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Does engagement with exposure yield better outcomes?: Components of presence as a predictor of treatment response for virtual reality exposure therapy for social phobia

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Abstract

Virtual reality exposure (VRE) has been shown to be effective for treating a variety of anxiety disorders, including social phobia. Presence, or the level of connection an individual feels with the virtual environment, is widely discussed as a critical construct both for the experience of anxiety within a virtual environment and for a successful response to VRE. Two published studies show that whereas generalized presence relates to fear ratings during VRE, it does not relate to treatment response. However, presence has been conceptualized as multidimensional, with three primary factors (spatial presence, involvement, and realness). These factors can be linked to other research on the facilitation of fear during exposure, inhibitors of treatment response (e.g., distraction), and more recent theoretical discussions of the mechanisms of exposure therapy, such as Bouton's (2004) description of expectancy violation. As such, one or more of these components of presence may be more strongly associated with the experience of fear during VRE and treatment response than the overarching construct. The current study (N=41) evaluated relations between three theorized components of presence, fear ratings during VRE, and treatment response for VRE for social phobia. Results suggest that total presence and realness subscale scores were related to in-session peak fear ratings. However, only scores on the involvement subscale significantly predicted treatment response. Implications of these findings are discussed.

Keywords: Social Anxiety; Virtual Reality Exposure; Presence

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1. Introduction

Virtual Reality Exposure Therapy (VRE) is an effective treatment for a variety of anxiety disorders, including social phobia (for a review see Parsons & Rizzo, 2008). VRE involves exposing anxious individuals to virtually-generated feared stimuli. An advantage of VRE relative to in *vivo* exposure therapies is the greater ease with which therapists can manipulate the feared stimuli within the virtual environment (Rothbaum, Hodges, Kooper, & Opdyke, 1995). This advantage is especially relevant to exposure treatment for social phobia, because *in vivo* treatment of social fears (e.g., fear of public speaking) requires recruitment of potentially large numbers of "audience members" on multiple occasions. Simulation of public speaking scenarios using virtual environments thus circumvents a significant barrier to treatment (Olfson et al., 2000).

A handful of studies have demonstrated the utility of VRE for reducing symptoms among those diagnosed with social phobia and those with high levels of public speaking fears. The largest study to date examined changes in social fears after 12 sessions of VRE in 18 participants with social phobia (Klinger et al., 2005). Exposures were conducted in four virtual environments; these environments replicated different social situations that revolved around performance (e.g., public speaking), interpersonal interaction (e.g., a dinner conversation), assertiveness (e.g., having a viewpoint challenged), and evaluation (e.g., completing a task while being observed). Those who received individual VRE demonstrated a comparable decrease in symptoms to those receiving cognitive behavioral group therapy. Two trials with smaller samples yielded similar findings. Anderson and colleagues (2005) demonstrated that VRE reduced public speaking fears

in 10 participants diagnosed with social phobia. VRE also was more effective than no treatment at reducing public speaking fears in a sample of undergraduates that rated public speaking as a highly feared situation (Harris, Kemmerling, & North, 2002).

The concept of presence has been identified as a mechanism by which exposure to virtual stimuli can successfully treat fears in the real world (Parsons & Rizzo, 2008; Regenbrecht, Schubert, & Friedmann, 1998; Robillard, Bouchard, Fournier, & Renaud, 2003; Rothbaum et al., 1995; Wiederhold & Wiederhold, 2005). Presence is the extent to which an individual feels connected to or engaged with a virtual stimulus or environment (Lee, 2004; Schubert, Friedmann, & Regenbrecht, 2001). Empirical investigations and theoretical models both suggest that presence is comprised of multiple factors (Lee, 2004; Schubert et al., 2001; Witmer & Singer, 1998). The first factor, spatial presence, is the feeling that one is physically in the virtual space. Involvement, the second factor, is the extent to which one keeps attention focused on the virtual stimulus and ignores competing incongruent information. Realness, or the extent that the virtual stimulus coincides with expectations of the real stimulus, constitutes the third factor.

