that she was moderately unmotivated at the Week 2 checkpoint, and it increased to either moderately
motivated or very motivated at subsequent checkpoints. P4 indicated being very motivated at the initial checkpoint (Week 2) but decreased to indifferent/mildly motivated at Week 4 and 6 checkpoints, and increased to moderately motivated by Week 8.

**Outcome Summary of Results**

As an overall summary, participants were classified as clearly improved, marginally improved, or not improved at post-treatment. This descriptive classification was developed for this study with the objective to standardize the visual interpretation of outcome data. These findings were integrated statistical findings and the clinical significance data (diagnostic status of the driving phobia at post-treatment) to examine convergence of results across these methods, which would allow more confident inferences regarding treatment efficacy for these five participants.

Three participants (P1, P2, and P5) showed the strongest treatment outcome at the post-treatment assessment. The visual analysis method showed clear or marginal improvement in Criterion 1 (decreased Main Target Phobia), Criterion 2 (decreased Global Phobia), Criterion 4 (Driving Anxiety Test with Low Peak Anxiety), Criterion 5 (Reduced Target Driving Fear Severity), and Criterion 6 (No Longer Meeting DSM-IV Criteria for Specific Phobia). The ipsative z-score and C-statistic identified that the changes for Main Target Phobia, and Global Phobia measures were statistically significant. None of these participants showed marginal or clear improvement in their driving frequency at the post-treatment assessment. Although some loss of treatment gains could be detected at the follow-up assessments, their scores were markedly below pre-treatment values.

One participant (P3) was classified as marginally improvement, given that she showed clear improvement on Criteria 2 and 5 (Global Phobia and Target Fear List) and marginal improvement in Main Target Phobia (Criterion 1). Her changes on Main Target Phobia and Global Phobia were identified as significant using both statistical methods. Given that she continued to meet DSM-IV criteria for specific phobia (Criterion 6), her overall clinical
improvement was considered to be somewhat less than P1, P2, and P5. Like the other participants, there was no change in her driving frequency. At the follow-up assessments, P3 showed a return of many of her symptoms, suggesting that although some gains were made at post-treatment, she was unable to maintain them over time.

P4 showed the least amount of improvement at the post-treatment assessment. Her score on Main Target Phobia (Criterion 1) and Driving Anxiety Test (Criterion 4) showed marginal improvement. Both statistical methods suggested that the change on Main Target Phobia (Criterion 1) was statistically significant. However, the C-statistic indicated that her baseline data on this measure was not stable, and this systematic variation in the data would have likely affected the statistical findings. There was no improvement on Global Phobia (Criterion 2), Target Fear List (Criterion 5), and Driving Frequency (Criterion 3). The C-statistic suggested a worsening of her phobia severity on Global Phobia. P4, like P3, continued to meet DSM-IV specific phobia criteria, and she also showed a dramatic loss of gains at both follow-up assessments.

Results from many of the exploratory measures also showed a similar pattern of outcome at the post-treatment assessment. The participants who clearly improved (P1, P2, and P5) had higher levels of treatment satisfaction (Client Satisfaction Questionnaire), showed a greater sense of presence in the virtual environment (Presence Questionnaire), were more motivated (Self-Monitoring and Motivation Checklist), and had lower severity of driving concerns (Driving Concerns Questionnaire) as compared to the other participants (P3 and P4) who showed less improvement.

For an additional analysis of overall outcome, the magnitude of change among the group of participants was examined with effect sizes (Cohen, 1977). Effect sizes were calculated for the outcome measures from pre- to post-treatment assessment. For comparative purposes, effect sizes were also computed for VRET phobia treatment outcome studies (see Table 13). This analysis was limited to studies (n = 6) in which adequate data (raw, M, SD) were provided. In order to be
able to include both group and small-n research studies, the formula $d = \frac{M_{pre} - M_{post}}{SD_{pooled}}$ and $SD_{pooled} = \sqrt{(sd_{pre}^2 + sd_{post}^2)/2}$ was used.

The effect sizes for measures in this study ranged from -0.80 for Driving Frequency (in this measure, negative effect sizes for Driving Frequency represent increased driving frequency) to 2.52 for Global Phobia (positive effect sizes for Global Phobia and the other three measures reflect decreased scores). For other studies, the major of effect sizes for other VRET studies were greater than 1.00 (range fell 0.54 to 2.76). Effect studies for wait list comparison groups were considerably lower, varying from zero to 0.24 (North et al., 1996, Rothbaum et al., 1995, 2000). An in vivo group was included in the study by Rothbaum et al., its effect sizes ranged from 1.09 to 1.79 and were marginally lower than the effect sizes than the VRET group on two measures, and higher on one measure. The effect size for a relaxation group was appreciably lower than the VRET group in the study by Mulberger et al. (2001). These findings suggest that the magnitude of change in this sample between pre- and post-treatment assessments was quite large and relatively similar to the effect sizes in other VRET outcome studies.

In conclusion, comparable results across multiple measures (except driving frequency) across several individuals (three out of five participants with chronic driving phobia), and across multiple analysis methods (visual inspection, ipsative z-score statistical method, and the C-statistic) were obtained. These findings provide further evidence for the efficacy of VRET to treat driving phobia (Wald & Taylor, 2001). The lack of improvement in driving frequency, the variation in treatment response, the loss of treatment gains in some participants, and findings from the exploratory measures are other notable results. A discussion of these findings is presented in the following chapter.
Table 13

Effect Sizes for VRET Treatment Outcome Studies

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Treatment Condition</th>
<th>Measures</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botella et al.</td>
<td>VRET (n = 4)</td>
<td>PRIQ</td>
<td>0.70</td>
</tr>
<tr>
<td>(2000)</td>
<td></td>
<td>ASI</td>
<td>0.93</td>
</tr>
<tr>
<td>Muhlberger et al.</td>
<td>VRET (n = 15);</td>
<td>SUDS</td>
<td>VRET = 1.23;</td>
</tr>
<tr>
<td>(2001)</td>
<td>RELAXATION (n = 15)</td>
<td></td>
<td>RELAXATION =</td>
</tr>
<tr>
<td>North et al.</td>
<td>VRET (n = 30);</td>
<td>ATAQ</td>
<td>VRET = 2.76;</td>
</tr>
<tr>
<td>(1996)</td>
<td>WAIT LIST (n = 30)</td>
<td>SUDS</td>
<td>WAIT LIST = -0.93</td>
</tr>
<tr>
<td>Rothbaum et al.</td>
<td>VRET (n = 12);</td>
<td>AQ</td>
<td>VRET = 1.94;</td>
</tr>
<tr>
<td>(1995)</td>
<td>WAIT LIST (n = 8)</td>
<td>ATHQ</td>
<td>WAIT LIST = 0.39</td>
</tr>
<tr>
<td>Rothbaum et al.</td>
<td>VRET (n = 15); IN</td>
<td>QATF</td>
<td>VRET = 1.37;</td>
</tr>
<tr>
<td>(2000)</td>
<td>VIVO (n = 15);</td>
<td></td>
<td>IN VIVO = 1.09;</td>
</tr>
<tr>
<td></td>
<td>WAIT LIST (n = 15)</td>
<td>QATF-F</td>
<td>VRET = 1.94;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IN VIVO = 1.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAIT LIST = 0.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FFI</td>
<td>VRET = 0.54;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IN VIVO = 1.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAIT LIST = 0</td>
</tr>
<tr>
<td>Wald &amp; Taylor</td>
<td>VRET (n = 1)</td>
<td>DF</td>
<td>- 1.49</td>
</tr>
<tr>
<td>(2001)</td>
<td></td>
<td>MTP</td>
<td>2.43</td>
</tr>
<tr>
<td>Wald (2002)</td>
<td>VRET (n = 5)</td>
<td>DF</td>
<td>-0.80</td>
</tr>
</tbody>
</table>

(table 13 continued)
Table 13 (continued)

**Effect Sizes for VRET Treatment Outcome Studies**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Treatment Condition</th>
<th>Measures(^a)</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wald (2002)</td>
<td>VRET (n = 5)</td>
<td>GP</td>
<td>2.52</td>
</tr>
<tr>
<td>TFL</td>
<td>1.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAT</td>
<td>2.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Effect sizes were only calculated on measures for which adequate data (raw, \(M, SD\)) were provided. Effect sizes between pre- and post-treatment were calculated by the formula:

\[
d = \frac{M_{\text{pre}} - M_{\text{post}}}{SD_{\text{pooled}}} \quad \text{and} \quad SD_{\text{pooled}} = \sqrt{sd_{\text{pre}}^2 + sd_{\text{post}}^2}/2.
\]

\(^a\)PRIQ, Problem-Related Impairment Questionnaire (interference); ASI, Anxiety Sensitivity Index; SUDS, Subjective Units of Distress Scale; ATAQ, Attitudes Towards Agoraphobia; AQ Acrophobia Questionnaire (total score); ATHQ, Attitudes Towards Heights Questionnaire (total score); FQ, Fear Questionnaire; QATF, Questionnaire on Attitudes Towards Flying; QATF-F, Questionnaire on Attitudes Towards Flying (fear item); FFI, Fear of Flying Inventory; DF, Driving Frequency; MTP, Fear Questionnaire (Main Target Phobia); GP, Fear Questionnaire (Global Phobia); TFL, Target Driving Fear List; DAT, Driving Anxiety Test.
DISCUSSION

The purpose of the study was to examine the efficacy of VRET to treat driving phobia using a multiple baseline across-subjects design. The sequence of events included a pre-treatment assessment, a baseline phase (nonconcurrent design schedule), eight weekly VRET sessions using a standardized treatment protocol, a post-treatment assessment, and 1- and 3-month follow-up assessments. A sample of seven treatment seeking adults with a DSM-IV diagnosis of specific phobia (situational type, driving) were recruited. Five completed the treatment and follow-up phases. One individual withdrew after the pre-treatment assessment, and the other, after the first treatment session.

It was hypothesized that VRET would reduce driving anxiety and avoidance symptoms between pre- and post-treatment assessments. A multiple assessment approach was used and measures were selected based on their sensitivity to detect treatment effects and their ability to capture the multi-faceted and idiographic nature of driving phobia. Treatment outcome criteria included: decreased Main Target Phobia ratings (criterion 1); decreased General Phobia ratings (criterion 2); increased driving frequency (criterion 3); the ability to complete a Driving Anxiety Test with low peak anxiety (criterion 4); reduced target fear severity (criterion 5); and no longer meeting DSM-IV specific phobia criteria (criterion 6). It was expected that treatment gains would be maintained at the follow-up assessments. Several exploratory measures were also incorporated to examine potential variables that may have been related to treatment outcome.

Visual and statistical procedures were employed to assess change from pre- to post-treatment assessments. For visual analysis, raw scores for each measure were converted into ipsative z-scores to allow direct comparisons of scores across measures. To reduce the subjectivity associated with interpreting visual data, conservative decision rules were used to classify change scores as clearly improved, marginally improved, or not improved. A statistical method was also utilized to assess the statistical significance of ipsative z-score change (Mueser et al., 1991; Yarnold, 1988) from pre- to post-treatment points. As an additional analysis, the C-
statistic, a simplified time series analysis, was completed on the Driving Diary data (Main Target Phobia, Global Phobia, and driving frequency) to determine whether comparable statistical findings would be obtained.

In summary, three participants (P1, P2, and P5) showed clear improvement in driving anxiety and avoidance symptoms between pre- and post-treatment assessments. There was a marginal decrease in these symptoms for participant (P3), and the remaining participant (P4) did not improve, and actually showed deterioration in some symptoms. There was negligible change in actual driving frequency in any participant. Some gains were lost at the 1- and 3-month follow-up assessments, but symptoms remained far below pre-treatment results, particularly for P1, P2, and P5. The chronic and long-standing nature of the participants' driving phobia, their symptoms were unlikely to remit spontaneously. The fact that symptom improvement occurred only after the treatment was implemented supports the beneficial role of VRET for three out of the five participants. For an additional analysis of the magnitude of change among the five participants as a group, effect sizes were calculated for the outcome measures from pre- to post-treatment assessment. For comparative purposes, effect sizes were also computed for VRET phobia treatment outcome studies (see Table 13). These calculations showed moderate to large effect sizes across studies (Cohen, 1977), which provides converging support for the efficacy of VRET to treat specific phobias.

Overall, similar results across measures, data analysis methods, and participants were obtained, which provides corresponding evidence about the conclusions drawn about treatment outcome for this sample. The use of a multiple baseline across subjects design minimized several potential internal validity threats (e.g., history, maturation), and strengthened the confidence in drawing causal inferences about treatment outcome. Inclusion of other elements into the design, such as a standardized treatment protocol as well as blind ratings of diagnostic interviews and treatment adherence further enhanced the methodological rigor of this study. To elaborate on these findings, the remainder of this chapter is organized into the following sections: a summary
of each participant; an overview of conceptual issues relating to treatment outcome; and a discussion of potential contributions and implications for research and practice.

Research Participant Summaries

Summary of P1

At admission, P1 described a long-standing driving fear over the last 21 years, and she had not driven a vehicle for 14 years following a motor vehicle accident. The SCID identified a severe driving phobia, and pre-treatment assessment measures also confirmed marked driving anxiety and avoidance (e.g., she was unable to complete any portion of the Driving Anxiety Test, in which she tried to drive around a residential neighbourhood block). At pre-treatment, P1 reported moderately high levels of subjective anxiety upon initial exposure to the six standard virtual driving scenarios. Her mean peak anxiety across the six scenarios was the highest of all the participants. On the exposure hierarchy, she anticipated moderate to high levels of anxiety across the various scenarios during treatment. At the pre-treatment assessment, P1 indicated that she would be away on a vacation (e.g., road trip through United States) for the next two weeks, but she agreed to complete the Driving Diary forms during her trip. As a result, her actual baseline phase spanned 19 days, which provided further data on the severity and stability of her driving anxiety and avoidance symptoms.

During the initial weeks of treatment, P1 showed a pattern of increased anxiety upon during VRET exposure followed by a reduction of anxiety with continued and repeated exposure. Her mean peak anxiety scores for individual treatment sessions progressively decreased during treatment. In the initial weeks of treatment, there was minimal decrease in her weekly mean Main Target Phobia and Global Phobia ratings, and no change occurred in her driving frequency. P1's treatment was interrupted for two weeks after Treatment Session 4 because of a vacation (another road and camping trip through the provincial interior). One of the primary reasons for P1 participating in this study was that she wanted to help her husband with the driving during this trip.
During her vacation, P1 made a number of driving trips on the highway and in rural communities. A dramatic decrease in her Global Phobia and Main Target Phobia ratings accompanied her increased driving. After returning home, she was able to drive in the city with very little anxiety. For the remaining treatment phase, these ratings remained low and she continued to make driving trips (almost weekly) with minimal anxiety. In Treatment Session 5, she indicated that the VRET had allowed a sufficient reduction in her symptoms so that she was able to drive during this trip, and felt that her “driving phobia was cured.” P1 experienced little anxiety during VRET in the remaining sessions. These findings suggest the important role of actual driving practice to facilitate anxiety and avoidance reduction. As compared to the other participants, P1 progressed quickly through the different scenarios on the driving fear hierarchy and, she was the only participant to complete all 18 scenarios by the end of Treatment Session 7. She was unable to attend Treatment Session 8 due to scheduling constraints.

At the post-treatment assessment, P1 was relatively asymptomatic, which was reflected in all of the outcome measures, except for driving frequency. Visual inspection and both statistical methods showed that the Main Target Phobia (criterion 1) and Decreased Global Phobia (criterion 2) were clearly improved. Even though P1 experienced a marked increase of driving frequency (criterion 3) during treatment, none of the analysis methods detected no improvement between pre-treatment (baseline) and the 1-week monitoring period at post-treatment. The visual method revealed marginal improvement on peak anxiety ratings on the Driving Anxiety Test (criterion 4) and Target Fear Severity (criterion 5), but the ipsative z-score statistical method did not find statistically significant changes. The clinical significance of VRET was also demonstrated by the fact that her driving phobia was in partial remission (criterion 6), which identified a marked decrease in her phobic-related anxiety, avoidance, interference, and distress symptoms.

Her treatment gains, except for driving frequency, were mostly maintained at the follow-up assessments. Although there was a slight increase in most of the other outcome scores at the 1-
and 3-month follow-up assessments, they were still noticeably lower than pre-treatment scores. Although she was not driving during the 1-week assessment probe at both assessments, her subjective avoidance and anxiety remained low.

Results on the exploratory measures provide additional information that may have been associated with her treatment outcome. At pre-treatment, the Driving Concerns Questionnaire indicated that P1’s was predominately concerned about danger expectancies (e.g., accident involvement, injury, no control over other people’s driving, and dangerous road conditions). At post-treatment, there was a noticeable decrease in her concerns. Her pre-treatment score on the Presence Questionnaire suggested a sufficient degree of presence in the virtual driving environment for her to be immersed and engaged within the VRET process. Her score increased at the post-treatment assessment, which suggests that regular practice on the driving simulator may have facilitated her sense of presence. Although simulator driving performance was not objectively assessed, the therapist noted that P1 mastered simulator driving (e.g., steering, speed control, lane tracking) very quickly, and she made no critical comments about the simulator. P1 expressed satisfaction with the treatment and verbally indicated that the exposure treatment helped her resume actual driving. During treatment, P1’s motivation as a research participant varied from moderately to very motivated, and she reported not completing the Driving Diary forms 50 to 75% of the time. With regards to adverse events during treatment, P1 experienced ongoing stressors relating to her child with special needs. Towards the end of treatment and both follow-up assessments, she acknowledged that she wasn’t driving because of increased work stress and had to take a stress leave from her job. It appears that these personal circumstances may have also contributed to the decreased driving after treatment ended.

Summary of P2

At admission, P2 reported a 25-year history of driving fear and avoidance. Over the past few years, she experienced greater distress and interference, and prior to the study, she was driving in very limited areas in the city. The SCID indicated that she had a mild to moderate
driving phobia. She was assigned to the 12-day baseline, but due to scheduling constraints, her actual baseline length was 7 days. In the baseline phase, she made one driving trip, and had the lowest mean Main Target Phobia and Global Phobia ratings of all the participants. At the pre-treatment assessment, unlike the other four participants, P2 experienced simulator sickness (e.g., nausea, light headedness) during the initial exposure to the six standard VR scenarios. She also reported heightened peak anxiety with each subsequent scenario. P2 expected to experience a high level of anxiety in the various VR driving situations on the exposure hierarchy.

P2 was the one of the few participants who attended sessions on a weekly basis. A modified treatment protocol was used to begin her treatment given that she experienced significant nausea during the pre-treatment exposure. In the first treatment session, P2 reported moderately high anxiety during VRET, which gradually decreased during the session with repeated exposure. She reported mild symptoms of simulator sickness during the first two sessions, which gradually abated. The standard protocol was resumed in Treatment Session 3, and she experienced minimal simulator sickness in the remaining sessions. During treatment, she progressed through the exposure hierarchy and her mean peak anxiety ratings gradually diminished across sessions. By the end of treatment, she had completed most of the situations on the hierarchy, and in the latter part of the treatment, she reported minimal anxiety during exposure. At the post-treatment assessment, she repeated the six standard virtual driving scenarios, and there was a substantial decrease in her mean peak anxiety from the pre-treatment assessment. Her expected peak anxiety ratings on the Virtual Driving Situation Exposure Hierarchy were dramatically lower at post-treatment.

P2’s driving frequency fluctuated from week to week, with no clear trend of increased driving during the treatment phase. During the initial weeks, her mean driving frequency was slightly higher that most other participants. A clearer pattern gradually decreasing Main Target Phobia and Global Phobia ratings during the initial weeks of treatment was observed and, there were slight fluctuations in these ratings for the latter half of the treatment sessions.
At the post-treatment assessment, P2's outcome was almost identical to P1. Low Main Target Phobia (criterion 1) and Global Phobia (criterion 2) ratings at the end of treatment reflected reduced driving anxiety and avoidance. Her scores on these measures were the lowest of all the participants and the significance of these changes were detected by visual and both statistical methods. At post-treatment, her mean driving frequency was noticeably higher than the pre-treatment score, and was highest of all the participants. However, none of the analyses identified improvement in this measure (criterion 3). Visual analysis suggested marginal improvement on the Driving Target Fear List (criterion 4) and Driving Anxiety Test (criterion 5). The post-treatment SCID confirmed that she no longer met the full specific phobia criteria (criterion 6), and she reported reduced anxiety, avoidance, interference, and distress. However, P2 remained fearful and unable to drive in certain driving situations (e.g., freeway driving), which continued to be embarrassing and frustrating for her.