Despite the theorized relation between presence and VRE treatment response, there has been relatively little research on this topic, and results have been underwhelming. Specifically, two published empirical studies in this area found no significant relations between presence and response to VRE treatment for specific phobias (Krijn et al., 2004; Price & Anderson, 2007). Krijn and colleagues (2004) compared treatment response for acrophobia across high- and low-presence conditions. Researchers manipulated presence by using a complex computer-automated virtual environment (CAVE) which projects the virtual environment on the walls of a room for the high presence condition and a head mounted display (HMD) for the low presence condition. Results indicated that treatment response did not differ across high- and low-presence

conditions. Price and Anderson (2007) reported similar findings in a sample of adults who received 8 sessions of VRE for fear of flying. Although presence was associated with peak fear ratings during the first virtual reality exposure therapy session, it did not predict treatment response.

These null findings as to the relation between presence and treatment response challenge a basic assumption of VRE – that presence is a mechanism by which exposure therapy works. From the beginning, VRE researchers linked the concept of presence to the emotion processing theory (Foa & Kozak, 1986), which posits that a phobic fear structure must be activated through presentation of a feared stimulus in order for effective exposure therapy to occur. Presence was conceptualized as the construct that enabled the experience of fear towards a virtual stimulus; it thus constituted a necessary condition for effective exposure therapy as detailed by emotional processing theory (Anderson, Rothbaum, & Hodges, 2000). Indeed, the first VRE treatment outcome studies specifically targeted fears with powerful physical cues (e.g., height) that could be easily modeled within a virtual environment in order to maximize presence and fear structure activation (Rothbaum et al., 1995).

However, according to emotional processing theory, activation of the fear structure alone does not guarantee effective exposure therapy (Foa & Kozak, 1986). According to the emotion processing theory, effective exposure therapy requires prolonged, repeated, and controlled exposure to feared stimuli for extinction of fear to occur. Although VRE is described as an ideal mechanism for exposure therapy because it can be more easily manipulated (e.g., prolonged, repeated, and controlled) than in vivo exposure, it is still a context that provides only the *potential* for extinction learning. As a result, presence has been described as a construct that is necessary, but not sufficient for obtaining treatment response (Price & Anderson, 2007).

Examining the distinct factors that compose the construct of "presence" may help clarify both its potential relation to VRE treatment response and the null findings to date obtained with global presence measures. For example, the involvement factor reflects attention to the virtual stimulus, and relates to research showing that distraction from feared stimuli inhibits treatment response (Grayson, Foa, & Steketee, 1982; Wells & Papageorgiou, 1998). Presumably, greater involvement with the virtual environment is associated with greater attention to the feared stimulus, thus enhancing the effectiveness of the virtual environment as a context for extinction learning.

The realness factor of presence (the extent to which the virtual stimulus coincides with expectations about the real world stimulus), maps on to the face valid concept of how "real" the virtual environment feels, and may be important for fear structure activation. It also pertains to Bouton's (2004) notion of the importance of expectancy violation in extinction learning. According to Bouton, exposure therapy provides the opportunity for disconfirmation of expectations about feared stimuli (e.g., when a college student with social phobia signs up for a class that includes an oral presentation and finds that she neither fails the assignment nor is humiliated, and the experience disconfirms her negative expectations). In the context of VRE, the notion of expectancy violation is particularly interesting. There are likely some expectancies that cannot be violated in the virtual environment (e.g., there is no chance that the student will fail a course based on poor performance on a speech in a virtual environment) and other expectancies that could be violated (e.g., the person does not sound "stupid" while speaking to a group).

Finally, the spatial presence factor of presence (the extent that the participant feels they are physically in the virtual environment) has been associated with increased physiological arousal

after completing goals in an interactive virtual environment (Niklas et al., 2004). For those with social phobia, interacting with a virtual audience should lead to increased arousal and anxiety.