At the follow-up assessments, P2 indicated that she was regularly driving, and this was reflected in the one-week Driving Diary probes. She had started taking a driver education course (in class and on-road) and at the 3-month follow-up was about to begin the on-road portion. Of all the participants, P2 had the highest mean driving frequency at the 3-month follow-up. Although there was a slight increase in the mean ratings at the follow-up assessments, her Main Target Phobia and Global Phobia ratings remained lower than pre-treatment values, which suggested that the treatment effects on driving anxiety and avoidance were mostly maintained. Similar to P1, these changes suggest the important role of driving practice to facilitate further gains. The SCID determined that her driving phobia remained in partial remission at follow-up, and she continued to report improvement, but felt ongoing frustration by her inability to drive in certain situations.

With regards to the exploratory measures, P2 had the highest Driving Concerns Questionnaire pre-treatment score, which was substantially lower at the post-treatment assessment. This score continued to decrease at both follow-up assessments. P2 was highly satisfied with the treatment and described it as very beneficial. During the treatment sessions, P2
became comfortable with the driving simulator relatively quickly. P2 had the highest pre-treatment score on the Presence Questionnaire, which further increased at the post-treatment assessment. Similar to P1, this finding implies that she found the simulator to be moderately realistic and she was immersed and involved in the virtual environment. Furthermore, she made few critical comments about the simulator and expressed that she wanted to continue in the study despite experiencing simulator sickness during the initial weeks of treatment. She was the only participant who did not report any adverse driving or non-driving related events during the treatment or follow-up phases. P2 acknowledged that she did not complete the Driving Diary forms about 50% at the four checkpoints during treatment.

Summary of P3

At admission, P3 also described a chronic and progressive driving phobia. Her fear of driving began at age 18 following involvement in a motor vehicle accident as a passenger. Her fear was further exacerbated after she was in another car accident as a passenger at age 21. After this incident, she also developed a fear of being a passenger. Although she was able to obtain her driver's license at age 22, she avoided driving when ever possible. Her fear increased again after she witnessed a motor vehicle accident fatality outside her home. Up to the time of the study, her fear had not abated and she continued to avoid driving in the city. She had become increasingly distressed because her inability to drive was interfering with her occupational functioning.

The SCID confirmed a severe driving phobia, which was supported by other pre-treatment measures. During the baseline phase, P3's mean Main Target Phobia and Global Phobia ratings for the baseline phase were quite high and minimally fluctuated. She made no driving trips and was unable to complete the Driving Anxiety Test because she felt too fearful to drive in the city. However at the pre-treatment assessment, P3 experienced relatively little anxiety upon initial exposure to the virtual driving environment, and her mean peak anxiety for the six standard driving scenarios was noticeably lower than the other participants.
In Treatment Session 1, P3 had the highest mean peak anxiety (tied with P1), and unlike the other participants (P1, P2, and P5) who improved, there was minimal change in her mean peak anxiety during exposure at the next session. In subsequent sessions, there was an overall trend of gradually decreasing mean peak anxiety, and by the last treatment session, she reported little anxiety. During the treatment phase, P3 made no driving trips at all, and there was minimal improvement in her Main Target Phobia and Global Phobia ratings.

At the post-treatment assessment, the visual analysis method classified P3 as marginally improved on the Main Target Phobia (criterion 1) and Global Phobia (criterion 2), and both statistical methods determined that the magnitude of these changes were statistically significant. However, as compared to the other participants, these ratings were relatively higher than the participants (P1, P2, and P5) who had an overall stronger treatment response. None of the data analyses detected change in her driving frequency. P3 declined to attempt the Driving Anxiety Test (criterion 4) at the pre- and post-treatment assessments and these results were interpreted as not improved. Only the visual inspection method detected marginal improvement on the Target Driving Fear List. Although there was a small improvement in her symptoms, P3 continued to meet criteria for a driving phobia (criterion 6). She felt slightly less fear, distress, and avoidance of driving in rural areas, but her fear of city driving remained unchanged.

At the follow-up assessments, she continued to be highly symptomatic and she endorsed greater levels of distress and interference. She was still unable to drive at all in the city, but was trying to make more attempts in rural areas. As compared to the other participants who improved (P1, P2, and P5), her Main Target Phobia and Global Phobia ratings increased at both assessments almost to the values obtained at the baseline phase. P3 declined to attempt the Driving Anxiety Test, and there was minimal changed in her Driving Target Fear List follow-up scores.

With regards to the exploratory measures, there was little pre- to post-treatment decrease in her Driving Concerns Questionnaire score. There was minimal change of her scores at the
follow-up assessments, and they remained noticeably higher than P1, P2, and P5’s scores. Although she was mostly satisfied with the treatment, P3 had more difficulty learning to drive the simulator. She often made comments about the simulator controls and was concerned about her driving performance. P3 had the tendency to drive quite slow and regularly had to be encouraged to increase her speed. At the pre-treatment assessment, her score on the Presence Questionnaire was in the average range, which suggested that she found the virtual environment moderately realistic and involving. However, there was a marked decrease in her score at the post-treatment assessment, which suggests that over repeated practice with the simulator P3 became less immersed and involved in the computer environment. She was less motivated during treatment as compared to P1, P2, and P5, and her self-reported adherence with the Driving Diary forms varied from 25 to 75%.

P3 experienced numerous significant non-driving related events in the baseline, treatment, and follow-up assessments, which included ongoing work stress, health problems and relationship difficulties. She acknowledged that these events had heightened her overall anxiety and had affected her mood and energy level. At the 3-month follow-up, she had left her job because of a change in her job duties that required her to drive. P3 was very distressed by the loss of employment and the financial difficulties that accompanied it. She also reported involvement in a minor car accident as a passenger that contributed to a slight increase in her driving phobia symptoms.

Summary of P4.

As compared to other participants, P4 learned to drive at an older age (31 years old). Prior to that time, she recalled feeling anxious as a passenger in certain driving situations. She had no history of motor vehicle accident involvement and reported one incident involving a near accident while she was driving. She drove very little after getting her driver’s license and over time her driving avoidance increased. Gradually, P4 became more distressed by her fear of driving but she did not experience significant functional interference. The SCID confirmed a mild
to moderate driving phobia, but she experienced the least functional interference of all the participants. Prior to the study, she drove infrequently and only in limited driving conditions. The pre-treatment assessment measures confirmed a moderate driving anxiety and avoidance.

P4 reported fairly high peak anxiety ratings when she practiced the six standard virtual driving scenarios and her expected mean peak anxiety ratings on the Virtual Driving Situation Exposure Hierarchy were the highest of all the participants. During the baseline phase, P4 had the highest mean driving frequency. Her Main Target Phobia and Global Phobia ratings fell in the moderate range. Her score on the Driving Target Fear List and Driving Anxiety Test were also elevated.

During the initial session, P4 reported relatively low peak anxiety ratings and across sessions there was no clear trend of decreasing mean peak anxiety scores across sessions. Of all the participants, she showed the least amount of change in her mean peak anxiety scores; her mean peak anxiety for Treatment Session 8 was almost identical to that obtained in the first session. Her mean driving frequency varied from week to week and there was no trend of increased driving frequency during treatment. There was a slight decrease in her mean weekly Main Target Phobia, and a less noticeable change in her mean Global Phobia ratings.

At the end of treatment, P4 was still highly symptomatic. At the post-treatment assessment, although her peak anxiety ratings in the six standard virtual driving scenarios had decreased, they remained slightly higher than the other participants who improved (P1, P2, and P5). At the post-treatment assessment, P4 had the highest mean ratings of all the participants on the Main Target Phobia and Global Phobia ratings. The visual inspection method found marginal improvement of the Main Target Phobia (criterion 1), and the ipsative z-score statistical procedure identified that this change was statistically significant. The C-statistic was not statistically significant. However, the C-statistic for her baseline Main Target Phobia data was statistically significant and this systematic variation in the data may have distorted the statistical findings. The visual analysis method classified her score on the Global Phobia (criterion 2).
measure as not improved, however the ipsative z-score method revealed that this change was statistically significant. The C-statistic identified a statistically significant negative trend, which suggested worsening of her phobia severity. Her mean driving frequency (criterion 3) had decreased from the baseline, and none of the analyses found improvement on her mean driving frequency. Only the visual analysis method revealed marginal improvement in her Driving Anxiety Test (criterion 4), and there was no change in her Target Driving Fear score (criterion 5). The SCID confirmed that she still met the criteria for driving phobia (criterion 6), although she described a small improvement in her driving anxiety as compared to before treatment.

Similar to P3, she did not maintain most of her treatment gains at the follow-up assessments. There was no change in her mean driving frequency at the 1-week Driving Diary probes at both follow-ups. Her mean Main Target Phobia and Global Phobia ratings increased at both assessment points, and were higher than pre-treatment mean scores, which suggests a worsening of symptoms. Her score on the Driving Target Fear List remained unchanged, and she declined to attempt the Driving Anxiety Test at both assessments. She continued to meet the criteria for a driving phobia at the 1- and 3-month follow-up assessments, and her symptoms (anxiety, avoidance, interference, and distress) increased at the 3-month follow-up, which she attributed to the winter driving conditions.

Congruent with P3’s results, there was little pre- to post-treatment decrease in P4’s Driving Concerns Questionnaire score. There was minimal change in her scores at the follow-up assessments, and they remained noticeably higher than P1, P2, and P5’s scores. She was also least satisfied with the treatment of all the participants. Similar to P3, she had more difficulty learning to drive the simulator, she often made comments about the simulator controls, and she frequently expressed concerned about her driving performance. At the pre-treatment assessment, her score on the Presence Questionnaire was in the average range, which suggested that she found the virtual environment moderately realistic and involving. However, there was a marked decrease in her score at the post-treatment assessment, which implies that over repeated practice with the
simulator, P4, like P3, became less immersed and involved in the computer environment. For adverse events, P4 often reported hearing about motor vehicle accidents in the news, which would temporarily exacerbate her driving fear. Her motivation during treatment varied at each checkpoint, and her self-reported adherence with the Driving Diary forms varied from 25 to 75%.

**Summary of P5.**

This participant described a 22-year history of driving fear, which began at age 16 and, over her adult life, gradually developed symptoms of increased driving avoidance, distress, and interference. She had no prior involvement in a motor vehicle accident and has limited driving experience, and described a number of “close-calls” when she did drive. P5 started to avoid driving after an incident in which she was nearly hit by an oncoming semi-truck while she was driving. At the admissions interview, the SCID confirmed a mild to moderate driving phobia, and she described relatively less distress than other participants.

At the pre-treatment assessment, P5 reported moderate peak anxiety ratings in the six standard virtual driving scenarios. Her peak anxiety for Scenario 4 (Highway with Merging) was quite high and she was visibly anxious to the therapist. When she finished the scenario, she became tearful and left the room for a short time. She was very surprised by her dramatic increase in anxiety, which she was not expecting to experience on a driving simulator. P4 was able to complete the remaining scenarios with moderate anxiety. On the Virtual Driving Situation Exposure Hierarchy, she expected to experience moderate to high levels of anxiety in the different situations. On the other outcome measures, her score on the Driving Target Fear List was elevated. She was unable to complete any portion of her Driving Anxiety Test because her anxiety markedly increased when she sat in the driver’s seat and she decided to stop the test. During the baseline phase, she made no driving trips and her mean Main Target Phobia and Global Phobia ratings were quite high and stable.

During the intervention phase, it was not possible to draw conclusions regarding change in her mean peak anxiety values across treatment sessions. In the fifth treatment session, P5
realized that she had been using an anxiety scale from zero to 10, rather than from zero to 100 in the last three sessions. Instructions for the anxiety scale were reviewed and she proceeded to use the correct scale (0–100) for the remaining sessions. Her mean weekly driving frequency remained unchanged during treatment, although there was a gradual decrease in her mean Main Target Phobia and Global Phobia ratings.

At the post-treatment assessment, she showed a noticeable reduction in her driving anxiety and avoidance. The SCID determined that the driving phobia was in partial remission (criterion 6). Her mean Main Target Phobia (criterion 1) and Global Phobia (criterion 2) ratings were quite low and all of the data analysis methods identified these post-treatment scores as improved. Like the other participants, her driving frequency remained unchanged (criterion 3). She was unable to complete the Driving Anxiety Test (criterion 4) because her car insurance had expired. Visual analysis classified her Target Driving Fear score as clearly improved, but this change was not found to be statistically significant.

At the follow-up assessments, P5 showed a trend of increasing mean driving frequency during the 1-week Driving Diary probes. There was a slight increase in her mean Main Target Phobia and Global Phobia ratings, however they remained far below baseline values. On the Target Driving Fear List, there was minimal increase in her score at both assessments. She was still unable to attempt the Driving Anxiety Test, as she had been able to renew her car insurance. At the 3-month follow-up, she was able to complete the test with considerably less peak anxiety than at the pre-treatment assessment. The SCID determined that her driving phobia was still in partial remission at both follow-up assessment points, but her symptoms increased slightly at the 3-month follow-up after she hit a large rock while she was driving.

On the exploratory measures, P5’s results were comparable to other participants who improved (P1, and P2), particularly on the Driving Concerns, Presence, and Client Satisfaction Questionnaires. There was a noticeable decrease in P5’s Driving Concerns Questionnaire score at the post-treatment assessment. P5 was highly satisfied with the treatment and described it as very
beneficial. At the checkpoints during treatment, she reported being quite motivated and her self-reported adherence of the Driving Diary forms varied from 0% to 25%. P2 became comfortable with the driving simulator relatively quickly; she made few critical comments about the simulator. Her pre-treatment score on the Presence Questionnaire suggests that she found the simulator to be moderately realistic and she was able to become involved in the virtual environment. Similar to P1 and P5, her score further increased at the post-treatment assessment. P5 experienced numerous adverse driving-related events during the baseline, treatment, and follow-up phases (e.g., hearing about or witnessing an accident) that would temporarily exacerbate her symptoms. During the time between the follow-up assessments, she hit a large rock when she was driving, and may have affected the results at the 3-month follow up.

Conceptual and Methodological Issues

Outcome research for a range of specific phobias generally finds that although participants improve, exposure-based treatments often do not totally eliminate driving phobia symptoms and, there is considerable variation in the magnitude and pattern of treatment responses across participants (Barlow, 1997; Mavissakalian & Barlow, 1981). Similar findings were obtained in this study. This pattern suggests that specific variables may influence treatment outcome, yet it appears that no current theoretical models can fully account for these differences. Further discussions of these findings are described below.

Pre-treatment Subject Characteristics

All of the participants described marked and unremitting history of driving fear and avoidance symptoms, which gradually progressed in severity (e.g., increased phobic-related avoidance, interference, and distress). None had received previous treatment for the driving phobia. Although the five participants who completed treatment were similar on many characteristics (age, gender, employment, valid driver’s license, and primary diagnosis), some pre-treatment differences did emerge, particularly relating to driving history. For example, P4 learned to drive at a much older age than the other the participants and, P5’s driving exposure had
been primarily limited to rural communities. Two participants (P1 and P3) had prior involvement in motor vehicle accidents, and all described exposure to potentially dangerous driving situations (e.g., being almost hit by another car). Reasons identified by participants for the fear onset were consistent with Ehlers et al. (1994). The most commonly identified reason was traumatic experiences (e.g., motor vehicle accidents or close calls). Other reasons included observing others who were afraid to drive, hearing information about the dangers of driving, not enough training, and being criticized for poor driving. All but one participant (P3), had an immediate family member who was afraid too drive, and most often, it was the participant’s mother. Research for other specific phobias have also demonstrated considerable variation in fear acquisition pathways (Menzies & Clarke, 1995).

The prognostic value of demographic and pre-treatment subject characteristics for exposure-based treatment outcomes with specific phobia has not yet been determined (Hellstrom & Ost, 1997). To date, no research has yet examined the role of these variables in predicting VRET treatment outcome. Although this research project was not intended to investigate this issue, no clear pattern between demographic and other pre-treatment characteristics with treatment outcome emerged. This finding supports other research that has found considerable heterogeneity among specific phobias to (Antony et al., 1999; Menzies & Clarke, 1995; Wilhem & Roth, 1997), and emphasizes the need for larger scale research to further address the relationship between pre-treatment individual differences and treatment outcome.

**Participant Experiences with the Driving Simulator**

Although none of the pre-treatment variables appeared to be associated with treatment outcome in this study, exploratory findings from this study suggest that the participants’ experiences with the driving simulator during treatment may have played an important role. Unlike other phobia treatments, VRET for driving phobia used a driving simulator that involved a skill learning and performance component. Although driving skill (perceived or objective) and performance anxiety was not directly assessed in this study, participants appeared to vary widely
in their skill level and speed of mastery, and comfort with the simulator. Clarification of these associations as potential process variables and predictors of improvement is needed.

The three participants (P1, P2, and P5) who clearly improved also had more positive interactions with the simulator. In particular, P1 had no difficulties with the simulator and seemed to easily master the controls within the first exposure. P2 and P5 took slightly longer in learning and tended to drive slower than P1, but rarely made negative comments about the simulator or their driving performance. In contrast, the other participants (P3 and P4) who responded more poorly to treatment also experienced more difficulties with the simulator, and often made critical comments regarding their performance and the driving simulator. For example, P4 stated that the simulator “undermined my confidence with real driving.” These differences suggest that the participants’ experiences with the driving simulator may have contributed to the some of the variations in treatment outcome.

It is possible that participants who were overly focused on the simulator and their performance rather than the exposure itself, may have interfered with the potential therapeutic benefits of VRET. Several studies (Borkovec & Grayson, 1980; Craske, Street, & Barlow, 1989; Grayson, Foa, & Steketee, 1986; Kamphuis & Telch, 2000) that have examined the effects of distraction during exposure has shown that it interferes with fear reduction. From a theoretical framework, Rachman (1980) indicated that distraction prevents emotional processing. Foa and Kozak (1986) suggested that distraction inhibits the activation of the fear structure by disrupting the matching process because of competing information, and prevents adequate processing of corrective information, which is needed for modification of the fear structure.

A related factor that may have had some influence on outcome was treatment credibility. The participant who withdrew following the pre-treatment assessment described the simulator to be very rudimentary (e.g., graphics, driving controls). Unlike the other participants at the pre-treatment assessment, he often laughed while driving through a scenario and despite attempting to “suspend disbelief” described the simulator and driving experience as being very unrealistic. He
(like P1) mastered driving on the simulator within the first few scenarios and had the tendency to drive extremely fast. After the initial exposure on the simulator, this participant appeared clearly skeptical about the potential benefits of this treatment. Unfortunately, he could not be contacted after he withdrew and did not return the pre-treatment questionnaires. Although it impossible to determine the exact reasons for why he terminated his participation, it is quite plausible that the lack of perceived treatment credibility may have been a factor in his decision to withdraw. However, this finding raises the issue of the “face validity” of the treatment for participants.

Arousal and Habituation During VRET

Habituation or the extinction of the conditioned fear response is often described as a primary explanation for phobia reduction across exposure-based treatments. A common element of exposure is the prevention of avoidance or escape behavior during exposure to ensure maximal habituation. However, most agree that the specific underlying mechanisms of habituation and its relation to fear reduction remains unclear. Furthermore, exposure-based treatment outcome for other specific phobia finds considerable variation in the process of habituation in participants.

In this study, arousal and habituation was measured by subjective anxiety ratings. Mean peak anxiety scores for individual treatment sessions progressively decreased within and across treatment sessions. This response pattern has been replicated in the majority of other VRET treatment outcome studies for a range of phobias (e.g., North et al., 1996; 1997; Rothbaum et al., 1996), which seems to demonstrate that VRET facilitates a process of decreased anxiety upon repeated exposure to feared stimuli. However, consistent with the research literature, findings in this study showed considerable individual differences in peak anxiety ratings during exposure, as well as the timing and patterns of habituation. No clear pattern between subjective arousal and habituation with treatment outcome (e.g., responders versus non-responders) emerged.

Although there has been some speculation on arousal and habituation as predictors of treatment outcome, the role of these variables in specific phobia remains inconclusive (Hellstrom & Ost, 1996). Some studies have suggested that people who experienced heightened arousal
(physiological and/or subjective) during in vivo or imaginal exposure had more positive outcomes than people who did not (Lang, 1977; Michelson, et al., 1985). Other research has suggested that greater habituation (e.g., heart rate) in the initial stages of exposure treatment are associated with more positive treatment response (Mueser et al., 1991). No research to date has specifically examined these processes within VRET treatment research for specific phobias.

Arousal and habituation processes within exposure therapy have often been conceptualized using the theoretical framework of emotional processing. To maximize the benefits of exposure therapy, it has been suggested that moderate levels of arousal during exposure is necessary for optimal emotional processing (Foa & Kozak, 1986; Foa & McNally, 1996). According to this theory, moderate arousal to fear stimuli is needed to activate the fear structure. Insufficient arousal may result in the failure to activate the fear structure, which in turn inhibits emotional processing of the fear network.

Computer-aided exposure (e.g., looking at pictures of fear stimuli on the computer screen) has been found to be less effective than in vivo exposure (Dewis et al., 2001, Smith et al., 1997). These authors have posited that computer-aided exposure elicits lower levels of arousal (subjective and physiological) than in vivo exposure, perhaps because the stimuli are not "real enough," and are considered as non-threatening and harmless (Smith et al. 1997). It may also contribute to our understanding of why in vivo exposure is more effective than imaginal exposure because imagined fear stimuli may lack sufficient details and realism to sufficiently activate the fear structure. One could also speculate for the same reasons that VRET would be superior to imaginal or relaxation training. Only one study (Mulberger et al. 2001) has compared VRET and relaxation training and the effect size for the relaxation group was appreciably lower than the VRET group. It appears that no other published studies to date have examined the relative efficacy between VRET and imaginal exposure.

To date, VRET treatment outcome studies support the comparative efficacy of VRET and in vivo. For example, similar effect sizes were found between VRET and in vivo groups
(Rothbaum et al., 2000). These findings suggest that VRET may have sufficient realism for emotional processing, which may be comparable to in vivo exposure. However, given the limited number of comparative treatment studies, it would be premature to draw conclusions about efficacy or the underlying causal mechanisms of exposure therapy.

A number of authors (Carlin et al., 1997; Rothbaum et al., 1995) have attempted to explain the realism of virtual reality by the sense of presence, and have hypothesized that a higher levels of presence will contribute to more positive treatment outcomes. As noted in other studies (North et al., 1996; Rothbaum et al., 1995), not all people report a high degree of presence in VRET and the rate of progression through various VR scenes also varies across participants. In this study, the three participants (P1, P2, and P5) who had higher post-treatment Presence Questionnaire scores also had more positive treatment outcomes. Relating these findings to the theoretical model of emotional processing underlying VRET, it is possible that a sense of presence in the virtual environment renders a more realistic experience with the computer environment, and is more likely to activate the fear structure and emotional processing. Given this pattern of results, individual differences in the experience of presence may play an essential role in treatment response.

The Role of Driving Fear Cognitions.

A measure of driving cognitions was included as an exploratory measure in this measure, because of their hypothesized causal mechanisms in treatment improvement. Subjective appraisals, meanings, and beliefs (e.g., danger and threat expectancies, vigilance to signs of threat, prediction of fear) are considered to be important factors in maintaining and propagating fear responses in specific phobias as well as other anxiety disorders (Barlow, 1988; Beck et al., 1985; Chambless & Gillis, 1993; Craske, 1999; Salkovskis, 1995; Salkovskis & Hackmann, 1997; Taylor & Rachman, 1994). Consistent with driving fear research (Ehlers et al., 1994; Taylor & Deane, 1999, 2000), this sample were primarily concerned about the potential dangers of driving (e.g., motor vehicle accident, injury, losing control over the vehicle), and were less
worried about the effects of anxiety or social evaluation. Other specific phobias also typically involve concern regarding external dangers (Wilhelm & Roth, 1997). Phobic-based cognitions often result in avoidance of the fear stimuli, which in turn prevents the occurrence of new experiences that may disconfirm the validity of those beliefs and appraisals.

With regards to treatment outcome, there was a substantial decrease in the post-treatment Driving Concerns Questionnaire scores in the three participants (P1, P2, and P5). These scores continued to decrease at the 1-month follow-up. On the other hand, there was little change in P3 and P4’s post-treatment scores. In this study, the cognitive change in the three participants appeared to occur without a marked increase of actual driving exposure. It is possible that positive experiences during VRET provides a sufficient cognitive shift (e.g., negative expectations about driving, beliefs about one’s driving competency etc.) to produce behavior change (e.g., decreased subjective driving anxiety). In turn, new driving experiences provide a corrective process to facilitate further reduction in driving concerns. Clarification of cognitive modification as a causative agent in VRET is yet to be determined.

Recent treatment outcome studies for other specific phobias have attempted to facilitate the effects of in vivo exposure therapy by manipulating cognitive variables that are thought to facilitate emotional processing. Kamphuis and Telch (2000) and Sloan and Telch (2002) examined how guided threat reappraisal during exposure might improve treatment outcome of specific phobias. Based on Foa and Kozak’s (1986) theory, the authors proposed that having participants deliberately focus their attention on fear stimulus and response elements of their core threats to facilitate emotional processing. As a second part, participants tested the accuracy of these appraisals during the exposure to facilitate threat disconfirmation. This corrective information is believed to result in enhanced modification of the fear structure.

To date, the efficacy of cognitive therapy in driving phobia treatment has not been investigated. The benefit of targeting specific driving fear cognitions, safety behaviors, and avoidance (cognitive and visual) during exposure therapy is also unknown and warrants further
research efforts. Unlike many other specific phobias, driving phobia actually involves a realistic possibility of having their worst fears or expectations actually occurring (e.g., being in a motor vehicle accident, making a driving mistake). Furthermore, driving phobia can be precipitated by a motor vehicle accident, which gives the individual "evidence" for the basis of their driving concerns. In this study, P3 was involved in a car accident prior to the 3-month follow-up and P5 was involved in an aversive driving situation, in which she hit a large rock while driving. As a result, cognitive strategies for treating driving phobia concerns may be more difficult to achieve, or may require specific modifications. Given the prevalence of motor vehicle accidents, rather than attempting to disconfirm this belief, addressing the overestimation danger, beliefs regarding abilities to drive and averting potentially dangerous situations may be useful.

Transfer of VRET to "Real-life" Driving.

Successful transfer to the real world has also been demonstrated in several VRET treatment outcome studies (North et al., 1996, 1997, Rothbaum, 1995, 1996, 2000). However, this study failed to show a noticeable increase in actual driving frequency by the end of treatment for any of the participants. It appears that VRET alone for this sample was not able to produce improvement in driving frequency. During treatment, to avoid confounding in vivo driving with VR driving on treatment outcome, participants were told at the baseline assessment that they would not be asked to drive during the study, and changes in their driving frequency would be at their discretion.

One would expect that fear-reduction covaries with a reduction of avoidance behavior. However, desynchrony between actual avoidance behavior and subjective levels of anxiety are frequently reported in the anxiety disorder literature. In this study, there was a discrepancy between the participants' self-reported phobic anxiety and avoidance and their actual behavior of driving frequency. This could possibly be explained by the lack of increased "real life" driving during or following treatment to facilitate further symptom reduction. Weekly homework assignments (e.g., in vivo driving trips) were not included homework in between sessions because
of the purpose of this study was to examine the efficacy of VRET alone. If homework assignments had been included during treatment, it would have been difficult to discern the differential treatment effects between VRET and homework.

P1's response pattern during treatment suggests that increased driving facilitated a sharp drop in her anxiety and avoidance symptoms during treatment. However, it was not possible in this design to separate the relative influences of VRET and real driving on treatment outcome. Although one could speculate that VRET and real driving had a mutual and interactive effect on symptom change. This finding may indicate that treatment that combines real driving with VRET could produce stronger treatment outcome than VRET alone. As one participant (P4) noted that the VRET was not sufficient in helping her drive more regularly and that she needed more support to help her overcome the driving phobia.

There was a lack of concordance between self-reported avoidance on Main Target Phobia ratings and actual driving frequency. Changes in driving frequency were minimal, yet all participants reported varying change in subjective avoidance and anxiety. Driving diary records, one-week probes at post-treatment and follow-up assessments may have been too short of a period to capture true driving frequency. Frequency data in other research has been also been identified as problematic by other researchers as being unreliable (De Beurs et al., 1994). Alternative measures of driving behavior over a longer duration than one week rather than driving frequency may be more useful (e.g., expected anxiety, peak anxiety, goal attainment scale).

Return of Symptoms at Follow-up Assessments

It is not uncommon for some individuals to experience a return of fear after treatment has ended. In this study, there was considerable variation in the loss of treatment gains at the follow-up assessments. There was a slight loss of gains in the three participants (P1, P2, and P5) who improved, but their follow-up scores remained far below pre-treatment values. Conversely, P3 and P4 showed a dramatic loss of gains, at the follow-up assessments and some of their scores had returned to pre-treatment values. Furthermore, P4 experienced worsening in her some of her
symptoms (e.g., decreased driving frequency). The return of fear (Rachman, 1979), or the reappearance of fear following a period of fear reduction, in some participants may be explained in terms of incomplete emotional processing during exposure treatment.

No VRET treatment outcome research to date has examined optimal variable of VRET to prevent the return of fear, such as the spacing of sessions and number of sessions. Typically VRET treatment studies have either used one or two sessions a week and both seem to produce similar treatment effects. Although this could suggest the possible robustness of the treatment regardless of the actual timing of sessions, additional research is needed. Prolonged exposures (e.g., 2 hours) would not be possible with VRET is that because of increased risk for simulator sickness which has been found in extended exposure lengths. Although not entirely consistent, some research has found higher rates of return of fear in massed exposures, as compared to spaced exposures (Lang & Craske, 2000; Rowe & Craske, 1998). Furthermore, spaced sessions may have greater client acceptability and lower treatment attrition (Barlow, 1988; Chambless, 1990). These authors have also suggested the importance of an expanding-spaced exposure schedule to further inhibit the reemergence of fear. Rowe and Craske (1998) have also found that the exposure-based treatment protocols that include a wide range of fear stimuli in varying contexts also inhibited the return of fear.

Adverse driving and non-driving related events after treatment ended may have also contributed to the loss of gains in some participants. For example, P1 reported that she wasn’t driving because of significant personal stressors at the follow-up assessments. P3 described several significant outside events in the treatment and follow-up phases. P4 indicated that her symptoms were exacerbated at the follow-up assessments partially due to the transition into winter driving conditions.

The Role of the Therapist, Therapeutic Relationship, and other Non-Specific Factors

The role of common factors in VRET (e.g., the therapeutic relationship, therapist characteristics as not received attention. To date, no process research on non-specific factors in
VRET has been published. VRET as with any other exposure-based treatment occurs within the context of a collaborative therapeutic relationship (Cahill, Carrigan, & Evans, 1998; Feldman, 1976; Garfield, 1995; Lewis, Hayes & Lewis, 1986; Rogers, 1957; Williams & Chambless, 1990).

The key ingredients in the therapeutic relationship (e.g., therapist competence and expertise, encouragement and reinforcement of change, warmth, acceptance, social influence) on exposure-based treatments, including VRET, has received limited attention. Keijsers, Schaap, Hoogdhuin and Lammers (1995) reported that these non-specific factors early in treatment predicted stronger treatment response. However, these variables were not addressed in this treatment study, and clarification of this aspect of treatment awaits future research. Overall, the use of computers and technology within the therapeutic process has received little attention and as technology continues to play a more predominant role in our lives and within the practice of psychotherapy, it is not overlook the importance of the therapeutic relationship.

Measurement Issues

The lack of measures that specifically designed to assess driving phobia symptoms limited the choice of measures that could be used in this study. A structured diagnostic interview (SCID) was used as a screening measure to determine the DSM-IV primary disorder at admission. As another descriptive measure, The Driving History Interview (Ehlers et al., 1994), was chosen because of its comparability to other driving fear research, but is limited by its lack psychometric data.

The specific phobia portion of the SCID was readministered at post-treatment and follow-up assessments as a global outcome measure of clinical significance. The Main Target Phobia and Global Phobia items from the Fear Questionnaire (Marks & Mathews, 1979) were used because of their strong psychometric properties and sensitivity in detecting treatment effects. The remaining treatment outcome measures were modified from existing measures that have been used in other phobia research (e.g., behavioral avoidance tests, target fear lists). I developed many
of the outcome measures from existing instruments and, with the exception of the Main Target Phobia and Global Phobia, their psychometric properties are unknown.

Exploratory measures were also used to examine other variables that may have influenced treatment process and outcome. These measures included driving related cognitions (Driving Concerns Questionnaire), experiences within the virtual environment (Presence Questionnaire), general treatment satisfaction (Client Satisfaction Questionnaire), concurrent events outside treatment (Adverse Events Checklist), motivation and adherence to self-monitoring (Self-Monitoring and Motivation Checks), and general feedback (Research Participant Feedback Questionnaire). It would be interesting to further examine the role of these variables in relationship to treatment outcome (e.g., predictors of outcome).

Criteria for treatment outcome vary among treatment studies and there is no consensus on the ideal measurement criteria. The problems of solely relying on visual analysis in single case research has been widely recognized (Franklin, et al., 1996). To overcome these issues, a standardized visual analysis procedure was used to classify participants as clearly improved, marginally improved, or not improved. Statistical procedures were also used and, results from these different techniques were compared (Gorman & Allison, 1996). The integration of visual and statistical analysis procedures proved to be very useful in this study in providing confirmatory objective information about treatment outcome.

Findings from the statistical procedures also highlight important issues that require further clarification. Discrepant results were between the visual and statistical analyses on the Target Fear List and Driving Anxiety Test for all of the participants. On these measures, the visual statistical method often classified these measures as marginally improved, whereas the ipsative z-score statistical method did not find the change to be statistically significant. These measures had substantially fewer data points, which varied from two to four for each participant, as compared to the Driving Diary data, which ranged from 26 to 39 data points. This finding raise questions regarding the power of this statistical technique when autocorrelations are based on
very few data points. The number of data points necessary to calculate an autocorrelation for the Critical Difference scores remains controversial, and it is possible that statistical significance of these two measures was not obtained because of insufficient power.

Although the importance of using measures with high reliability coefficients has been recommended for the ipsative z-score statistical method, this was difficult to achieve in this study, given the limited availability of this type of data in existing driving phobia measures. In this study, the test-retest reliability coefficients of three measures (driving frequency, Driving Anxiety Test, and Target Driving Fear List) were not known. For these measures, the lag-1 autocorrelation was used as an estimate of the measure’s reliability. Nishith et al. (1995) has shown that it is more difficult to obtain statistical significance in measures with lower reliability (e.g., higher reliability coefficient will produce lower CD values). This is also true for the autocorrelation, when it is used as a reliability estimate. The CD values for Main Target Phobia and Global Phobia measures were considerably lower than those obtained for the other measures (driving frequency, Target Driving Fear List, and Driving Anxiety Test). Conversely, the autocorrelation values of these three measures were substantially smaller than the test-retest correlation coefficients for Main Target Phobia and Global Phobia measures.

All of the participants acknowledged not completing the daily Driving Diary forms at levels ranging from 25 to 75% of the time. Yet when the forms were checked for missing data, there was very little. This suggests that participants most likely completed the forms at one sitting, possibly before attending the session (e.g., while waiting for the appointment). Problems with adherence to the homework may have affected the treatment results, yet the relationship between adherence and outcome is not known (Craske, 1999). Future treatment protocols that build in more attention to homework adherence to self-monitoring may enhance the validity of the results.
Generalizability of Results

A direct replication strategy (Barlow & Hersen, 1984, Hersen & Barlow, 1976; Kazdin, 1982, 1999) was used in this study, which involved the recruitment of a relatively homogenous sample based on strict inclusion criteria. As a result, generalizability of the results to the target population is limited to other individuals with similar characteristics to the sample’s composition, which included treatment seeking individuals with a primary DSM-IV driving phobia diagnosis with similar subject characteristics (e.g., middle adult aged females). Results cannot be extrapolated to people whose driving fear is associated with a different primary disorder such as agoraphobia with a history of panic disorder, post traumatic stress disorder, or social phobia. It was not known whether similar results would be obtained in samples with different subject characteristics (e.g., young adults with limited driving exposure, people who have no driving experience).

Another limitation of generalizability relates to the setting, time, and stimulus conditions. With respect to the setting, results of this study can only be generalized to a university research setting using this treatment protocol and driving simulator. Follow-up assessment was limited to three months, therefore it was not be known if treatment effects were maintained over a longer duration. The assessment (stimulus) characteristics of this study may also limit the extent to which the results can be generalized to other assessment approaches. The provision of detailed information regarding the assessment (e.g., use of a structured diagnostic interview and other treatment outcome measures) and treatment conditions (e.g., treatment protocol, treatment adherence ratings, treatment outcome criteria) facilitates generalizability, as it allows independent researchers and sites to attempt to replicate the results.

Contributions and Future Directions for Research and Practice

There are several potential methodological, empirical, and clinical contributions of this study. For psychotherapy outcome research, this study demonstrates the valuable role of single case experimental research, which has been relatively underutilized. From a methodological
perspective, single case research provides several advantages that include intensive examination of treatment outcome for a small number of individuals. This study used strict criteria and procedures for assessing treatment outcome. Statistical procedures in single case psychotherapy studies has been underused, and although there have been many problems associated with relying on visual analysis procedures alone, they remain the primary method of assessing the significance of change. This study demonstrates how visual and statistical analysis can be integrated, and provide converging evidence about treatment outcome, and strengthen the validity of causal inferences.

The efficacy of VRET for driving phobia has not yet been determined, and this design demonstrates the valuable role of how this type of experimental design can provide information about treatment outcome. It can also identify treatment components or variables that may facilitate or inhibit VRET response, and prevent return of fear. In turn, these findings can be used to modify the treatment to possibly enhance client outcome. Although it was expected that driving frequency would increase between pre- and post-treatment assessments, the failure to obtain such results is an important finding. It implies that VRET alone may not be sufficient in the treatment of driving phobia. Findings from this study, also draw attention to other unique aspects of driving phobia that warrant further investigation, such as the role of driving skill (on-road and simulator), presence, driving concerns, and performance anxiety. As further evidence mounts towards establishing VRET as an efficacious treatment for specific phobias, more research on identifying predictors of improvement with larger scale studies will be needed to guide treatment formulations and client-treatment matching.

The Driving History Interview examined some aspects of their driving history (e.g. age to first obtain driver's license), but it did not assess actual driving experience, experience in different driving situations, and subjective appraisals of perceived driving skills and aversive driving events. It appears that no studies to date have specifically examined driving ability in people with driving phobia. There is some research to suggest that driving ability may actually be
impaired in heightened anxiety states. Objective measures of simulator driving performance are
being built into the DriVR™, and these might be useful in further investigating the role of driving
skill on outcome in future research. Another possibility would be to include other objective
measures of driving skill (e.g., a standardized closed-course road test), and its relation to
subjective anxiety. It may also be useful for future research to systematically examine the role of
comfort and familiarity with computer technology, the credibility of treatment rationale and
treatment expectations (Hillenberg & Collins, 1983), and motivation.

Stronger treatment effects could possibly be obtained by exposing participants to VR
situations that target specific driving fears, thereby possibly eliciting slightly higher levels of
arousal in participants, and matching greater number of driving fear stimuli, which is thought to
be necessary for optimal emotional processing. In this study, six standard scenarios were used,
which were then modified to model different driving conditions. These scenarios were chosen to
allow participants to practice residential, highway, and urban driving. Once participants became
acustomed to the scenario, and events within the scenario became predictable (e.g., a car pulling
out in front of the participant), they evoked little anxiety when different weather conditions were
added. Further improvements to the driving simulator, by adding in more scenarios of different
complexity, variety, and unpredictable events, would allow greater realism and tailoring of VRET
to an individual's specific driving concerns, which in turn could facilitate greater treatment
results. As virtual reality technology improves, greater realism in fear stimuli can be expected.
The addition of other components with VRET may also augment treatment response, such as
behavioral homework assignments (e.g., in vivo driving), as well as cognitive strategies (e.g.,
threat reappraisal, the effects of cognitive or visual avoidance, coping statements).

Direct replication of this study by independent researchers is an important step to
establishing VRET as an empirically-supported treatment for driving phobia. Systematic
replication procedures could examine the generalizability of this treatment to other driving fear
sub-types (e.g., people who have been unable to get their driver's license due to a driving fear,
people with driving fear associated with panic disorder with agoraphobia or posttraumatic stress disorder). Additional single case research has much to offer and could shed further light on the treatment components that facilitate more positive outcomes. This could be explored by using an alternating treatment design which counterbalances different treatment components across individuals (e.g., VRET and in vivo, VRET and imaginal). It would be useful for future research to include homework as part of the VRET (e.g., randomized control group design with one group receiving VRET and one group receiving VRET plus in vivo homework). Other dismantling strategies used in single case research would also be useful to identify specific active ingredients of VRET. Maintenance of gains was limited to a 3-months post-treatment, and future outcome studies should consider longer term follow-up assessments.