Of the two prior studies that examined the relation between presence and treatment response, one study (Price & Anderson, 2007) assessed presence using a unidimensional measure, and thus did not assess the roles of distinct aspects of the construct. Krijn and colleagues (2004) did not assess presence directly, but instead manipulated it by assigning participants to low and high-presence conditions. Notably, a moderate proportion of participants dropped out or withdrew (n=10) from the low presence condition because it did not arouse anxiety. Thus, there are theoretical reasons to evaluate the relation between presence, particularly the factors of presence, and treatment response that have not been adequately examined in the two studies examining the topic to date.

The current study sought to examine associations between presence, the global construct as well as its constituent factors (spatial presence, involvement, realness), fear ratings during VRE for public speaking fears, and treatment response among a clinical sample diagnosed with social phobia. We hypothesized that the overall score on a self-report measure of presence, as well as scores on each of the 3 factor subscales would be positively associated with both fear ratings during VRE sessions and treatment response. A second aim of the study was to replicate prior research showing that the global construct of presence is related to fear ratings during VRE, and to extend this research by examining how specific presence factors relate to fear during VRE.

2. Methods

2.1 Participants

Participants were 41 individuals diagnosed with social phobia according to DSM-IV criteria who were recruited as part of two larger treatment outcome studies. Diagnoses were

made using the Structured Clinical Interview for the DSM-IV (SCID; First, Gibbon, Spitzer, & Williams, 2002) by doctoral students that were trained in diagnostic interviewing via training tapes and practice interviews under the supervision of a licensed clinical psychologist. Agreement between the clinicians and the trainees on a subsample (20%) of the assessment interviews was 100%. Approximately 41% (n = 17) met criteria for social phobia: generalized subtype. The majority of participants did not meet criteria for any comorbid diagnoses (*n* = 30, 73%). Participants were recruited through newspaper advertisements, posted flyers, and internet-based outlets seeking participants with significant fears of public speaking. To be included in the study, participants had to be English speakers and to meet DSM-IV criteria for social phobia. Participants taking psychoactive medication had to have been stabilized on their current medication(s) and dosage(s) for at least 3 months and were also required to remain at the same dosage throughout the study. Individuals meeting any of the following criteria were excluded, (a) history of mania, schizophrenia, or other psychoses; (b) current suicidal ideation; (c) current alcohol or substance dependence; (d) inability to tolerate the virtual reality helmet; (e) history of seizures.

The majority of the sample was female (*n* = 24, 60%), married (*n* =19, 48%), and well educated (*n* = 27, 68%). The sample self-identified as "Caucasian" (*n* = 21, 54%), "African-American" (*n* =12, 28%), "Latino" (*n* = 2, 4%), and "Asian American" (*n* = 2, 6%). The remaining 3 participants reported "other" racial/ethnic identities.

2.2. Measures

The following measures were used to assess social phobia symptoms and presence.

2.2.1 Igroup Presence Questionnaire (IPQ; Schubert et al., 2001): The IPQ is a 14-item self-report questionnaire designed to assess presence. Items are scored on a 7-point likert scale (1-7)

with higher scores indicating a greater sense of presence. The IPQ can be used as a composite measure of presence with scores ranging from 7 to 98 or it can be divided into subscales assessing the three components of presence (spatial presence, involvement, and realness). The spatial presence scale contains five items assessing feelings that one is physically within a virtual environment (e.g., "I had a sense of acting in the virtual space, rather than operating something from outside."). The involvement subscale contains four items assessing attention to the virtual world (e.g., "I was completely captivated by the virtual world."). The realness subscale contains four items assessing how real the virtual stimuli appear (e.g., "How real did the virtual world seem to you?"). The measure has good psychometric properties and a factor structure that has been replicated across multiple samples (Schubert et al., 2001). In the current study, the IPQ was administered at the end of sessions in which exposure was conducted (session 5 to 8).