Summary and Conclusions

In summary, as compared to other specific phobias, there has been little descriptive research on their clinical characteristics, and even less on treatment outcome. Findings from this study provided additional information about this disorder, which have important contributions to the anxiety disorder literature and to specific disciplines including clinical, counselling, and rehabilitation psychology. The sample in this study of five treatment seeking adults reported a chronic and intractable driving phobia, which caused significant distress and functional interference. Recognition of this fear in treatment settings is important, as is provision of acceptable and effective treatment modalities. VRET appears to be a potentially beneficial treatment medium that may encourage more people with this phobia to come forward for treatment and serve as an important bridge to real driving. The methodological rigor used in this treatment study also demonstrates the valuable role of single case experimental research and the integration of visual and statistical procedures for assessing treatment outcome. Findings from this research identified several areas for future investigation and proposed ways for ultimately improving treatment outcome for people with driving phobia.
REFERENCES


Appendix A

Summary of VRET Phobia Treatment Outcome Studies

List of Tables

Table A-1 Summary of VRET Phobia Treatment Outcome Studies. ........................................... 177
Table A-1

Summary of VRET Outcome Studies for Phobia Treatment

<table>
<thead>
<tr>
<th>Author</th>
<th>Description of Design &amp; Sample</th>
<th>Outcome Measures</th>
<th>Description of Treatment</th>
<th>Treatment Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botella et al. (1988)</td>
<td>Case report with pre- and post-treatment assessments</td>
<td>Fear &amp; Avoidance Scales, Fear of Closed Spaces Measure, Problem-Related Impairment, Questionnaire, Self-Efficacy, Towards the Target Behavior Measure, Attitudes Towards CTS Measure</td>
<td>8 sessions over 3 weeks (35 - 45 minutes each)</td>
<td>Pre- to post-treatment improvement (↓ anxiety and avoidance), Gains maintained at 1-month follow-up</td>
</tr>
<tr>
<td>Botella et al. (2000)</td>
<td>Nonconcurrent multiple baseline across subjects design with pre- and post-treatment assessments</td>
<td>Behavioral Avoidance Test, Fear Record, Problem-Related Impairment, Questionnaire, Anxiety Sensitivity Index</td>
<td>8 sessions (2 sessions/week, 35-45 minutes each)</td>
<td>Pre- to post-treatment improvement (↓ anxiety and avoidance), Gains maintained at 3-month follow-up</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Fear of Flying Scale</td>
<td>General Fear of</td>
<td>VRET</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>----------------------</td>
<td>-----------------</td>
<td>------</td>
</tr>
<tr>
<td>Muhlbefer et al.</td>
<td>Experimental group design with pre- and post-treatment</td>
<td>Fear of Spiders Scale</td>
<td>VRET, she received exposure to spider photographs</td>
<td>VR tactile augmentation, 8 sessions (50 minutes)</td>
</tr>
<tr>
<td>Carlin et al. (1997)</td>
<td>Case report with pre- and post-treatment assessments</td>
<td>4 graded sessions (50 minutes) + 8 VR tactile augmentation sessions</td>
<td>For Spiders Scale</td>
<td>VR &gt; relaxation</td>
</tr>
<tr>
<td>al. (2001) post-treatment assessments</td>
<td>Flying Questionnaire</td>
<td>exposure flights in one session (each flight = 16 minute duration, total = 64 minutes)</td>
<td>Subjective fear (SUDS) and physiological (heart rate and skin conductance) measures within and across VR flights</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>n = 30 randomly assigned to VRET (n = 15) or relaxation (n = 15)</td>
<td>Danger Expectancy Scale</td>
<td>Anxiety Expectancy Scale</td>
<td>Anxiety Sensitivity Index</td>
<td></td>
</tr>
<tr>
<td>100% = DSM-IV specific phobia (flying)</td>
<td>3 pre-treatment assessments pre1 = (3 weeks prior to treatment, pre2 = 1 week prior to treatment, and pre3 = immediately before treatment session)</td>
<td>Both groups completed pre- and post-treatment flight tests (immediately before and after treatment)</td>
<td>Both groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 post-treatment assessments (post1 = immediately after treatment session; post2 = 2 weeks after session; post3 = 14 weeks after session)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study Authors</td>
<td>Case Report with Pre- and Post-Treatment Assessments</td>
<td>Subjective Units of Distress Scale (SUDS)</td>
<td>8 Sessions of Pre- to Post-Treatment Graded VRET Improvement (↓ Anxiety and Avoidance)</td>
<td>Pre-follow-up</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>North &amp; North (1996)</td>
<td>Male with DSM-IV Acrophobia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n = 30 Randomly Assigned to VRET Group (n = 30) or Wait List Control Group (n = 30)</td>
<td></td>
<td></td>
<td>80% of VRET Group Had ↓ in SUDS Across Sessions</td>
</tr>
<tr>
<td></td>
<td>100% = DSM-IV Agoraphobia</td>
<td></td>
<td></td>
<td>50% ↓ in SUDS Across Sessions</td>
</tr>
<tr>
<td>North et al., (1997)</td>
<td>Case Report with Pre- and Post-Treatment Assessments</td>
<td>No Psychometric Measures Used, Only Subjective Units of</td>
<td>5 Sessions (20 to 30 Minutes)</td>
<td>Pre-follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Improvement (↓ Anxiety)</td>
</tr>
<tr>
<td>Study</td>
<td>Participants</td>
<td>Measures</td>
<td>Treatment</td>
<td>Results</td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td>----------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Distress Scale</td>
<td>42 year old male with fear of flying (he was treated for acrophobia in the above study)</td>
<td>SUDS (SUDS)</td>
<td>graded VRET symptoms, ↑ flying frequency</td>
<td>↓ SUDS across and within treatment sessions No follow-up</td>
</tr>
<tr>
<td>Rothbau et al. (1995)</td>
<td>Case report</td>
<td>Acrophobia Questionnaire, Attitudes Towards Heights Questionnaire, Behavioral Avoidance Test Fear Questionnaire (Degree of Distress)</td>
<td>5 graded VRET sessions (35 to 45 minutes) over 3 weeks</td>
<td>Pre- to post-treatment improvement (↓ anxiety, avoidance, and distress) No follow-up phase No control over in vivo exposure to heights during treatment</td>
</tr>
<tr>
<td>Rothbau et al. (1995)</td>
<td>Experimental group design with pre- and post-treatment assessments n = 20 randomly assigned to VRET (n = 12) or wait list control group (n = 8)</td>
<td>Acrophobia Questionnaire, Attitudes Towards Heights Questionnaire Fear Questionnaire (Degree of Distress)</td>
<td>7 weekly VRET sessions</td>
<td>VRET &gt; wait list ↓ SUDS across and within treatment sessions Attraction = 2 (VRET) + 1 (wait list) No follow-up</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Participants</td>
<td>Measures</td>
<td>Interventions</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>--------------</td>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>Rothbau et al., (1996)</td>
<td>Case report</td>
<td>42 year old female with DSM-IV specific phobia (flying)</td>
<td>Fear of Flying Inventory, Self-Survey of Stress Response, Clinical Global Improvement Questionnaire on Attitudes Towards Flying</td>
<td>7 sessions anxiety management training + 6 weeks graded VRET + post-treatment flight 2 days after last session</td>
</tr>
<tr>
<td>Rothbau et al. (2000)</td>
<td>Experimental group design with pre- and post-treatment assessments</td>
<td>N = 49, randomly assigned to VRET, standard in vivo, or wait list control group</td>
<td>Questionnaire on Attitudes Towards Flying Clinical Global Improvement Fear of Flying Inventory</td>
<td>8 sessions over 6 weeks (1 hour each)</td>
</tr>
</tbody>
</table>

Causal inferences confounded by in vivo exposure of 7 of VRET group during treatment (without therapist instruction)
<table>
<thead>
<tr>
<th>93% = DSM-IV specific phobia, 7% = panic disorder with agoraphobia</th>
<th>vivo treatment</th>
<th>Causal inferences confounded by pre-treatment anxiety management</th>
</tr>
</thead>
<tbody>
<tr>
<td>post-treatment in vivo flight</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Downward arrow (↓) = decreased scores (improvement in symptom). Upward arrow (↑) = increased score (improvement in “real-life” exposure). Outcome represented by symbols (>) for superiority of one treatment modality over another and (=) for no difference between treatment modalities.
Appendix B

Copy of the Informed Consent Form and Certificate of Ethics Approval
includes another interview, some questionnaires, and having you drive through six different VR driving scenarios. After the treatment sessions are completed, you will be asked to attend a post-treatment assessment, which will take approximately 2-3 hours to complete, which includes another interview, some questionnaires, and having you drive through the VR driving scenarios again. You will be asked to attend a 2-3 hour follow-up assessment one and three months after your treatment is over.

Since this is a research study, we will evaluate your progress in somewhat greater depth than we would for routine clinical purposes. To determine the efficacy of VR exposure therapy, we will primarily focus on patterns and changes in your driving phobia symptoms over the course of the study. Therefore, we may be asking you to monitor your driving and your driving phobia before, during, and after treatment using forms that we will give you. Diagnostic accuracy is vital for ensuring you receive appropriate treatment. In order to ensure the accuracy of our diagnoses, our diagnostic interview and therapy sessions will be audiotaped and reviewed each week by either the principal investigator, Dr. Beth Haverkamp, a registered psychologist, or by Dr. Steven Taylor, a registered psychologist in the Department of Psychiatry at UBC, who is also a member of her dissertation committee. Audiotaping ensures that the assessments and treatment are administered in the best possible manner.

Potential Risks:

A small number (approximately 10%) of people who use VR systems experience motion sickness, which may include symptoms of dizziness, nausea, drowsiness, or blurred vision. People who have experienced motion sickness in the past are most susceptible to experiencing VR motion sickness. As a result, we are not allowing people who have a history of motion sickness to participate in the study. Before, during, and after the treatment sessions, your therapist will also be monitoring you for signs of motion sickness. Extra precautions will also be taken to minimize the possibility of these symptoms, such as gradually increasing VR exposure time. You will be encouraged to report these symptoms if they occur and the VR exposure will be immediately stopped. Typically, if symptoms occur, they subside shortly after the VR exposure is stopped. There are no known long-term risks for VR exposure, particularly for exposures of short durations. Finally, you will be provided with an information sheet to give you additional information about VR motion or “simulator” sickness symptoms.

Research has shown that exposure therapy is the treatment of choice for phobias, where exposure to frightening situations results in fear reduction. In this study, you will be exposed to simulated driving conditions which may cause transient anxiety or fear, which will usually subside with continued exposure to the fearful situation. However, the choice of driving conditions and rate of progression will be under your control. At any point, if you become too fearful, you will be able to stop the VR immersion.
Appendix C

Summary of Research Participants who Withdrew from the Study
Research Participant (P6)

P6, a 31-year old Caucasian male lab technician dropped out of the study after the pre-treatment assessment. He withdrew from the study before completing the Driving History Interview, information regarding his driving background is limited to notes taken at the pre-treatment telephone interview. In the interview, P6 reported that he had always felt uncomfortable about driving and deliberately avoided learning how to drive until the age of 30. At that time, he learned to drive through a driving school and obtained his driver’s license on his first attempt. Since getting his license, P6 has drove once. His primary driving concerns were fears of causing a motor vehicle accident, being uncomfortable with the car size, and feeling a lack of control over the vehicle. He reported no history of motor vehicle accident involvement. He has relied on cycling as his primary mode of transportation during his adulthood and adjusted his lifestyle around not driving. However, he acknowledged that he felt embarrassed by not being able to drive and wanted to be able to drive in the city (e.g., daily activities, social activities) without distress.

At the pre-treatment assessment, he completed the six standard driving VR scenarios, and his peak anxiety ranged from 20 to 30. He frequently laughed as he drove on the simulator and often had to be reminded to drive more slowly. After finishing the last scenario, he indicated that the simulator was not realistic and this would be a major barrier in treatment. His expected peak anxiety ratings on the Fear Hierarchy of Virtual Driving Situations ranged from 20 to 50. He cancelled the first treatment session and did not return telephone messages or the pre-treatment assessment questionnaire package to the therapist. As a result, the reason(s) for withdrawing from the study cannot be verified.

Research Participant (P7)

P7 was a 57-year old Caucasian single female who worked in a retail sales position. P7 relied on public transportation and had been unable to travel to work for almost two months during a municipal public transit strike. She became increasingly concerned about losing her job
and incurring financial difficulties, and decided to buy a car despite her long-standing fear of
driving. However, after she purchased the vehicle, P7 experienced intense anxiety when she tried
to drive, and stopped making attempts shortly after. She was very motivated to obtain treatment
for her driving fear, so that she would be able to begin driving as soon as possible. Her motivation
was also reflected by her willingness to walk (1 hour one-way) to the appointments for the
admissions interview and pre-treatment assessment. However, after the first treatment session,
she reluctantly decided to withdraw from the study because she found the long walks to the
appointments too time consuming and exhausting. P7 also indicated that she was “forcing”
herself to drive and was planning to take some driving lessons.

With regards to her driving history, P7 15 years old when she learned to drive and
recalled feeling somewhat anxious while learning. For the next several years, she did not need to
drive and never tried getting her driver’s license, but she did not recall feeling fearful of driving
during that time. At age 32, she took driving lessons and passed her driver’s examination on her
first attempt. After getting her license, she drove for the next seven years with little anxiety. She
started to fear and avoid driving at age 39. During this time, she identified a number of non-
driving related stressors (financial, relationship, work) as well as several negative experiences
with driving (e.g., car breaking down frequently). Since that time, her driving fear gradually
increased in severity and she also became fearful as a passenger in some driving
situations. Although she became accustomed to the restrictions of not driving, it caused
interference in daily functioning and she was bothered by the dependency on her husband to
drive. For the next several years, she drove only when it was absolutely necessary.

At the time of the study, her primary driving concerns was being injured and disabled in a
motor vehicle accident. Information about accidents and the potential dangers of driving in the
news (e.g., road rage) would temporarily exacerbate her driving fear. She noted that her mother
was afraid to drive and she always relied on her father to drive. She indicated that the three most
important reasons that led to her driving phobia were: not enough training, bad experiences with
car breaking down, and traumatic experiences. With regards to accident involvement, P7 was in a car accident at age one, in which the car she was riding in hit ice on the road and rolled over. She indicated that her parents told her that she would become very upset and anxious whenever she rode in a car following this accident. She noted that the fear eventually subsided after a number of years.

**Pre-Treatment Assessment Data.** P7 completed all six standard driving scenarios with peak anxiety ratings ranging from 20 to 50. She reported a number of physical reactions after each scenario (face flushing, shallow breathing, sweaty palms). On the second scenario, P7 reported mild dizziness and stomach awareness. She completed the remaining scenarios and the sensations gradually diminished. After finished the last scenario, P7 became very nauseous, and this symptom lasted for a few minutes. On the Fear Hierarchy of Virtual Driving Situations, she expected to experience moderate to high levels of anxiety across the 18 scenarios, with peak expected anxiety ranging from 50 to 90. Before leaving the assessment, she acknowledged feeling quite surprised by the physical reactions and high subjective anxiety levels while driving on the simulator. P7 indicated that she wanted to continue with the treatment and attributed the nausea and dizziness to anxiety than simulator sickness.

**Treatment Session 1.** Since P7 experienced simulator sickness at the pre-treatment assessment, a modified treatment protocol was used in the first treatment session (see Appendix G, for the Treatment Protocol Modification for Simulator Sickness). In the initial session, her peak anxiety ratings gradually diminished across trials. P7 experienced with minimal sensations of simulator sickness. She reported feeling pleased with the session and was relieved at not experiencing more severe simulator sickness symptoms.
Appendix D

Copies of the Instruments Developed for this Study

Table of Contents

I. Driving Diary Form.................................194
II. Driving Anxiety Test Form..........................195
III. Target Fear List Form..............................196
IV. Research Participant Feedback Questionnaire...........197
V. Adverse Events Checklist..............................198
VI. Self-Monitoring and Motivation Checklist..............199
Driving Fear Diary

Driving Avoidance. How would you rate the degree to which you would avoid driving today on the scale below?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>not avoid it</td>
<td>slightly avoid it</td>
<td>definitely avoid it</td>
<td>markedly avoid it</td>
<td>always avoid it</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Present State of Driving Phobia Symptoms. How would you rate the state of your driving phobia symptoms today on the scale below?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>no phobia</td>
<td>slightly disturbing/ not really disabling</td>
<td>definitely disturbing/ disabling</td>
<td>markedly disturbing/ disabling</td>
<td>very disturbing/ disabling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Driving Frequency. If you drove today, please record all trips you made by filling out the following section. Peak anxiety* is the highest anxiety rating you experienced during the trip, based on the scale from 0 (no anxiety) to 100 (extreme anxiety).

<table>
<thead>
<tr>
<th>Trip</th>
<th>Alone or with passengers</th>
<th>Driving time (minutes)</th>
<th>Description of driving route, time of day, driving &amp; weather conditions</th>
<th>Peak Anxiety* (0 - 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Driving Test

Using the top section of the form (pre-test information), choose a route that you would rate as fairly anxiety-provoking, but one that you believe you could complete (i.e., a route that you would rate approximately 80 on a scale from 0 to 100 (0 = no anxiety; 100 = extreme anxiety). Pick a route that doesn’t vary and one that could be repeated under similar conditions. Also rank your estimated confidence level from 0 to 100 (0 = no confidence that you would be able to complete the route; 100 = total confidence that you would be able to complete the route). Immediately after you complete the test, fill out the bottom section of this form (test results). Bring this form back to your next session in sealed envelope. Remember with this test, you can remove yourself from the situation at anytime or can refuse to do it.

<table>
<thead>
<tr>
<th>Pre-Test Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Designated Test Route:</td>
</tr>
<tr>
<td>Estimated Distance and Completion Time:</td>
</tr>
<tr>
<td>Estimated Anxiety Level from 0 to 100: (0 = No Anxiety; 100 = Extreme Anxiety)</td>
</tr>
<tr>
<td>Estimated Confidence Level from 0 to 100 (0 = No Confidence; 100 = Total Confidence)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: _____ Time of Day: _____</td>
</tr>
<tr>
<td>Description of Weather &amp; Driving Conditions:</td>
</tr>
<tr>
<td>Peak Anxiety Rating from 0 to 100: (0 = No Anxiety; 100 = Extreme Anxiety): _____ (Peak = highest anxiety level experienced during test)</td>
</tr>
<tr>
<td>Time Driving on Route (minutes): _____</td>
</tr>
<tr>
<td>Alone or with Passenger: _____</td>
</tr>
<tr>
<td>Please check: Completed test route _____</td>
</tr>
<tr>
<td>Partially completed test route _____</td>
</tr>
<tr>
<td>(Estimated % of route completed _____)</td>
</tr>
</tbody>
</table>
Target Driving Fear List

On the following page, please write down three driving situations you are most afraid of. List the fears from most to least severity. Under each scale, circle or underline the severity of each fear using the scale provided. Try to be very specific and concrete in describing your target driving fears.

Target Fear #1

_______________________________________________

_______________________________________________

_______________________________________________

Judged Severity:

Absent  Trivial  Mild  Moderate  Severe

Target Fear #2

_______________________________________________

_______________________________________________

_______________________________________________

Judged Severity:

Absent  Trivial  Mild  Moderate  Severe

Target Fear #3

_______________________________________________

_______________________________________________

_______________________________________________

Judged Severity:

Absent  Trivial  Mild  Moderate  Severe
Research Participant Feedback Questionnaire

This questionnaire includes a number of questions to help evaluate the treatment you received. In answering these questions, please feel free to comment on the driving simulator, the therapist, homework forms, the treatment format (e.g., length, content), or anything else you found to be relevant. Your honest feedback, either negative or positive, is greatly appreciated!

What were the most helpful aspects of the treatment you received?

What were some of the aspects of the treatment, which you believe could be improved?

What were some aspects of the treatment, which you believe contributed to the change of your driving fear symptoms (e.g., reduced driving anxiety, increased driving frequency etc). If no change occurred, please feel free to comment on possible reasons for this outcome as well.
Life Events Checklist

During your participation in this treatment study, it is important to monitor significant events that happen to you outside of your treatment, which might affect your progress, motivation, interest, or ability to attend sessions and complete the self-monitoring tasks. Please use the following checklist to indicate whether you have experienced any of these events, difficulties, or stressors during the last week. Briefly describe each event/situation you have experienced. When you are finished, please give this form to your therapist, who may ask you some additional questions about these experiences to clarify the impact they are having on you. However, these stressors or difficulties cannot be addressed in this treatment study. Please remember to indicate the date you fill this form out.

Driving Situations and Events:

- Witnessed a car accident
- Heard about a serious car accident (e.g., in the news)
- A close friend or family member was in a car accident
- Involvement in a car accident as a passenger or driver
- Heard about the possible dangers of driving (e.g., in the news)
- Encountered dangerous road conditions while riding in a car as a passenger or driver
- Other unusual or stressful experiences associated with driving, road situations, or vehicles

Non-Driving Situations and Events:

- Work/school stress
- Financial problems
- Relationship problems with friends or family
- Physical illness
- Panic attack
- Very intense and unpleasant anxiety
- Noticeable changes in your mood or energy level
O holiday/vacation from work or school

O other significant events, difficulties, or stressors:
Self-Monitoring and Motivation Checklist

The purpose of this checklist is to randomly monitor your self-monitoring, level of motivation, and satisfaction as a research participant in this study. **Your responses will have no impact on your treatment or participation in this study.** Please answer the following questions honestly! This information is only being gathered to examine other factors which might influence your progress and outcome from this **treatment study**. When you have completed this form, please seal it an envelope and return it to your therapist who will not have access to this information until your treatment is over. **Please remember to indicate the date you fill this form out.**

1. In the last week, how often did you forget or neglect completing the daily self-monitoring forms?

   1. Never forgot or neglected to complete the forms
   2. I forgot or neglected to complete the forms about 25% of the time
   3. I forgot or neglected to complete the forms about 50% of the time
   4. I forgot or neglected to complete the forms about 75% of the time
   5. Always forgot or neglected to complete the forms

2. In the last week, how would you rate your motivation as a research participant in this study?

   1. Very unmotivated
   2. Moderately unmotivated
   3. Indifferent, or mildly motivated
   4. Moderately motivated
   5. Very motivated

3. In the last week, to what extent are you satisfied with the treatment you are receiving in this study?

   1. Quite satisfied
   2. Indifferent or mildly dissatisfied
   3. Mostly satisfied
   4. Very satisfied

Please feel free to elaborate on these questions in the space below or on the back of this page.
Appendix E

Copies of the Therapist Treatment Manual, the Research Participant Treatment Manual, and

Treatment Adherence Rating Forms

Table of Contents

I. Research Participant Treatment Manual .......................................................... 169

II. Therapist Treatment Manual ........................................................................... 176

III. Treatment Adherence Rating Forms ............................................................... 187
VIRTUAL REALITY EXPOSURE THERAPY
FOR DRIVING PHOBIA

- Research Participant Manual -

Developed by Jaye Wald, M.Ed., Ph.D. Cand., Counselling Psychology, Department of Educational and Counselling Psychology, and Special Education University of British Columbia. (2001).

Please do not copy without written permission of the author.
Overview of the Treatment Study

Thank-you for participating in the driving phobia treatment study. This manual covers the information that was explained to you in the pre-treatment assessment. If you have any questions about the following information please feel free to ask your therapist.

Your participation in this study involves a pre-treatment assessment, a baseline phase, a treatment phase consisting of virtual reality exposure therapy, a post-treatment assessment and 1 and 3 month follow-up assessments. Since this is a treatment study, we will be following your changes very closely. In addition to attending assessment and treatment sessions, you will also be asked to self-monitor different aspects of the driving phobia. **For the treatment to be effective, it is essential that you are committed to attend all of the treatment sessions and remember to complete all self-monitoring assignments.**

The Virtual Reality Driving Simulator

Your treatment in this study will involve using a driving simulator known as the *driVR™*. It was developed to create realistic interactive scenarios that allow you drive within a virtual 3D world. The *driVR™* provides a range of computer-generated driving scenarios and routes of varying complexity. They are designed to model “real life” driving, which allows you to practice driving in a safe and non-threatening environment.

You will be wearing a light headset (or head tracker). It gives you a 360-degree view of the virtual world, which allows for a greater sense of immersion and realism than traditional “video-games”. The term used to describe entering and travelling within a virtual environment is called **immersion**. The earphones on the headset allow for audio input of traffic and collision sounds. Driving controls including the steering wheel, forward and reverse gear, as well as brake and gas pedals give you greater control over your virtual driving experience.

In the pre-treatment session, you received an orientation to the *driVR™* and practised driving in several different scenarios. These routes included urban, highway, and residential driving. Weather, road, and light conditions can also be modified. Your individualized treatment plan will be designed to progress through a hierarchy of driving scenarios.

At first, virtual driving may seem difficult and awkward but with continued practice it becomes easier and more “real”. It may take some time to become accustomed to driving within the virtual world and try to “suspend your disbelief” while being immersed in the computer environment. In the early treatment sessions particular, it is important that you drive slowly and always practice safe driving.

VR Exposures Safety Guidelines

There is a small risk of experiencing symptoms of motion sickness or “**simulator sickness**” during and after exposure to virtual reality environments. One research study showed that approximately 10% of users experienced some degree of simulator sickness using the *driVR™*. The possible symptoms of side effects fall into the following categories.
Visual Disorientation Nausea

- Eyestrain
- Visual fatigue
- Blurred or double vision
- Headache
- Dizziness
- Vertigo
- Balance disturbance
- Drowsiness
- Sweating
- Stomach awareness
- Increase salivation

These symptoms will usually arise within 5 to 10 minutes of immersion. The longer you continue exposure while experiencing these symptoms, the longer they will last. As soon as you, or the therapist, notice any of these symptoms, the exposure will be stopped. A glass of water and 3 to 5 minutes of fresh air may be offered to help reduce the symptoms. Symptoms typically subside once the exposure is stopped. **If any of these symptoms occur during the treatment session, please tell your therapist immediately.**

Other changes in your physical state, illnesses, and use of some medications, may increase your risk of experiencing simulator sickness. Examples include having a flu or ear infection, consuming a large amount of alcohol the night before a treatment session, and sleep deprivation. **If you are experiencing any of these conditions before an appointment, please contact your therapist and your appointment may need to be rescheduled.**

Simulator discomfort may vary from session to session, therefore these side effects will be monitored every session with a pre and post-exposure measure called the **Simulator Sickness Questionnaire.**

The time-limited immersion you received in the pre-treatment session is recommended for first time users of VR to reduce the risk of simulator sickness. Over the course of the treatment sessions, you will spend longer and longer periods of time (up to 30-40 minutes with frequent breaks) immersed in the VR environment. This gradual increase of exposure also minimizes simulator sickness risk. There are no known long term risks for short duration VR exposures.

**Pre Treatment Assessment**

In the pre-treatment session, you were given an orientation to the treatment study and virtual reality exposure therapy, completed some questionnaires, received instructions and information about self-monitoring, and were given an interview about your driving history. You also received an orientation to the driVR™ and practised driving in several different driving scenarios, which allowed you and your therapist to develop a treatment plan for the virtual reality exposure therapy.

**Baseline Phase**

Before your virtual reality exposure therapy begins, you have been asked to complete a “driving test” as a homework assignment and self-monitor certain aspects of your driving
phobia for period of time using a Driving Diary. This is called the baseline phase of a treatment study. Your first treatment session will be scheduled immediately after the end of the baseline phase. This information will provide us with some information about your driving fear before treatment begins.

Driving Fear Diary

During the baseline phase, you have been asked to record your daily driving frequency, the severity of your driving avoidance, and severity of your driving phobia symptoms using the Driving Fear Diary forms that your therapist gave you.

Driving Avoidance. You are asked to rate the degree of driving avoidance you experience each day on a scale from 0 (would not avoid driving) to 8 (always avoid driving).

Present State of Driving Phobia. You are asked to rate the severity of your driving phobia symptoms each day on a scale from 0 (no phobia present) to 8 (very disturbing/disabling). For this rating, consider how much the driving phobia bothers or distresses you, as well as how much it interferes with your daily life.

Driving Frequency. You are asked to record all driving trips you make under the section on driving frequency. Indicate whether you drove alone or had passengers, how long you drove in minutes, and describe the route, time of day, as well as driving and weather conditions. Peak anxiety ratings (the highest anxiety rating you experienced during the drive) is based on a scale from 0 (no anxiety) to 100 (extreme anxiety).

Please use a blank form for each day in the baseline. Remember to try to get in the habit of completing these forms at the same time each day when you're not busy and are relatively free of distractions.

Bring the completed forms to your first treatment session. Before you return your self-monitoring forms, please seal them in an envelope addressed to the therapist's research supervisor, Dr. Beth Haverkamp, which will also be provided. This will allow your therapist to focus on her role as your therapist, rather than evaluating your outcome while you are receiving treatment. As a result, your therapist will not have access to your completed self-monitoring forms until your treatment phase in this study is over.

Your therapist will randomly telephone you two times during the baseline phase, to see if you are encountering any difficulties with the daily self-monitoring. If you have any questions about the self-monitoring tasks during the baseline phase, please feel free to telephone your therapist. Please note that some people find that self-monitoring can cause a temporary increase of anxiety or discomfort because you are asked to focus on your fears rather than avoid them. This is a normal and short-term reaction, which subsides with continued self-monitoring.

Driving Test

Between the pre-treatment assessment and the beginning of your treatment, you have asked to choose a Driving Test to complete on your own. If possible, please complete
this driving test as soon as possible after the pre-treatment session and before you start the self-monitoring phase of the baseline period.

Using the Driving Test Form provided, choose a route that you would rate as fairly anxiety-provoking, but one that you believe you could complete (i.e., a route that you would rate approximately 70 to 80 on a scale from 0 to 100 (0 = no anxiety; 100 = extreme anxiety). Pick a route that doesn’t vary and one that could be repeated under similar conditions. Also rank your estimated confidence level from 0 to 100 (0 = no confidence that you would be able to complete the route; 100 = total confidence that you would be able to complete the route). Fill out the top portion of the form (pre-test information).

Immediately after you complete the test, fill out the bottom section of this form (test results). Bring this form back to your first treatment session in a sealed envelope. Remember with this test, you can remove yourself from the situation at anytime or can refuse to do it. At the end of treatment and at the follow-up assessments you will be asked to complete the same task again to see whether you can complete the test with less anxiety.

To determine the effectiveness of the treatment, it is extremely important that you carefully monitor different aspects of your driving phobia.

Your therapist has assigned you with an ID Code Number, which she will give you. She (or you) will put your code on all of your self-monitoring forms. To maintain your confidentiality, do not put your name on any of the forms.

Phobias and VR Exposure Therapy (VRET)

People with severe fears, or phobias, tend to avoid or escape the situations, objects, or events that they are afraid of (i.e., driving). While avoidance or escape from the fear reduces and prevents the unpleasant and distressing feelings of anxiety, the person never gets the opportunity to confront and overcome the fear. As a result, the fear often becomes worse and the avoidance results in interference with daily activities.

VRET is based on a form of a behavioral intervention called exposure therapy. The basic idea of exposure therapy is that gradual, repeated, and prolonged exposure to the feared driving situation results in the fear subsiding. Graded exposure therapy for driving fears allows you to slowly face feared situations of increasing difficulty. This approach allows you to successfully master threatening driving situations one at a time. As your fear diminishes with regular practice, you can gradually progress to more difficult steps. This ensures that you do not face extremely frightening or overwhelming situations.

For optimal effectiveness, exposure therapy requires:

- your active participation in choosing the feared scenarios you would like to overcome.
- your willingness to allow yourself to experience temporary anxiety symptoms by being exposed to anxiety provoking situations in a graduated manner of increasing difficulty. These feelings may be unpleasant and uncomfortable. However, they are normal and short-term reactions, which will subside with continued exposure.
• prolonged and repeated exposures until you are anxiety-free.
• avoidance of "safety behaviors" (i.e., closing your eyes, talking) which help you
distract or avoid being in the anxiety-provoking situation.
• being engaged in the situation as much as possible, concentrating on the "here and
now."
• attending regular appointments, completion of homework assignments, and a
commitment to stay in treatment.
• **PRACTICE, PRACTICE, AND MORE PRACTICE!!**

During each treatment session, you will be exposed to feared driving situations using the
virtual reality driving simulator. Using the list of virtual driving scenarios that you rank
ordered from least to most anxiety provoking, you will start with the scenario that is least
threatening. Over repeated trials to the scenario, you will become less anxious. Over
sessions, you will progress through the hierarchy. Your therapist will encourage you to
continue rather than stop the exposure. However, the rate of progress in VRET will be
under your complete control and you can stop the exposure at any time.

A rating scale called the **Subjective Units of Distress Scale (SUDS)** will be used to
monitor your anxiety level during VRET. The SUDS is a scale goes from 0 (no anxiety)
to 100 (extreme anxiety). While you are immersed in the driving scenario, you will be
asked to verbally report your peak SUDS level at the end of each scenario, which is the
highest anxiety you experienced during the scenario. You will repeat the scenario until
your SUDS level drop to less than 10. Once your reported anxiety is less than 10, you
will be encouraged to move on to a more challenging scenario. This scale will be used to
guide your progress through the scenarios.

Your sessions will be scheduled over **8 weekly sessions (approximately 1 hour long).**
It is important to attend all sessions and try to schedule them on a weekly basis. The first
5 to 10 minutes of each session will be spent discussing the session plan. For the
remainder of the session, you will practice virtual driving. Your therapist will be present
at all times.

**During treatment, you will also be asked to continue recording Driving Fear Diary
forms on a daily basis.** Each week you will be given a set of blank forms and an
envelope. Bring completed forms back each session in a sealed envelope addressed to
the therapist's research supervisor, Dr. Beth Haverkamp. At the beginning of each
session, your therapist will check to see if you are encountering any difficulties with the
self-monitoring forms.

**Post-Treatment and Follow-up Assessments**

One week after your last treatment session, you will return for a post-treatment
assessment. During that week, you will be asked to continue recording your **Driving
Fear Diary.** During the post-treatment assessment, you will be given a short interview
and you will be asked to complete the same questionnaires and virtual driving scenarios
you completed at the pre-treatment session. After the post-treatment assessment, you
will also be asked to complete the **Driving Test.**

One and three months after your last treatment session, you will be asked to complete
for follow-up assessments similar to the format of the post-treatment assessment. The
therapist will mail you a questionnaire package with instructions, and will contact you by telephone to arrange a short telephone interview. The purpose of the follow-up assessments is to assess the maintenance of your progress.

Other Information

Depending on how much anxiety you experience during a treatment session, your therapist may encourage you to relax and unwind before leaving the office. If you become very upset and anxious during the exposure treatment, you may also want to take some time after the session to relax before travelling home or going back to work (i.e., going for a walk). This can be a very normal and short-term reaction to this type of therapy. Please do not hesitate to discuss any concerns you have about this.

During this treatment program, we will only be addressing your driving fears. However, if other concerns or issues arise during treatment, your therapist will give you referral information to pursue other treatment after you finish with this treatment program.

We ask that you do not seek other psychological treatment during this treatment study. Please notify your therapist if you need to.

We also ask that you try not to make significant changes to your lifestyle or schedule. Since life events cannot be entirely controlled, your therapist will have you complete a weekly checklist on outside events or difficulties you encountered, which might affect your treatment outcome.

You will also be randomly given a form that will ask you to report how often you forgot to record the daily data and will inquire into your level of motivation. Please complete these forms and seal them in the envelope before giving them to your therapist.

Please continue to drive as you usually would and its fine if you drive more as you progress in your treatment. However, we will not be asking you to try to drive more or less than you normally do.

Remember, if you need to contact your therapist during the week, please leave a message at 868-3890 (confidential voice mail). Please give 24 hours notice to cancel or reschedule an appointment.
VIRTUAL REALITY EXPOSURE THERAPY
FOR DRIVING PHOBIA

- Therapist Treatment Manual -

Developed by Jaye Wald, M.Ed., Ph.D. Cand., Counselling Psychology, Department of Educational and Counselling Psychology, and Special Education University of British Columbia (2000)

Please do not copy without written permission of the author.
This manual is adapted from the Exposure Therapy for Posttraumatic Stress Disorder Treatment Manual (Traumatic Stress Unit, Department of Psychiatry, University of British Columbia, 1999).
A. PRE-TREATMENT ASSESSMENT DESCRIPTION

Summary of Pre-Treatment Assessment.

| 0 Review the purpose and procedures of the pre-treatment assessment and study. The participant is given a copy of the Research Participant Treatment Manual. |
| 0 Review description and rationale for VRET |
| 0 Review description of Anxiety Scale |
| 0 Review information about simulator sickness and VR exposure safety guidelines. Therapist administers Simulator Sickness Questionnaire (pre-exposure sections). |
| 0 Orientation to the drVR™ system |
| 0 Practice of 6 standard VR driving scenarios Therapist completes the Virtual Driving Scenario Record Form. When participant is finished, the therapist administers the Simulator Sickness Questionnaire (post-exposure section). |
| 0 The participant complete the Hierarchy of Virtual Driving Scenarios |
| 0 Review instructions for baseline self-monitoring and questionnaire package (see Appendix for questionnaires). |
| 0 Administer questions from Driving History Interview |
| 0 Schedule Treatment Session 1 |

The following should be presented to the research participant. You need not read this verbatim. The important thing is to ensure the person understands the main points.

"Review the purpose and procedures of the pre-treatment assessment and study"

"Thank-you for participating in the driving phobia treatment study. This assessment will take approximately two to three hours. In this session, you will receive an orientation to the treatment study and virtual reality exposure therapy. You'll receive an orientation to the drVR™ and practice some different virtual driving scenarios. We'll also set up your treatment plan for the virtual reality exposure therapy (VRET). I'll also give you a questionnaire package as homework and you'll receive an interview about your driving history. We'll take a break half-way through and if you need additional breaks please let me know. Here is a copy of the Research Participant Treatment Manual, which will cover the information that is covered today. If you have any questions, please feel free to ask."

"Your participation in this study involves a pre-treatment assessment, a baseline phase, a treatment phase consisting of virtual reality exposure therapy, a post-treatment assessment and 1 and 3 month follow-up assessments. Since this is a treatment study, we will be following your changes very closely. In addition to attending assessment and treatment sessions, you will also be asked to self-monitor different aspects of the driving phobia."

"Your sessions will be scheduled over 8 weekly sessions (approximately 1 hour long). It is important to attend all sessions and try to schedule them on a weekly basis. The first 5 to 10 minutes of each session will be spent discussing the session plan. For the remainder of the session, you will practice virtual driving. Your therapist will be present at all times. For the treatment to be effective, it is essential that you are"
committed to attend all of the treatment sessions and remember to complete all self-monitoring assignments."

**Review description and rationale for VRET**

"People with severe fears, or phobias, tend to avoid or escape the situations, objects, or events that they are afraid of (i.e., driving). While avoidance or escape from the fear reduces and prevents the unpleasant and distressing feelings of anxiety, the person never gets the opportunity to confront and overcome the fear. As a result, the fear often becomes worse and the avoidance results in interference with daily activities (use examples from participant’s history)."

"VRET is based on a form of a behavioral intervention called exposure therapy. The basic idea of exposure therapy is that gradual, repeated, and prolonged exposure to the feared driving situation results in the fear subsiding. Graded exposure therapy for driving fears allows you to slowly face feared situations of increasing difficulty. This approach allows you to successfully master threatening driving situations one at a time. As your fear diminishes with regular practice, you can gradually progress to more difficult steps. This ensures that you do not face extremely frightening or overwhelming situations." (To make the treatment more meaningful for the participant, ask the individual, “Have you ever overcame something else that you've feared or dreaded in your life? ... If so, how did you do it?)