2.2.2 Personal Report of Confidence as a Speaker (PRCS; Paul, 1966): The PRCS is a 30-item self-report questionnaire that assesses behavioral and cognitive responses to public speaking. Sample items include "My hands tremble when I try to handle objects on the platform" and "While preparing a speech, I am in a constant state of anxiety." Answers are recorded in a True/False format with summary scores ranging from 0-30 such that higher scores indicate greater fear of public speaking. The PRCS has been shown to be moderately to strongly correlated with broader measures of social phobia (Daly, 1978). Prior research with a large normative sample indicated that PRCS scores do not differ across demographic variables including age, ethnicity, and gender (Phillips, Jones, Rieger, & Snell, 1997). Additionally, research that has used the PRCS as an outcome measure has shown it be sensitive to change for exposure based interventions (Altmaier, Ross, Leary, & Thornbrough, 1982; Kirsch & Henry, 1977; Lawm, Schwartz, Houlihan, & Cassisi, 1994).

2.2.3 Subjective Unit of Discomfort Scale (SUDS): The SUDS rating scale is a self-report measurement of anxiety on a 0 to 100 point scale. Scores of 0 represent no fear and 100 represents the most fear the individual has ever felt. The therapist recorded peak SUDS ratings during each virtual reality exposure treatment session.

2.2.4 Structured Clinical Interview for the DSM-IV (SCID; First et al., 2002): The SCID is a structured, well-validated diagnostic clinical interview used to assess psychological disorders based upon DSM-IV criteria. For the current project, the SCID was used to determine participation eligibility as well as presence of a variety of Axis I conditions within the mood, alcohol/substance use, and anxiety disorders modules.

2.3 Procedure

Data for the present study were collected through two treatment trials for a total of N = 41. The first, a randomized controlled trial, compared cognitive behavioral group therapy to VRE to a WL control for social phobia. Only data from the participants who received VRE are included in the present study (n=31). The second trial (n=10) examined amygdala activity as a predictor of treatment response to VRE using functional magnetic resonance imaging (fMRI). For the purposes of the present study, the procedures are the same across the two trials, with the exception that participants in the fMRI trial were not randomly assigned to treatment; they all received VRE. Figures 1 and 2 were prepared in accordance with guidelines outlined in the CONSORT (Consolidated Standards of Reporting Trials; Altman et al., 2001) and TREND (Transparent Reporting of Evaluations with Nonrandomized Designs; Des Jarlais, Lyles, Crepaz, & the TREND Group, 2004) statements. Figure 1 and Figure 2 show the flow of VRE participants through Trial 1 and Trial 2.

Setting and Personnel. All procedures for this study were conducted at the Psychology Clinic at Georgia State University and were approved by the University's Institutional Review Board. Four doctoral candidates in clinical psychology conducted all assessment procedures, including telephone screening and in-person assessments under the supervision of a licensed clinical psychologist. Treatment was administered by five study therapists, two senior therapists were licensed psychologists with prior experience implementing manualized cognitive behavior therapy and three junior therapists were doctoral students. Prior to administering therapy, study therapists attended two-day intense training workshops, led by the developer of the treatment. Junior therapists were supervised by the last author.

2.3.1 Assessments. Eligibility was determined through a two-part process, involving a brief telephone screening and an in-person, pre-treatment assessment. During the phone screen, potential participants were asked questions to rule out obvious exclusion criteria (e.g., began psychoactive medication within the past 3 months). Following the phone screen, interested and eligible individuals were scheduled for face-to-face pre-treatment assessment, which included administration of the SCID and self-report measures. Participants completed the PRCS at pre-treatment, mid-treatment, and post-treatment assessments. The IPQ was administered at the end of each exposure session (sessions 5-8).

2.3.2 Treatment. VRE consisted of eight sessions of individual therapy delivered according to a treatment manual (Anderson et al., 2005). The treatment was designed to target several processes shown to maintain social anxiety, including self-focused attention, negative perceptions of self and others, perceptions of lack of emotional control, rumination, and realistic goal setting for social situations. The first four sessions targeted these processes via use of cognitive restructuring and videotape feedback exercises, but did not include exposures to any of

the virtual environments. Sessions 5-8 consisted of exposure to various virtual environments. These scenarios were presented via a head-mounted display (HMD) that consisted of a helmet with headphones, goggles, and a tracker that allowed the virtual environment to move naturally with the participant. The virtual reality (VR) scenarios included 1) a conference room (approximately 5 audience members), 2) a classroom (approximately 35 audience members), and 3) a large auditorium (approximately 100 audience members). VRE therapists could manipulate audience reactions (e.g., making them appear interested/bored, supportive/hostile, distracted), as well the difficulty of questions posed by audience members, according to each client's treatment goals.