"For optimal effectiveness, exposure therapy requires:

- your active participation in choosing the feared scenarios you would like to overcome.
- your willingness to allow yourself to experience temporary anxiety symptoms by being exposed to anxiety provoking situations in a graduated manner of increasing difficulty. These feelings may be unpleasant and uncomfortable. However, they are normal and short-term reactions, which will subside with continued exposure.
- prolonged and repeated exposures until you are anxiety-free.
- avoidance of “safety behaviors” (i.e., closing your eyes, talking) which help you distract or avoid being in the anxiety-provoking situation.
- being engaged in the situation as much as possible, concentrating on the “here and now.”
- attending regular appointments, completion of homework assignments, and a commitment to stay in treatment.
- **PRACTICE, PRACTICE, AND MORE PRACTICE!!**

"During each treatment session, you will be exposed to feared driving situations using the virtual reality driving simulator. Using the list of virtual driving scenarios that you rank ordered from least to most anxiety provoking, you will start with the scenario that is least threatening. Over repeated trials to the scenario, you will become less anxious. Over sessions, you will progress through the hierarchy. Your therapist will encourage you to continue rather than stop the exposure. However, the rate of progress in VRET will be under your complete control and you can stop the exposure at any time."
A rating scale called the Anxiety Scale will be used to monitor your anxiety level during VRET. The scale goes from 0 (no anxiety) to 100 (extreme anxiety). While you are immersed in the driving scenario, you will be asked to verbally report your peak anxiety level at the end of each scenario, which is the highest anxiety you experienced during the scenario. You will repeat the scenario until your peak anxiety level drops to less than 10. Once your reported anxiety is less than 10, you will be encouraged to move on to a more challenging scenario. This scale will be used to guide your progress through the scenarios.” (To make the scale more meaningful for the participant, ask the individual to generate examples of recent times when they experienced anxiety levels of 0, 25, 50, 75, and 90+)

Review information about simulator sickness and VR exposure safety guidelines

“There is a small risk of experiencing symptoms of motion sickness or "simulator sickness" during and after exposure to virtual reality environments. One research study showed that approximately 10% of users experienced some degree of simulator sickness using the driVR™. The possible symptoms can include visual symptoms (e.g., eyestrain, blurred or double vision, headache), disorientation (e.g., dizziness, vertigo, balance disturbance), and nausea (e.g., sweating, stomach awareness, increased salivation). Fatigue or drowsiness can also occur. These symptoms will usually arise within 5 to 10 minutes of immersion. The longer you continue exposure while experiencing these symptoms, the longer they will last. As soon as you, or the therapist, notice any of these symptoms, the exposure will be stopped. A glass of water and 3 to 5 minutes of fresh air may be offered to help reduce the symptoms. Symptoms typically subside once the exposure is stopped. Remember, if any of these symptoms occur during the treatment session, please tell your therapist immediately.”

“Other changes in your physical state, illnesses, and use of some medications, may increase your risk of experiencing simulator sickness. Examples include having a flu or ear infection, consuming a large amount of alcohol the night before a treatment session, and sleep deprivation. If you are experiencing any of these conditions before an appointment, please contact your therapist and your appointment may need to be rescheduled.”

“Simulator discomfort may vary from session to session, therefore these side effects will be monitored every session with a pre and post-exposure measure called the Simulator Sickness Questionnaire.” (have participant complete the pre-exposure section before and after VR exposure in the assessment)

“The time-limited immersion you received in the pre-treatment session is recommended for first time users of VR to reduce the risk of simulator sickness. Over the course of the treatment sessions, you will spend longer and longer periods of time (up to 30-40 minutes with frequent breaks) immersed in the VR environment. This gradual increase of exposure also minimizes simulator sickness risk. There are no known long term risks for short duration VR exposures.”

Orientation to the driVR™ system
"Next, I’m going to give you an orientation to the driving simulator and have you try out some different driving scenarios. The treatment in this study will involve using a driving simulator known as the driVR™. (have participant sit in simulator and load Scenario 1: Rural Residential). It was developed to create realistic interactive scenarios that allow you to drive within a virtual 3D world. The driVR™ provides a range of computer-generated driving scenarios and routes of varying complexity. They are designed to model “real life” driving, which allows you to practice driving in a safe and non-threatening environment. I will be beside you at all times during the exposure and will load the different scenarios for you."

"You will be wearing a light headtracker (demonstrate by putting it on yourself). It gives you a 360-degree view of the virtual world, which allows for a greater sense of immersion and realism than traditional “video-games”. The earphones on the headset allow for audio input of traffic and collision sounds. (have participant put head tracker on, demonstrate how to properly adjust it, have participant look around in both directions).

"Driving controls including the steering wheel, forward and reverse gear, as well as brake and gas pedals give you greater control over your virtual driving experience. (have participant practice using each control until he/she feels comfortable, and give tips on how to steer and use the brake/gas pedals)."

"Some people find simulator driving to be more difficult than driving a real car. Simulator driving is like learning a new skill (e.g., like riding a bike), it is difficult at first, but gets easier and more automatic with practice. It will also seem more “real” the more you practice. Almost everyone takes some time to become accustomed to driving within the virtual world. It may be helpful to suspend your disbelief while being immersed in the computer environment. I will give you feedback on your driving, especially when you start. In the early treatment sessions particular, it is important that you drive slowly and always practice safe driving, and follow all the driving rules."

Practice of 6 standard VR driving scenarios

"Now for practice, I’m going to get you to try 6 different scenarios, starting off with residential driving, and then moving on to some highway and urban scenarios. At the end of each scenario, I’ll ask you for your peak (highest) anxiety using the Anxiety Scale. As you go along, I’ll give you tips on how to control the simulator, but other than that I’m going to be quiet, so I don’t distract you from driving. I also encourage you to not talk much while your driving, so you can concentrate on driving the simulator and the virtual experience. Just do your best and try to not worry too much about your driving performance and comparing it to real driving" (have participant attempt the six VR driving scenarios, and record peak anxiety ratings and completion on the form). (0 = incomplete or partially complete; 1 = complete) were recorded by the therapist.

Complete the Hierarchy of Virtual Driving Scenarios

"Now that you’ve had a chance to try out the residential, urban, and highway driving scenarios, I’m going to get you to fill out a form. This list has 18 different virtual driving situations. First rate the degree of anxiety (anxiety scale 0-100: 0 = no anxiety; 100 = extreme anxiety) that you would expect to experience for each situations in a
virtual environment. Then, you can rank order the situations from least to most difficult based on their anxiety ratings. I will use these ratings to set up your individualized exposure treatment plan, so you'll start off the treatment with the situation that you’ve ranked as least difficult (1). Once your feeling very little anxiety in that scenario, you'll move on to the next simulated driving condition that you ranked as the next least difficult (2) and so forth. The treatment will involve you progressing through these different simulated driving situations.” (have participant complete the form)

Review instructions for baseline self-monitoring and questionnaire package

"To determine the effectiveness of the treatment, it is extremely important to carefully monitor different aspects of your driving phobia between now and your first treatment session. This period is called the baseline phase. Each participant has been randomly assigned to a pre-determined baseline length. You've been assigned to the _ day baseline length (tell participant how many), so we should try to schedule your first appointment according to how many days it is from now. During this time, you will be asked to complete some questionnaires and Driving Diary form each day."

"You have been assigned you an ID Code Number, which will be put on all of your questionnaires and Driving Diary forms. To maintain your confidentiality, do not put your name on any of the forms."

"I'm going to go through each of the questionnaires with you (see Appendix for copies and instructions of the instruments, go through each measure with the participant, and ensure participant understands the rationale and instructions for each one). Please return all of the questionnaires and Driving Diary forms at the initial treatment session. I'm also going to call you once during the baseline phase to see if you’re having any difficulties completing the forms. You are also welcome to call me if you encounter any problems."

Administer questions from Driving History Interview

Schedule Treatment Session 1 and Other Instructions

"Your first treatment session should be scheduled immediately after the end of the baseline phase.” (have participant schedule appointment)

"Depending on how much anxiety you experienced today, you may want to take some time after the session to relax before travelling home or going back to work (i.e., going for a walk). You might feel a little tense and irritable for awhile, and this is a very normal and short-term reaction to this type of therapy. Please do not hesitate to contact the therapist over the next few days if you continue to feel upset.”

"During this treatment, we will only be addressing your driving fears. However, if other concerns or issues arise during treatment, your therapist will give you referral information to pursue other treatment after you finish with this treatment. We ask that you do not seek other psychological treatment during this treatment study. Please notify your therapist if you need to.”
"We also ask that you try not to make significant changes to your lifestyle or schedule. Since life events cannot be entirely controlled, your therapist will have you complete a weekly checklist on outside events or difficulties you encountered, which might affect your treatment outcome."

"Please continue to drive as you usually would and it's fine if you drive more as you progress in your treatment. However, we will not be asking you to try to drive more or less than you normally do."
B. TREATMENT DESCRIPTION

Summary of Treatment Sessions

- The therapist collects Driving Diary forms in a sealed envelopes.
- The participant completes the Adverse Checklist Form.
- The participant completes the Simulator Sickness Questionnaire (pre-exposure).
- The therapist reviews the session plan.
- VRET (exposure time increases from 25 to 50 minutes each session).
- The participant completes the Simulator Sickness Questionnaire (post-exposure).
- The therapist gives Driving Diary forms and envelopes.
- The therapist and patient schedule next session.

There are 8 VRET treatment sessions. The above summary is a general outline of session content. The specific protocol for each session is provided in the Appendix and must be followed.

There are several therapist behaviors that are also considered as permissible therapist behaviors, which may be used to facilitate treatment and compliance with self-monitoring homework. They are considered as necessary (but not mandatory) therapist behaviors in every session. These include:

- emphasizes the importance of adherence to self-monitoring, addresses any difficulties/concerns with self-monitoring, and asks for anticipated problems.
- provides minimal verbal reinforcement and empathic responses for effort and driving performance during exposure, encourages participant to not focus on driving performance.
- encourages the importance of safe and slow driving, asks the participant to "suspend disbelief" of virtual reality and driving controls during exposure, and emphasizes the importance of practice.
- asks participant for simulator sickness symptoms during exposure.
- addresses safety behaviors (e.g., criticizing equipment, excessive talking, not looking at road, stopping on road etc.) and points them if they occur.
- addresses problems that are directly associated with participation in treatment (e.g., misunderstanding of SUDS scale, missed treatment sessions).
- normalizes participant's experiences of frustration, irritability, and excessive anxiety or distress.
- gives instructions and/or corrective feedback regarding driving performance (e.g., steering, speed, stopping at stop signs, sitting position in simulator, driving through intersections).
• discusses related topics to the driving phobia or treatment study are acceptable, as long as they are kept to a minimum. These topics could include:
  - driving experiences between sessions
  - questions relating to licensing, driving lessons etc.
  - other factors interfering with participation in study, real driving, or compliance with self-monitoring (e.g., car broke down, illness, getting to appointments)
  - questions relating to the simulator and driving (e.g., steering, graphics, braking etc.).
  - reviewing progress

• minimally encourages and reinforces efforts towards real driving

• if client wishes to discuss other personal issues (e.g., marital stress, work stress) the therapist can employ problem-solving and/or active and empathic listening, but does not focus on these problems excessively (no more than 5 minutes at beginning or end of session).

It is essential that you not use other treatment modalities, which would confound the treatment results. These are considered as Infractions from the Treatment Protocol, which include the following.

• instructs the client to apply anxiety management skills such as diaphragmatic breathing, sensory attention focusing, or relaxation techniques.

• applies cognitive therapy or techniques by asking client to challenge inaccurate cognitions, use thought-stopping, or directly challenge cognitions.

• encourages exploration of the therapeutic relationship.

• interferes with the participant's exposure (e.g., engages participant in conversation beyond what is defined as acceptable in the above section).

• encourages discussion of other issues or events not related to driving phobia.

Description of Treatment Protocol

The protocol used in this study involved participants gradually progressing through the various scenarios, based on their ratings on the Hierarchy of Virtual Driving Scenarios completed at the pre-treatment assessment.

In Treatment Session 1, participants began their VR exposure with the virtual driving scenario, which was rated as the least anxiety-provoking on the hierarchy. At the end of the scenario, participants verbally reported their peak anxiety (Anxiety Scale 0 to 100: 0 = no anxiety; 100 = extreme anxiety). They would repeat the scenario over a series of trials until their peak anxiety dropped to drops to 10 or less. Once this rating was obtained, they would then be introduced to the next scenario on the hierarchy (e.g., the scenario rated as the next least anxiety provoking).

At each subsequent session, participants would start the exposure with the last two scenarios that were practiced in the previous session. They would repeat these
scenarios until their reported peak anxiety dropped to 10 or less. Once this was achieved, participants would proceed to the next scenario. For the remainder of treatment, participants continued to move through the different scenarios at their own pace. Progression to the new scenarios was ultimately under their control and they could stop the exposure at any time.

The exposure time gradually increased over sessions, which was built into the study to minimize simulator sickness (e.g., 25 minutes for Treatment Session 1, 30 minutes for Treatment Session 2 etc.). The maximum exposure time per session was 50 minutes, as longer exposure lengths are associated with increased simulator sickness. Initial sessions typically lasted 40 minutes and toward the end of treatment were minutes in length.

**Additional Instructions.**

The therapist should schedule each session for sixty minutes, even though the session may be finished before that time. Each session should be scheduled weekly, or as close too weekly, as possible. Reasons for departures from this format should be recorded in the Research Participant Contact Record form. If fewer than 8 sessions are completed, then the reasons should be documented in their file. All contact (session appointments, telephone contact between sessions) should be recorded in the Contact Record form. Participants should be encouraged to complete the full 8 sessions. Ensure that the audio-tape is set up before each session.

This manual is adapted from the Exposure Therapy for Posttraumatic Stress Disorder Treatment Manual (Traumatic Stress Unit, Department of Psychiatry, University of British Columbia, 1999).
VIRTUAL REALITY EXPOSURE THERAPY FOR DRIVING PHOBIA:
TREATMENT ADHERENCE RATINGS TO THE TREATMENT PROTOCOL
VIRTUAL REALITY EXPOSURE THERAPY FOR DRIVING PHOBIA: TREATMENT ADHERENCE RATINGS TO THE TREATMENT PROTOCOL

GENERAL INSTRUCTIONS

Please familiarize yourself with the Therapist Treatment Manual before you start rating sessions. If you have any questions regarding the treatment study, please contact the researcher. Each research participant has been given an ID code. The ID code and session number is marked on the tapes and rating forms.

You have been given three randomly selected treatment session tapes for each research participant for treatment integrity ratings on adherence to the treatment manual.

Please listen to the entire treatment session. In cases where you are not able to rate, please leave those items blank, and write a note in the margin.

You will complete a treatment adherence rating form for each tape. Each form includes: 1) checklist for adherence to the treatment protocol; 2) checklist for permissible therapist behaviors; 3) checklist for therapist infractions from the treatment protocol; 4) treatment adherence rating.
1) CHECKLIST FOR ADHERENCE TO THE TREATMENT PROTOCOL

The therapist was required to follow a standardized treatment protocol for each session. The protocol for each session is described in a record form for each session (attached).

For each item on the session record form, you will assess whether the therapist demonstrated the particular behavior or task described in the item. These behaviors are considered an essential part of the treatment. If the therapist behavior is present for a given item on the session form, check the line next to the item.

   e.g.,  X The therapist collects self-monitoring forms in sealed envelopes, asks about adherence and if necessary, addresses any difficulties/concerns with self-monitoring.

From the audiotape, it may not always be clear whether a particular task was completed by the therapist. When this occurs, please use the code “?” for "UNKNOWN" for those items.

   e.g.,  ? The participant completes the Adverse Checklist Form.

If a tape you are coding has technical problems (e.g., runs out before session has ended, sound is inaudible), please leave the item(s) blank and write a note in the margin stating "TECHNICAL PROBLEMS" and explain why.

With some participants, the therapist may have to use the modified treatment protocol. If this occurred, it will be noted on the tape and a modified rating form will be attached. Please refer to the therapist treatment manual for specific instructions and adherence rating forms.

An essential aspect of the treatment is ensuring that research participants receive the allotted exposure time for a given session. You need to document the total session time and total exposure time on each session form. Make sure the tape is rewound to the beginning of the session. You need to record the time when the session and exposure portion begins and ends. The session starts when the tape begins and is considered to end when the last item on the session form is completed.

**Exposure start time.** Count the timing of the exposure section from the start of the exposure. The start of the exposure is at the point where the engine noise starts (you may hear a car door slam). That’s the ideal point for when to record the start time. At times it may be difficult to determine from the audiotape. If you cannot hear the engine sound, listen for the therapist instructions to begin driving (eg., “OK you can start driving now”). If the start time is still not clear, give your best estimation and make a note in the margin stating “ESTIMATED” and explain why. **Exposure end time.** The end of the exposure is at the point when the therapist asks for the SUDS level and indicates that the research participant is finished driving. If the participant is still driving through a scenario when the exposure time has been reached, the therapist does not stop them. If the end time is not clear, give your best estimation and make a note in the margin stating “ESTIMATED” and explain why.
In some sessions, there are technical problems with the computer (e.g., software gliches, computer freezes etc.). When this happens (and depending on what the problem is), the therapist may extend the exposure time to ensure the participant "full dose" (time) for that session. When this occurs, make a note of it in the margin.
2) CHECKLIST FOR PERMISSIBLE THERAPIST BEHAVIORS WITHIN THE TREATMENT PROTOCOL

There are several therapist behaviors that are also considered as permissible therapist behaviors, which may be used to facilitate treatment and compliance with self-monitoring homework. They are considered as necessary (but not mandatory) therapist behaviors in every session. Please check each item that the therapist uses during the session.

___emphasizes the importance of adherence to self-monitoring, addresses any difficulties/concerns with self-monitoring, and asks for anticipated problems.

___provides minimal verbal reinforcement and empathic responses for effort and driving performance during exposure

___encourages the importance of safe and slow driving, asks the participant to “suspend disbelief” of virtual reality and driving controls during exposure, and emphasizes the importance of practice

___asks participant to report simulator sickness symptoms during exposure

___observes for participant safety behaviors (e.g., criticizing equipment, excessive talking, not looking at road, stopping on road etc.) and points them if they occur

___addresses problems that are directly associated with participation in treatment (e.g., misunderstanding of SUDS scale, missed treatment sessions)

___normalizes participant’s experiences of frustration, irritability, and excessive anxiety or distress

___gives instructions and/or corrective feedback regarding driving performance (e.g., steering, speed, stopping at stop signs, sitting position in simulator, driving through intersections)

___discusses related topics to the driving phobia or treatment study are acceptable, as long as they are kept to a minimum. These topics could include:
   - driving experiences between sessions
   - questions relating to licensing, driving lessons etc.
   - other factors interfering with participation in study, real driving, or compliance with self-monitoring (e.g., car broke down, illness, getting to appointments)
   - questions relating to the simulator and driving (e.g., steering, graphics, braking etc.).
   - reviewing progress

___minimally encourages and reinforces efforts towards real driving

___if client wishes to discuss other personal issues (e.g., marital stress, work stress) the therapist can employ problem-solving and/or active and empathic listening, but does not focus on these problems excessively (no more than 5 minutes at beginning or end of session).
3. CHECKLIST FOR THERAPIST INFRACTIONS FROM THE TREATMENT PROTOCOL IN EACH SESSION

It is essential that the therapist not use other treatment modalities, which would confound the treatment results. Please put a check beside any of the following items that the therapist uses during the session.

_____ The therapist instructs the client to apply anxiety management skills such as diaphragmatic breathing, sensory attention focusing, or relaxation techniques.

_____ The therapist applies cognitive therapy or techniques by asking client to challenge inaccurate cognitions, use thought-stopping, or directly challenge cognitions.

_____ The therapist encourages exploration of the therapeutic relationship.

_____ The therapist interferes with the participant’s exposure (e.g., engages participant in conversation beyond what is defined as acceptable in the above section).

_____ The therapist encourages discussion of other issues or events not related to driving phobia.
4) TREATMENT ADHERENCE RATING TO THE TREATMENT PROTOCOL

After consideration of how the therapist adhered to the requirement set out in the above sections, please rate the degree of adherence to the treatment protocol for the session.

On a scale from 1 (no adherence) to 5 (very much in adherence, to what degree did the therapist adhere to the session treatment protocol for the session.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No adherence</td>
<td>Poor adherence</td>
<td>Average adherence</td>
<td>Good Adherence</td>
<td>Very much in adherence</td>
</tr>
</tbody>
</table>

Please feel free to make any comments below.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #1

A. Note the total length of the session
Time Session Started: 
Time Session Ended: 
Length of session: ___ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: 
Time Exposure Portion Ended: 
Length of Exposure portion: ___ minutes

(Exposure portion for Session 1 should be approximately 25 minutes)

C. Session Opening

The therapist collects self-monitoring forms in a sealed envelope, asks about adherence, and if necessary addresses any difficulties/concerns with self-monitoring

The participant completes the Adverse Checklist Form.

D. VR Exposure

The therapist checks the research participant’s understanding of VRET and SUDS.

The participant completes the Simulator Sickness Questionnaire (pre-exposure).

The therapist reviews the procedure for graduated VRET.

The participant begins the exposure with the scenario rated as the least anxiety provoking based on the ratings on the Virtual Driving Scenario Hierarchy.

The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.

The participant completes the Simulator Sickness Questionnaire (post-exposure).

E. Session Closure

The therapist gives self-monitoring forms and an envelope.

The therapist and patient schedule Session #2.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #2

A. Note the total length of the session

Time Session Started: 
Time Session Ended: 
Length of session: minutes

B. Note the time spent on exposure

Time Exposure Portion Started: 
Time Exposure Portion Ended: 
Length of Exposure portion: minutes

Exposure for Session 2 should be approximately 30 minutes maximum)

C. Session Opening

The therapist collects self-monitoring forms in a sealed envelope.
The participant completes the Adverse Checklist Form.

D. VR Exposure

The participant completes the Simulator Sickness Questionnaire 
(pre-exposure)
The therapist describes the session plan.
The participant begins by repeating the last 2 scenarios that were completed in Session 1. The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.
The therapist records the exposure using the VRET Record Form on the next page for all trials (completed and incomplete).
The participant completes the Simulator Sickness Questionnaire 
(post-exposure).

E. Session Closure and Homework

The therapist and patient schedule Session #3.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #3

A. Note the total length of the session
Time Session Started: ____________
Time Session Ended: ____________
Length of session: _______ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: ____________
Time Exposure Portion Ended: ____________
Length of Exposure portion: _______ minutes

(Exposure for Session 3 should be approximately 35 minutes maximum)

C. Session Opening

_____ The therapist collects self-monitoring forms in a sealed envelope.
_____ The participant completes the Adverse Checklist Form.

D. VR Exposure

_____ The participant completes the Simulator Sickness Questionnaire (pre-exposure)
_____ The therapist describes the session plan.
_____ The participant begins by repeating the last 2 scenarios that were completed in Session 2. The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.
_____ The therapist records the exposure using the VRET Record Form on the next page for all trials (completed and incomplete).
_____ The participant completes the Simulator Sickness Questionnaire (post-exposure).

E. Session Closure and Homework

_____ The therapist gives self-monitoring forms and an envelope.
_____ The therapist and patient schedule Session #4.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #4

A. Note the total length of the session
Time Session Started: 
Time Session Ended: 
Length of session: ________ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: 
Time Exposure Portion Ended: 
Length of Exposure portion: ________ minutes

(Exposure for Session 4 should be approximately 40 minutes maximum)

C. Session Opening

____ The therapist collects self-monitoring forms in a sealed envelope.
____ The participant completes the Adverse Checklist Form

D. VR Exposure

____ The participant completes the Simulator Sickness Questionnaire
(pre-exposure)
____ The therapist describes the session plan.
____ The participant begins by repeating the last 2 scenarios that were completed in
Session 3. The participant repeats each scenario until the SUDS level drops to 10 or
less and then progresses to the next scenario.
____ The therapist records the exposure using the VRET Record Form on the next
page for all trials (completed and incomplete).
____ The participant completes the Simulator Sickness Questionnaire
(post-exposure).

E. Session Closure and Homework

____ The therapist gives self-monitoring forms, an envelope, and the Self-Monitoring
and Motivation Checklist.
____ The therapist and patient schedule Session #5.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE

Treatment Session: #5

A. Note the total length of the session
Time Session Started: ______________
Time Session Ended: ______________
Length of session: ______ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: __________
Time Exposure Portion Ended: __________
Length of Exposure portion: ______ minutes

(Exposure for Session 5 should be approximately 45 minutes maximum)

C. Session Opening

_____ The therapist collects self-monitoring forms in a sealed envelope.
_____ The participant completes the Adverse Checklist Form

D. VR Exposure

_____ The participant completes the Simulator Sickness Questionnaire
(pre-exposure)
_____ The therapist describes the session plan.
_____ The participant begins by repeating the last 2 scenarios that were completed in Session 4. The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.
_____ The therapist records the exposure using the VRET Record Form on the next page for all trials (completed and incomplete).
_____ The participant completes the Simulator Sickness Questionnaire (post-exposure).

E. Session Closure and Homework

_____ The therapist gives self-monitoring forms and an envelope.
_____ The therapist and patient schedule Session #6.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE

Treatment Session: #6

A. Note the total length of the session
   Time Session Started: __________
   Time Session Ended: __________
   Length of session: _______ minutes

B. Note the time spent on exposure
   Time Exposure Portion Started: __________
   Time Exposure Portion Ended: __________
   Length of Exposure portion: _______ minutes

(Exposure for Session 6 should be approximately 50 minutes maximum)

C. Session Opening

   _____ The therapist collects self-monitoring forms in a sealed envelope.
   _____ The participant completes the **Adverse Checklist Form**

D. VR Exposure

   _____ The participant completes the **Simulator Sickness Questionnaire**
   (pre-exposure)
   _____ The therapist describes the session plan.
   _____ The participant begins by repeating the last 2 scenarios that were completed in Session 5. The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.
   _____ The therapist records the exposure using the **VRET Record Form** on the next page for all trials (completed and incomplete).
   _____ The participant completes the **Simulator Sickness Questionnaire**
   (post-exposure).

E. Session Closure and Homework

   _____ The therapist gives self-monitoring forms, an envelope, and the **Self-Monitoring and Motivation Checklist**.
   _____ The therapist and patient schedule Session #7.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #7

A. Note the total length of the session
Time Session Started: ____________
Time Session Ended: ____________
Length of session: ______ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: ____________
Time Exposure Portion Ended: ____________
Length of Exposure portion: ______ minutes

(Exposure for Session 7 should be approximately 50 minutes)

C. Session Opening

_____ The therapist collects self-monitoring forms in a sealed envelope.
_____ The participant completes the **Adverse Checklist Form**

D. VR Exposure

_____ The participant completes the **Simulator Sickness Questionnaire**
(pre-exposure)
_____ The therapist describes the session plan.
_____ The participant begins by repeating the last 2 scenarios that were completed in Session 6. The participant repeats each scenario until the SUDS level drops to 10 or less and then progresses to the next scenario.
_____ The therapist records the exposure using the **VRET Record Form** on the next page for all trials (completed and incomplete).
_____ The participant completes the **Simulator Sickness Questionnaire**
(post-exposure).

E. Session Closure and Homework

_____ The therapist gives self-monitoring forms and an envelope.
_____ The therapist and patient schedule Session #8.
VIRTUAL REALITY EXPOSURE THERAPY: TREATMENT ADHERENCE
Treatment Session: #8

A. Note the total length of the session
Time Session Started: __________________________
Time Session Ended: __________________________
Length of session: ________ minutes

B. Note the time spent on exposure
Time Exposure Portion Started: ________________
Time Exposure Portion Ended: ________________
Length of Exposure portion: ________ minutes

(Exposure for Session 8 should be approximately __________ 50 minutes maximum)

C. Session Opening

_____ The therapist collects self-monitoring forms in a sealed envelope.
_____ The participant completes the Adverse Checklist Form

D. VR Exposure

_____ The participant completes the Simulator Sickness Questionnaire
(pre-exposure)
_____ The therapist describes the session plan.
_____ The participant begins by repeating the last 2 scenarios that were completed in
Session 7. The participant repeats each scenario until the SUDS level drops to 10 or
less and then progresses to the next scenario.
_____ The therapist records the exposure using the VRET Record Form on the next
page for all trials (completed and incomplete).
_____ The participant completes the Simulator Sickness Questionnaire
(post-exposure).

E. Session Closure and Homework

_____ The therapist reviews progress and treatment with participant.
_____ The therapist gives self-monitoring forms, an envelope and the Self-Monitoring
and Motivation Checklist.
_____ The therapist and patient schedule the post-treatment assessment.
Appendix F

Pre-, and Post-Treatment Expected Anxiety Ratings on the Virtual Driving Situation Exposure Hierarchy for Research Participants

List of Tables

Table F-1  Pre-, and Post-Treatment Expected Anxiety Ratings on the Virtual Driving Situation Exposure Hierarchy (P1)..............236
Table F-2  Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P2). .............238
Table F-3  Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P3). .............240
Table F-4  Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P4). .............242
Table F-5  Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P5). .............244
Table F-1

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P1)

<table>
<thead>
<tr>
<th>Virtual Driving Situation</th>
<th>Expected Anxiety (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Daytime residential driving</td>
<td>40</td>
</tr>
<tr>
<td>Night residential driving</td>
<td>45</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>50</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>60</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>55</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>70</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>70</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>75</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>80</td>
</tr>
<tr>
<td>Night highway driving with rain and fog</td>
<td>85</td>
</tr>
<tr>
<td>Day highway driving with snow</td>
<td>80</td>
</tr>
<tr>
<td>Night highway driving with snow and ice</td>
<td>90</td>
</tr>
<tr>
<td>Daytime urban driving</td>
<td>65</td>
</tr>
<tr>
<td>Night urban driving</td>
<td>70</td>
</tr>
</tbody>
</table>

(table F-1 continued)
Table F-1 (continued)

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P1).

<table>
<thead>
<tr>
<th>Virtual Driving Situation</th>
<th>Expected Anxiety (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Day urban driving with rain</td>
<td>70</td>
</tr>
<tr>
<td>Night urban driving with rain and fog</td>
<td>70</td>
</tr>
<tr>
<td>Day urban driving with snow</td>
<td>70</td>
</tr>
<tr>
<td>Night urban driving with snow and ice</td>
<td>70</td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 – 100): 0 = no anxiety; 100 = extreme anxiety.
Table F-2

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P2).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 – 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Daytime residential driving</td>
<td>50</td>
</tr>
<tr>
<td>Night residential driving</td>
<td>50</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>70</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>80</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>90</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>90</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>90</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>90</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>90</td>
</tr>
<tr>
<td>Night highway driving with rain and fog</td>
<td>95</td>
</tr>
<tr>
<td>Day highway driving with snow</td>
<td>95</td>
</tr>
<tr>
<td>Night highway driving with snow and ice</td>
<td>95</td>
</tr>
<tr>
<td>Daytime urban driving</td>
<td>80</td>
</tr>
<tr>
<td>Night urban driving</td>
<td>85</td>
</tr>
</tbody>
</table>

(table F-2 continued)
Table F-2 (continued)

Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P2).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 – 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Day urban driving with rain</td>
<td>85</td>
</tr>
<tr>
<td>Night urban driving with rain and fog</td>
<td>90</td>
</tr>
<tr>
<td>Day urban driving with snow</td>
<td>90</td>
</tr>
<tr>
<td>Night urban driving with snow and ice</td>
<td>90</td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 – 100): 0 = no anxiety; 100 = extreme anxiety.
### Table F-3

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P3).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 - 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Daytime residential driving</td>
<td>20</td>
</tr>
<tr>
<td>Night residential driving</td>
<td>50</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>50</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>95</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>70</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>90</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>70</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>90</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>70</td>
</tr>
<tr>
<td>Night highway driving with rain and fog</td>
<td>100</td>
</tr>
<tr>
<td>Day highway driving with snow</td>
<td>100</td>
</tr>
<tr>
<td>Night highway driving with snow and ice</td>
<td>100</td>
</tr>
<tr>
<td>Daytime urban driving</td>
<td>20</td>
</tr>
<tr>
<td>Night urban driving</td>
<td>50</td>
</tr>
<tr>
<td>Day urban driving with rain</td>
<td>60</td>
</tr>
<tr>
<td>Night urban driving with rain and fog</td>
<td>95</td>
</tr>
</tbody>
</table>

(table F-3 continued)
Table F-3 (continued)

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P3).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 - 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Day urban driving with snow</td>
<td>80</td>
</tr>
<tr>
<td>Night urban driving with snow and ice</td>
<td>100</td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 – 100): 0 = no anxiety; 100 = extreme anxiety.
Table F-4

Pre- and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P4).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 –100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Daytime residential driving</td>
<td>50</td>
</tr>
<tr>
<td>Night residential driving</td>
<td>60</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>70</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>100</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>90</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>100</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>80</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>90</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>90</td>
</tr>
<tr>
<td>Night highway driving with rain and fog</td>
<td>100</td>
</tr>
<tr>
<td>Day highway driving with snow</td>
<td>100</td>
</tr>
<tr>
<td>Night highway driving with snow and ice</td>
<td>100</td>
</tr>
<tr>
<td>Daytime urban driving</td>
<td>65</td>
</tr>
<tr>
<td>Night urban driving</td>
<td>70</td>
</tr>
<tr>
<td>Day urban driving with rain</td>
<td>75</td>
</tr>
</tbody>
</table>

(table F-4 continued)
Table F-4 (continued)

Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P4).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 –100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Night urban driving with rain and fog</td>
<td>95</td>
</tr>
<tr>
<td>Day urban driving with snow</td>
<td>95</td>
</tr>
<tr>
<td>Night urban driving with snow and ice</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note.* Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.
Table F-5

Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P5).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 –100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Daytime residential driving</td>
<td>35</td>
</tr>
<tr>
<td>Night residential driving</td>
<td>35</td>
</tr>
<tr>
<td>Day residential driving with rain</td>
<td>37</td>
</tr>
<tr>
<td>Night residential driving with rain and fog</td>
<td>40</td>
</tr>
<tr>
<td>Day residential driving with snow</td>
<td>45</td>
</tr>
<tr>
<td>Night residential driving with snow and ice</td>
<td>50</td>
</tr>
<tr>
<td>Daytime highway driving</td>
<td>73</td>
</tr>
<tr>
<td>Night highway driving</td>
<td>80</td>
</tr>
<tr>
<td>Day highway driving with rain</td>
<td>74</td>
</tr>
<tr>
<td>Night highway driving with rain and fog</td>
<td>82</td>
</tr>
<tr>
<td>Day highway driving with snow</td>
<td>75</td>
</tr>
<tr>
<td>Night highway driving with snow and ice</td>
<td>90</td>
</tr>
<tr>
<td>Daytime urban driving</td>
<td>55</td>
</tr>
<tr>
<td>Night urban driving</td>
<td>65</td>
</tr>
<tr>
<td>Day urban driving with rain</td>
<td>57</td>
</tr>
</tbody>
</table>

(table F-5 continued)
Table 7-5 (continued)

Pre-, and Post-Treatment Expected Anxiety Ratings on the Fear Hierarchy of Virtual Driving Situations (P5).

<table>
<thead>
<tr>
<th>Driving Situation</th>
<th>Expected Peak Anxiety (0 –100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>Night urban driving with rain and fog</td>
<td>70</td>
</tr>
<tr>
<td>Day urban driving with snow</td>
<td>60</td>
</tr>
<tr>
<td>Night urban driving with snow and ice</td>
<td>72</td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.
Appendix G

Summary of Treatment Sessions for Research Participants

List of Tables

Table G-1 Summary of Treatment Sessions (P1) ....................... 247
Table G-2 Summary of Treatment Sessions (P2) ....................... 248
Table G-3 Summary of Treatment Sessions (P3) ....................... 249
Table G-4 Summary of Treatment Sessions (P4) ....................... 250
Table G-5 Summary of Treatment Sessions (P5) ....................... 251
Table G-1

**Summary of Treatment Sessions (P1)**

<table>
<thead>
<tr>
<th>Treatment Session</th>
<th>Number of New Scenarios Introduced in Each Session</th>
<th>Total Number of Scenarios Practiced in Each Session</th>
<th>Total Number of Trials Completed in Each Session</th>
<th>Mean Peak Anxiety (0-100)</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>27.50</td>
<td>2</td>
<td>27.50</td>
<td>11.02</td>
</tr>
<tr>
<td>Session 2</td>
<td>1</td>
<td>3</td>
<td>9</td>
<td>16.67</td>
<td>1</td>
<td>16.67</td>
<td>6.12</td>
</tr>
<tr>
<td>Session 3</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>16.50</td>
<td>4</td>
<td>16.50</td>
<td>8.18</td>
</tr>
<tr>
<td>Session 4</td>
<td>3</td>
<td>5</td>
<td>10</td>
<td>21.00</td>
<td>3</td>
<td>21.00</td>
<td>13.50</td>
</tr>
<tr>
<td>Session 5</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>10.00</td>
<td>7</td>
<td>10.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Session 6</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>10.42</td>
<td>9</td>
<td>10.42</td>
<td>1.44</td>
</tr>
<tr>
<td>Session 7</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>10.00</td>
<td>10</td>
<td>10.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>69.10</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Note. Virtual reality exposure therapy (VRET) was conducted in a standardized format based on the participant’s expected anxiety ratings on the Hierarchy of Virtual Driving Scenarios.

Anxiety Scale (0–100): 0 = no anxiety; 100 = extreme anxiety. Based on total number of trials in each session.
Table G-2

Summary of Treatment Sessions for P2

<table>
<thead>
<tr>
<th>Treatment Session</th>
<th>Number of New Scenarios Introduced in Each Session</th>
<th>Total Number of Scenarios Practiced in Each Session</th>
<th>Total Number of Trials Completed in Each Session</th>
<th>Mean Peak Anxiety (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>26.67</td>
</tr>
<tr>
<td>Session 2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>19.00</td>
</tr>
<tr>
<td>Session 3</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>7.14</td>
</tr>
<tr>
<td>Session 4</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>7.86</td>
</tr>
<tr>
<td>Session 5</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>5.00</td>
</tr>
<tr>
<td>Session 6</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>6.38</td>
</tr>
<tr>
<td>Session 7</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>11.50</td>
</tr>
<tr>
<td>Session 8</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>3.29</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td></td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.
Table G-3

Summary of Treatment Sessions for P3

<table>
<thead>
<tr>
<th>Treatment Session</th>
<th>Number of New Scenarios Introduced in Each Session</th>
<th>Total Number of Scenarios Practiced in Each Session</th>
<th>Total Number of Trials Completed in Each Session</th>
<th>Mean Peak Anxiety (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>27.50</td>
</tr>
<tr>
<td>Session 2</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>25.00</td>
</tr>
<tr>
<td>Session 3</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>14.00</td>
</tr>
<tr>
<td>Session 4</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>12.50</td>
</tr>
<tr>
<td>Session 5</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>11.25</td>
</tr>
<tr>
<td>Session 6</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>7.50</td>
</tr>
<tr>
<td>Session 7</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>20.83</td>
</tr>
<tr>
<td>Session 8</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>7.00</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.*
Table G-4

Summary of Treatment Sessions for P4

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of New Scenarios Introduced in Each Session</th>
<th>Total Number of Scenarios Practiced in Each Session</th>
<th>Total Number of Trials Completed in Each Session</th>
<th>Mean Peak Anxiety (0-100)</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>15.00</td>
<td>3</td>
<td>15.00</td>
<td>8.94</td>
</tr>
<tr>
<td>Session 2</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>10.00</td>
<td>5</td>
<td>10.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Session 3</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>13.12</td>
<td>3</td>
<td>13.12</td>
<td>4.58</td>
</tr>
<tr>
<td>Session 4</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>15.56</td>
<td>2</td>
<td>15.56</td>
<td>5.27</td>
</tr>
<tr>
<td>Session 5</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>19.17</td>
<td>2</td>
<td>19.17</td>
<td>12.81</td>
</tr>
<tr>
<td>Session 6</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>15.00</td>
<td>2</td>
<td>15.00</td>
<td>4.63</td>
</tr>
<tr>
<td>Session 7</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>17.78</td>
<td>4</td>
<td>17.78</td>
<td>10.93</td>
</tr>
<tr>
<td>Session 8</td>
<td>4</td>
<td>6</td>
<td>13</td>
<td>15.38</td>
<td>4</td>
<td>15.38</td>
<td>5.19</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0 –100): 0 = no anxiety; 100 = extreme anxiety.
<table>
<thead>
<tr>
<th>Treatment Number</th>
<th>Number of New Scenarios Introduced in Each Session</th>
<th>Total Number of Scenarios Practiced in Each Session</th>
<th>Total Number of Trials Completed in Each Session</th>
<th>Mean Peak Anxiety (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>15.00</td>
</tr>
<tr>
<td>Session 2</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6.00</td>
</tr>
<tr>
<td>Session 3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5.80</td>
</tr>
<tr>
<td>Session 4</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>5.43</td>
</tr>
<tr>
<td>Session 5</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>48.20</td>
</tr>
<tr>
<td>Session 6</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>9.82</td>
</tr>
<tr>
<td>Session 7</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>8.40</td>
</tr>
<tr>
<td>Session 8</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>6.11</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Anxiety Scale (0-100): 0 = no anxiety; 100 = extreme anxiety.
Appendix H