3. Results

Descriptive statistics for all variables can be found in Table 1. A preliminary comparison suggested that pretreatment PRCS scores did not significantly differ across participants with social phobia and those with social phobia: generalized subtype, F (1, 39) = 0.15, p = 0.70.

3.1. The relation between presence and anxiety.

Multilevel modeling (MLM) was used to examine how strongly IPQ scores related to the experience of anxiety in session, as indicated by peak SUDS fear ratings. First, a model was fitted that included level 1 fixed effects for intercept, slope, and IPQ scores (Table 2). The fixed effect for slope was not significant, indicating that peak levels of fear did not change during the course of treatment (β_{10} = 0.12, p = 0.44), but the fixed effect for IPQ scores was significant (β_{20} = 0.09, p < 0.01). This suggests that, after controlling for slope, overall presence was positively associated with peak fear ratings. To further explore the relation between presence and in-session fear, a similar model was constructed that included fixed effects for the IPQ subscales (spatial presence, involvement, and realness) instead of the total score. These findings indicated that

after controlling for slope, realness was significantly related to peak fear ratings ($\beta_{40} = 0.22$, $p < 0.01$), but spatial presence ($\beta_{20} = 0.02$, $p = 0.84$) and involvement ($\beta_{30} = 0.01$, $p = 0.81$) were not.

3.2. Associations between presence and treatment response.

A repeated measures ANOVA was conducted to compare IPQ scores across exposure therapy sessions. Findings indicated that IPQ scores did not differ over time, F (3, 37) = 1.07, p = 0.37. Similar findings were obtained for the spatial presence, F (3, 37) = 2.11, p = 0.68, involvement, F (3, 37) = 2.48, p = 0.21, and realness subscales, F (3, 37) = 0.08, p = 0.97. Based on these findings, mean IPQ and the IPQ subscale scores from the four sessions in which exposure was conducted were used to examine the association between presence and treatment response.

A multilevel model that included a fixed effect for intercept and slope at level 1 and total IPQ scores at level 2 was fitted to examine how strongly presence predicted the rate of change during the course of treatment (Table 3). These findings suggested that PRCS scores declined during the course of treatment ($\beta_{10} = -3.79$, $p < 0.01$). However, total IPQ scores were unrelated to the rate of change ($\beta_{11} = -0.07$, $p = 0.16$).

A similar model was used to examine the association between the IPQ subscales and treatment response (Table 3). The subscales were entered as level 2 fixed effects for slope of PRCS scores. Findings indicated that the involvement scale was associated with an increased rate of change (slope; $\beta_{12} = -0.40$, $p < 0.01$), but the spatial presence ($\beta_{11} = 0.20$, $p = 0.24$) and realness scales were not ($\beta_{13} = 0.14$, $p = 0.46$). The involvement scale alone accounted for 9% of the variance in the slope of PRCS scores. These findings indicate that the involvement component of presence related to changes in social phobia symptoms from pretreatment to

posttreatment but the overall construct of presence, as well as the spatial presence and realness components, were not.

4. Discussion

Findings from the current study suggest that different components of presence are associated with the experience of fear and treatment response to VRE. Total presence scores were significantly associated with peak self-reported fear ratings during VRE; however, this association appeared to be driven largely by a significant relationship between the realness component of presence and fear ratings during exposure. In contrast, the involvement scale was the only component that was significantly associated with treatment response.