Driving Diary Results For Research Participants

List of Figures

Figure H-1. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P1) ................................................................. 255

Figure H-2. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P2) ................................................................. 256

Figure H-3. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P3) ................................................................. 257

Figure H-4. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P4) ................................................................. 258

Figure H-5. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P5) ................................................................. 259

Figure H-6. Driving Diary Results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1) ................................................................. 260
Figure H-7. Driving Diary Results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1).................................261

Figure H-8. Driving Diary Results: Raw data for Driving Frequency during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1).................................262

Figure H-9. Driving Diary Results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2).................................263

Figure H-10. Driving Diary Results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2).................................264

Figure H-11. Driving Diary Results: Raw data for Driving Frequency during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2).................................265

Figure H-12. Driving Diary Results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3).................................266

Figure H-13. Driving Diary Results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3).................................267

Figure H-14. Driving Diary Results: Raw data for Driving Frequency during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3).................................268

Figure H-15. Driving Diary Results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up
Phases (P4) 269

Figure H-16. Driving Diary Results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up

Phases (P4) 270

Figure H-17. Driving Diary Results: Raw data for Driving Frequency during Baseline, Treatment, 1-Month, and 3-Month Follow-up

Phases (P4) 271

Figure H-18. Driving Diary Results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up

Phases (P5) 272

Figure H-19. Driving Diary Results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up

Phases (P5) 273

Figure H-20. Driving Diary Results: Raw data for Driving Frequency during Baseline, Treatment, 1-Month, and 3-Month Follow-up

Phases (P5) 274
Figure H-1. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (PI). Main Target Phobia and Global Phobia ratings are items from the Fear Questionnaire (Marks & Mathews, 1979); Main Target Phobia Scale (0-8): 0 = would not avoid it (driving) and 8 = always avoid it (driving), Global Phobia Scale (0-8): 0 = no phobia present; 9 = very severely disturbing/disabling.
Figure H-2. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P2). Main Target Phobia and Global Phobia ratings are items from the Fear Questionnaire (Marks & Mathews, 1979); Main Target Phobia Scale (0-8): 0 = would not avoid it (driving) and 8 = always avoid it (driving), Global Phobia Scale (0-8): 0 = no phobia present; 9 = very severely disturbing/disabling
Figure H-3. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P3). Main Target Phobia and Global Phobia ratings are items from the Fear Questionnaire (Marks & Mathews, 1979); Main Target Phobia Scale (0-8): 0 = would not avoid it (driving) and 8 = always avoid it (driving), Global Phobia Scale (0-8): 0 = no phobia present; 9 = very severely disturbing/disabling
Figure H-4. Driving Diary Results during Baseline, Treatment, and 1- and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P4). Main Target Phobia and Global Phobia ratings are items from the Fear Questionnaire (Marks & Mathews, 1979); Main Target Phobia Scale (0-8): 0 = would not avoid it (driving) and 8 = always avoid it (driving), Global Phobia Scale (0-8): 0 = no phobia present; 9 = very severely disturbing/disabling.
Figure H-5. Driving Diary Results during Baseline, Treatment, and 1-, and 3-Month Follow-up Assessments: Weekly Mean Main Target Phobia and Global Phobia and Driving Frequency Scores (P5). Main Target Phobia and Global Phobia ratings are items from the Fear Questionnaire (Marks & Mathews, 1979); Main Target Phobia Scale (0-8): 0 = would not avoid it (driving) and 8 = always avoid it (driving), Global Phobia Scale (0-8): 0 = no phobia present; 9 = very severely disturbing/disabling
Figure H-6. Driving Diary results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1). Main Target Phobia rating scale (0-8): 0 = would not avoid driving; 8 = always would avoid driving. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling restraints and treatment interruptions, the time period between weekly data points varied. Week 7 represents the post-treatment phase (see text for further information).
Figure H-7. Driving Diary results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1). Global Phobia rating scale (0-8): 0 = no phobia present; 8 = very severely disturbing/disabling. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling restraints and treatment interruptions, the time period between weekly data points varied. Week 7 represents the post-treatment phase (see text for further information).
Figure H-8. Driving Diary results: Raw data for Driving Frequency (minutes) during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P1). Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Due to scheduling restraints and treatment interruptions, the time period between weekly data points varied. Week 7 represents the post-treatment phase (see text for further information).
Figure H-9. Driving Diary results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2). Main Target Phobia rating scale (0-8): 0 = would not avoid driving; 8 = always would avoid driving. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase.
Figure H-10. Driving Diary results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2). Global Phobia rating scale (0-8): 0 = no phobia present; 8 = very severely disturbing/disabling. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-11. Driving Diary results: Raw data for Driving Frequency (minutes) during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P2). Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-12. Driving Diary results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3). Main Target Phobia rating scale (0-8): 0 = would not avoid driving; 8 = always would avoid driving. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-13. Driving Diary results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3). Global Phobia rating scale (0-8): 0 = no phobia present; 8 = very severely disturbing/disabling. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-14. Driving Diary results: Raw data for Driving Frequency (minutes) during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P3). Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-15. Driving Diary results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P4). Main Target Phobia rating scale (0-8): 0 = would not avoid driving; 8 = always would avoid driving. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-16. Driving Diary results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P4). Global Phobia rating scale (0-8): 0 = no phobia present; 8 = very severely disturbing/disabling. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-17. Driving Diary results: Raw data for Driving Frequency (minutes) during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P4). Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-18. Driving Diary results: Raw data for Main Target Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P5). Main Target Phobia rating scale (0-8): 0 = would not avoid driving; 8 = always would avoid driving. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-19. Driving Diary results: Raw data for Global Phobia during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P5). Global Phobia rating scale (0-8): 0 = no phobia present; 8 = very severely disturbing/disabling. Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Figure H-20. Driving Diary results: Raw data for Driving Frequency (minutes) during Baseline, Treatment, 1-Month, and 3-Month Follow-up Phases (P5). Each data point represents one day. The treatment phase is presented in weeks; each week represents the number of days between treatment sessions (e.g., Week 1 = number of days from when Treatment Session 1 was conducted up to the day before Treatment Session 2). Week 8 represents the post-treatment phase (see text for further information).
Appendix I

Target Driving Fear List Results for Research Participants

List of Tables

Table I-1: Target Driving Fear List Results at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

276
Table 1-1

Target Driving Fear List Results at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments

<table>
<thead>
<tr>
<th>Participant</th>
<th>Target Fear</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>1 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Fear 1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fear 2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fear 3</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>P2</td>
<td>Fear 1</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Fear 2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Fear 3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>P3</td>
<td>Fear 1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Fear 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Fear 3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>P4</td>
<td>Fear 1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Fear 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Fear 3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Severity (1 – 5)
Table I-1 (continued)

**Target Driving Fear List Results at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Target Fear</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>1 Month Follow-up</th>
<th>3 Month Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5</td>
<td>Fear 1</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Fear 2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Fear 3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

*Note.* Target Fear Severity Scale (1 – 5): 1 = absent; 2 = trivial; 3 = mild; 4 = moderate; 5 = severe.
Appendix J

Avoidance, Interference, and Distress Ratings for Research Participants

List of Tables

Table J-1: Avoidance, Interference, and Distress Ratings

at Pre-Treatment, Post-Treatment, 1-Month,
and 3-Month Follow-up Assessments

..............................................279
Table J-1

Avoidance, Interference, and Distress Ratings at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Variable</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>1 Month Follow-up</th>
<th>3 Month Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Avoidance</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Interference</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Distress</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>P2</td>
<td>Avoidance</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Interference</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Distress</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>P3</td>
<td>Avoidance</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Interference</td>
<td>8</td>
<td>7</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Distress</td>
<td>10</td>
<td>7</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>P4</td>
<td>Avoidance</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Interference</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Distress</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

(table J-1 continued)
Table J-1 (continued)

Avoidance, Interference, and Distress Ratings at Pre-Treatment, Post-Treatment, 1-Month, and 3-Month Follow-up Assessments.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Variable</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>1 Month Follow-up</th>
<th>3 Month Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5</td>
<td>Avoidance</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Interference</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Distress</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Note. Avoidance Scale (1-10): 1 = would not avoid driving; 10 = would always avoid driving.
Interference Scale (1-10): 1 = no interference; 10 = extreme interference; Distress Scale (1-10): 1 = not bothered/distressed; 10 = very bothered/distressed.
Appendix K

Plots of Ipsative Z-Scores for Outcome Measures for Research Participants

List of Figures

Figure K-1. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments (P1).......282

Figure K-2. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments (P2).......283

Figure K-3. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments (P3).......284

Figure K-4. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments (P4).......285

Figure K-5. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments (P5).......286
Figure K-1. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments for P1.
Figure K-2. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments for P2.
Figure K-3. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments for P3.
Figure K-4. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments for P4.
Figure K-5. Plot of Ipsative Z-Scores for Outcome Measures at Pre-, Post-, 1-, and 3-Month Follow-up Assessments for P5.
Appendix L

Results of Ipsative Z-Score Statistical Method for Research Participants

List of Tables

Table L-1  Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P1.................................288

Table L-2  Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P2...........................................289

Table L-3  Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P3...........................................290

Table L-4  Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P4...........................................291

Table L-5  Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P5...........................................293
Table L-1

Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P1.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>z1</th>
<th>z2</th>
<th>z3</th>
<th>z4</th>
<th>r^2 or CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Frequency</td>
<td>39</td>
<td>1.13</td>
<td>7.12</td>
<td>-0.16</td>
<td>0.74</td>
<td>-0.16</td>
<td>-0.16</td>
<td>-0.03^b</td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>39</td>
<td>5.53</td>
<td>2.91</td>
<td>0.85</td>
<td>-1.51</td>
<td>-1.21</td>
<td>-0.87</td>
<td>0.93^a</td>
</tr>
<tr>
<td>Global Phobia</td>
<td>39</td>
<td>4.00</td>
<td>1.99</td>
<td>1.01</td>
<td>-1.22</td>
<td>-1.01</td>
<td>-0.50</td>
<td>0.79^a</td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>10.75</td>
<td>2.87</td>
<td>1.48</td>
<td>-0.26</td>
<td>-0.61</td>
<td>-0.61</td>
<td>0.05^b</td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td>4</td>
<td>18.38</td>
<td>36.74</td>
<td>1.81</td>
<td>-0.23</td>
<td>-0.23</td>
<td>0.09</td>
<td>-0.10^b</td>
</tr>
</tbody>
</table>

Note. n = number of data points upon which summary statistics are based at pre-treatment, treatment, and follow-up assessments. Mean (M) and standard deviation (SD) scores are based on raw scores of the 4 assessment points. Assessment Points: z1 = pre-treatment assessment, z2 = post-treatment assessment, z3 = 1-month follow-up assessment; 3-month follow-up assessment. Number of comparisons (J) = 2 (between pre-and post-treatment assessments). For Driving Diary Measures (Main Target Phobia, Global Phobia, and Driving Frequency), baseline data was used for pre-treatment scores.

^aTest-rest reliability coefficients were available for Main Target Phobia (r = 0.93, Marks & Mathews, 1979) and Global Phobia (r = 0.79, Marks & Mathews, 1979). For all other measures, the 1 lag-autocorrelation, ACF(1), was calculated since reliability coefficients were not available. ACF(1) was calculated using Bartlett’s r test. Bold font = statistical significance (p < .05).
Table L-2

Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P2.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>z1</th>
<th>z2</th>
<th>z3</th>
<th>z4</th>
<th>r^a or b</th>
<th>CD</th>
<th>ACF(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Frequency</td>
<td>27</td>
<td>4.26</td>
<td>12.22</td>
<td>-0.23</td>
<td>0.47</td>
<td>-0.17</td>
<td>0.00</td>
<td>-.125b</td>
<td>2.46</td>
<td></td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>27</td>
<td>2.19</td>
<td>1.07</td>
<td>1.42</td>
<td>-1.11</td>
<td>-1.31</td>
<td>-0.18</td>
<td>0.93a</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Global Phobia</td>
<td>27</td>
<td>2.26</td>
<td>1.06</td>
<td>1.68</td>
<td>-1.19</td>
<td>-1.25</td>
<td>-0.25</td>
<td>0.79a</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>13.00</td>
<td>1.41</td>
<td>1.42</td>
<td>0.00</td>
<td>-0.71</td>
<td>-0.71</td>
<td>0.17b</td>
<td>2.12</td>
<td></td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td>4</td>
<td>21.25</td>
<td>13.15</td>
<td>1.42</td>
<td>-0.09</td>
<td>-0.48</td>
<td>-0.86</td>
<td>0.11b</td>
<td>1.55</td>
<td></td>
</tr>
</tbody>
</table>

Note. n = 4 for all outcome measures (n = number of z-scores upon which summary statistics are based at pre-treatment, treatment, and follow-up assessments). Mean (M) and standard deviation (SD) scores are based on raw scores of 4 assessment points. Assessment Points: z1 = pre-treatment assessment, z2 = post-treatment assessment, z3 = 1-month follow-up assessment; 3-month follow-up assessment. Number of comparisons (J) = 2 (between pre-and post-treatment assessments). For Driving Diary Measures (Main Target Phobia, Global Phobia, and Driving Frequency), baseline data was used for pre-treatment scores.

*Test-rest reliability coefficients were available for Main Target Phobia (r = 0.93, Marks & Mathews, 1979) and Global Phobia (r = 0.79, Marks & Mathews, 1979). For all other measures, the 1 lag-autocorrelation, ACF(1), was calculated since reliability coefficients were not available. ACF(1) was calculated using Bartlett's r test. Bold font = statistical significance (p < .05).
Table L-3

Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P3.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>z1</th>
<th>z2</th>
<th>z3</th>
<th>z4</th>
<th>r or</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving Frequency</td>
<td>26</td>
<td>0.62</td>
<td>2.25</td>
<td>-0.28</td>
<td>0.46</td>
<td>0.10</td>
<td>-0.28</td>
<td>-0.09b</td>
<td>2.42</td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>26</td>
<td>5.65</td>
<td>2.21</td>
<td>0.91</td>
<td>-0.90</td>
<td>-0.42</td>
<td>0.61</td>
<td>0.93a</td>
<td>0.61</td>
</tr>
<tr>
<td>Global Phobia</td>
<td>26</td>
<td>5.85</td>
<td>1.87</td>
<td>2.23</td>
<td>-1.17</td>
<td>-0.45</td>
<td>0.53</td>
<td>0.79a</td>
<td>1.06</td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>13.25</td>
<td>1.26</td>
<td>1.39</td>
<td>-0.20</td>
<td>-0.99</td>
<td>-0.20</td>
<td>0.04b</td>
<td>2.27</td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. n = 4 for all outcome measures (n = number of z-scores upon which summary statistics are based statistics are based at pre-treatment, treatment, and follow-up assessments). Mean (M) and standard deviation (SD) scores are based on raw scores of 4 assessment points. Assessment Points: z1 = pre-treatment assessment, z2 = post-treatment assessment, z3 = 1-month follow-up assessment; 3-month follow-up assessment. Number of comparisons (J) = 2 (between pre-and post-treatment assessments). For Driving Diary Measures (Main Target Phobia, Global Phobia, and Driving Frequency), baseline data was used for pre-treatment scores.

*Test-rest reliability coefficients were available for Main Target Phobia (r = 0.93, Marks & Mathews, 1979) and Global Phobia (r = 0.79, Marks & Mathews, 1979). For all other measures, the 1 lag-autocorrelation, ACF(1), was calculated since reliability coefficients were not available. ACF(1) was calculated using Bartlett’s r test. Bold font = statistical significance (p < .05).
Table L - 4


<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>z1</th>
<th>z2</th>
<th>z3</th>
<th>z4</th>
<th>( r^a ) or ( b )</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving Frequency</td>
<td>33</td>
<td>1.52</td>
<td>6.55</td>
<td>0.67</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>-0.02( ^b )</td>
<td>2.34</td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>33</td>
<td>5.93</td>
<td>1.22</td>
<td>-0.45</td>
<td>-1.58</td>
<td>0.88</td>
<td>0.88</td>
<td>0.93(^* )</td>
<td>0.61</td>
</tr>
<tr>
<td>Global Phobia</td>
<td>33</td>
<td>5.76</td>
<td>1.09</td>
<td>0.94</td>
<td>1.61</td>
<td>2.20</td>
<td>1.14</td>
<td>0.79(^* )</td>
<td>1.06</td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>15.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td>2</td>
<td>52.50</td>
<td>24.75</td>
<td>0.71</td>
<td>-0.71</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. \( n = 4 \) for all outcome measures (\( n = \) number of z-scores upon which summary statistics are based statistics are based at pre-treatment, treatment, and follow-up assessments). Mean (M) and standard deviation (SD) scores are based on raw scores of 4 assessment points. Assessment Points: \( z_1 = \) pre-treatment assessment, \( z_2 = \) post-treatment assessment, \( z_3 = \) 1-month follow-up assessment; 3-month follow-up assessment. Number of comparisons (\( J = 2 \) (between pre-and post-treatment assessments). For Driving Diary Measures (Main Target Phobia, Global Phobia, and Driving Frequency), baseline data was used for pre-treatment scores.

\(^*\)Test-rest reliability coefficients were available for Main Target Phobia (\( r = 0.93 \), Marks & Mathews, 1979) and Global Phobia (\( r = 0.79 \), Marks & Mathews, 1979). For all other measures, the 1 lag-autocorrelation, ACF(1), was calculated since reliability coefficients were not available. ACF(1) was calculated using Bartlett’s \( r \) test. Bold font = statistical significance (\( p < .05 \)).
For the Driving Anxiety Test, the autocorrelation cannot be calculated based on 2 scores only.

For the Target Fear List, the autocorrelation cannot be calculated when the number is a constant.
Table L-5

Descriptive statistics, ACF(1) Estimates, and Absolute Critical Difference (CD) Scores for Treatment Outcome Measures for P5.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>z1</th>
<th>z2</th>
<th>z3</th>
<th>z4</th>
<th>r^a or b</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving Frequency</td>
<td>29</td>
<td>0.93</td>
<td>2.83</td>
<td>0.33</td>
<td>0.33</td>
<td>0.59</td>
<td>1.15</td>
<td>-0.11^b</td>
<td>2.45</td>
</tr>
<tr>
<td>Main Target Phobia</td>
<td>29</td>
<td>3.48</td>
<td>2.13</td>
<td>1.47</td>
<td>-0.56</td>
<td>-0.83</td>
<td>-0.30</td>
<td>0.93^a</td>
<td>0.61</td>
</tr>
<tr>
<td>Global Phobia</td>
<td>29</td>
<td>3.03</td>
<td>1.95</td>
<td>1.47</td>
<td>-0.89</td>
<td>-0.60</td>
<td>-0.28</td>
<td>0.79^a</td>
<td>1.06</td>
</tr>
<tr>
<td>Target Fear List</td>
<td>4</td>
<td>12.75</td>
<td>1.71</td>
<td>1.32</td>
<td>-1.02</td>
<td>-0.44</td>
<td>0.15</td>
<td>-0.32^b</td>
<td>2.66</td>
</tr>
<tr>
<td>Driving Anxiety Test</td>
<td>2</td>
<td>42.50</td>
<td>10.61</td>
<td>0.71</td>
<td>-</td>
<td>-</td>
<td>-0.71</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. n = 4 for all outcome measures (n = number of z-scores upon which summary statistics are based statistics are based at pre-treatment, treatment, and follow-up assessments). Mean (M) and standard deviation (SD) scores are based on raw scores for 4 assessment points. Assessment Points: z1 = pre-treatment assessment, z2 = post-treatment assessment, z3 = 1-month follow-up assessment; 3-month follow-up assessment. Number of comparisons (J) = 2 (between pre-and post-treatment assessments). For Driving Diary Measures (Main Target Phobia, Global Phobia, and Driving Frequency), baseline data was used for pre-treatment scores.

^aTest-rest reliability coefficients were available for Main Target Phobia (r = 0.93, Marks & Mathews, 1979) and Global Phobia (r = 0.79, Marks & Mathews, 1979).

^bFor all other measures, the 1 lag-autocorrelation, ACF(1), was calculated since reliability coefficients were not available. ACF(1) was calculated using Bartlett’s r test.

For the Driving Anxiety Test, the autocorrelation cannot be calculated based on 2 scores only.