Findings that peak within session fear ratings were associated with the overall construct of presence and the realness subscale are consistent with prior research demonstrating a positive association between presence and anxiety towards virtual stimuli (Krijn, Emmelkamp, Olafsson, & Biemond, 2004; Price & Anderson, 2007). Emotional processing theory indicates that a stimulus must be able to activate the fear structure if successful extinction learning is to take place (Foa & Kozak, 1986). The association found in this and prior studies suggest that presence is the mechanism by which a virtual stimulus can elicit fear and allow extinction learning to occur. Given the correlational nature of the present study, as well as the use of retrospective reports taken at the end of each session to measure presence, conclusions about the direction of this relation cannot be drawn. It is possible that proneness to experience presence, particularly its realness component, leads to higher ratings of fear during exposure therapy. Alternatively, elevated levels of fear during exposure may lead participants to report later that they felt more connected with the virtual environment and that it appeared more realistic. Additional research using “on-line” measures of presence during actual exposure sessions are necessary to better

understand how presence and fear relate to each other during VRE at both temporal and conceptual levels.

With regard to the relation between presence and treatment response, only scores on the involvement scale predicted response to VRE treatment for public speaking fear. The involvement subscale provides a measure of how closely the participant focused on the virtual environment and ignored distracting information from other sources during exposure (Schubert et al., 2001). Findings of the current study are consistent with other research demonstrating that sustained attention during exposure is associated with improved response, and distraction is associated with poorer response (Kamphuis & Telch, 2000; Telch et al., 2004), as well as work showing that an avoidant attention bias at the start of treatment was associated with reduced outcomes in those with social phobia (Price, Tone, & Anderson, In press). These findings were presumed to be attributed to the reduced availability of cognitive resources for extinction learning because of distraction. Although not directly tested, the same explanation could apply to the current study. During VRE, participants reporting higher involvement were better able to focus on the virtual environment and ignore incongruent information from outside the virtual environment. Such individuals may therefore have been less likely to have divided attentional resources, leaving them with more attentional capacity to devote to extinction learning.

These findings have implications for clinical work. Clinicians using VRE to treat social phobia should try to maximize a client's presence within the virtual environment. Past research has highlighted the importance of contextual cues in the acquisition of extinction learning (Bouton, 2004; Bouton, Westbrook, Corcoran, & Maren, 2006). VRE provides an excellent means to expose the participant to multiple contexts without leaving the therapist's office. Results from the current study suggest that maximizing presence for each context may increase

the amount of fear experienced and maximizing involvement, or attentional focus, may lead to better treatment response. At a practical level, this suggests that VRE therapists may achieve better results by turning off lights in the office to reduce distraction from outside the virtual environment. Prior research has shown that increasing the number of phobic elements, or salient aspects of feared stimuli, in virtual environments is associated with increased reports of presence (Price & Anderson, 2007; Ravaja et al., 2006). Asking clients to dress as they would when giving a presentation or to hold common presentation props such as pointers may be helpful in enhancing the VRE experience. Also, feared aspects that are specific to each client should be replicated during the exposures to enhance a sense of presence.

Scores on the spatial presence subscale showed consistently nonsignificant associations with in-session fear and treatment response. This suggests that spatial presence, the sense of being in the virtual world, may be less important for both the experience of and successful response to VRE than other components of presence. Alternatively, because public speaking scenarios, which place the participant at the front of the audience as a speaker, were the only virtual environment used in the present study, it is possible that the implied physical distance between the participant and the audience members may have reduced participants' feeling that they were physically present in an actual room. Furthermore, public speaking scenarios typically involve less interaction with virtual audience members than do other types of social interaction scenarios, such as conversations. Thus, the implied physical distance from audience members may have attenuated associations between spatial presence and both the experience of fear, and treatment response. Additional research is needed to assess the association between these variables in virtual environments (e.g., conversations or parties) that place participants in close proximity and sustained interactions with virtual peers.

The current study contained several limitations of note. First, the study relied exclusively on self-report measures of public speaking fear and presence. Future work should assess how presence is associated with physiological indicators of public speaking fear such as skin conductance levels and heart rate. Also, sample size for the current study was relatively small (N = 41). Although this is the largest sample of individuals with social phobia to receive VRE in the literature thus far, the inconsistency of the present findings with prior research in samples with specific phobia highlights the need for replication with larger samples before firm conclusions can be drawn about presence and treatment response. Third, the current study exclusively used public speaking scenarios, which constitute only one specific type of social interaction. As a result, we do not know the effects of presence on decreases in fears for other social situations. This is important because a recent review (Blöte, Kint, Miers, & Westenberg, 2009) questioned the utility of speech tasks for assessing social anxiety symptoms, and suggested that public speaking anxiety may be a specific subtype of social phobia. Additional research is needed to determine how these subscales may be associated with treatment response for other types of social interactions such as conversations, social settings such as parties, or other types of evaluative environments, as much of the research using VRE to treat social phobia has focused on addressing public speaking fears (Anderson et al., 2005; Harris et al., 2002; Klinger et al., 2005). Virtual reality provides an excellent method by which to treat a variety of social fears due to the flexibility of the system in that it can portray a range of environments. The therapist can access a number of different social environments and interaction types to better tailor the exposure to the needs of the individual.

Despite these limitations, findings of the current study are consistent with prior research demonstrating that presence, particularly its realness component, is associated with the

experience of fear during VRE. It is the first study to show that presence (or any aspect of presence) is related to treatment response. The finding that a particular aspect of presence, involvement, is associated with treatment response converges with proposed mechanisms of exposure therapy.

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Table 1.

Descriptive statistics for presence and social phobia measures.

	Pretreatment	Midtreatment (Session 5)	Session 6	Session 7	Posttreatment (Session 8)
PRCS	23.98 (3.11)	22.69 (4.35)	-	-	16.42 (7.26)
IPQ	-	56.77 (9.80)	57.16 (11.13)	57.44 (11.22)	55.38 (13.98)
Spatial Presence	-	20.33 (3.04)	20.54 (3.02)	20.11 (2.23)	20.73 (3.33)
Involvement	-	16.39 (4.37)	17.38 (5.58)	18.04 (5.21)	16.12 (6.22)
Realness	-	15.17 (4.59)	14.81 (4.76)	14.68 (5.00)	13.88 (5.98)

Note: PRCS = Personal Report of Confidence as a Speaker. IPQ = Igroup Presence Questionnaire. Values in parentheses are standard deviations.

Table 2.

MLM using IPQ and IPQ subscales as a predictor of slope for peak SUDS ratings across session 5 through 8.

	Parameter	SUDS
Level 1		
Intercept	β_{00i}	1.59 (1.57)
Slope	β_{10i}	-0.12 (0.15)
IPQ Total Score	β_{20i}	0.09** (0.02)
Level 1		
Intercept	β_{00i}	2.65 (2.08)
Slope	β_{10i}	-0.10 (0.15)
IPQ Spatial subscale	β_{20i}	0.02 (0.10)
IPQ Involvement subscale	β_{30i}	0.01 (0.05)
IPQ Realness subscale	β_{40i}	0.22** (0.05)

Note: ** = $p < 0.01$. PRCS = Personal Report of Confidence as a Speaker. IPQ = Igroup Presence Questionnaire. Values in parentheses are standard errors.

Table 3.

MLM using mean IPQ and mean IPQ subscales as a predictor of slope for PRCS

	Parameter	PRCS
Level 1		
Intercept	β_{00i}	38.88** (1.14)
Slope	β_{10i}	-3.79** (0.55)
Level 2		
IPQ Total Score	β_{11i}	-0.07 (0.05)
Level 1		
Intercept	β_{00i}	25.68** (0.56)
Slope	β_{10i}	-4.18** (0.57)
Level 2		
IPQ Spatial subscale	β_{11i}	0.20 (0.16)
IPQ Involvement subscale	β_{12i}	-0.40** (0.13)
IPQ Realness subscale	β_{13i}	0.13 (0.18)

Note: ** = $p < 0.01$. PRCS = Personal Report of Confidence as a Speaker. IPQ = Igroup Presence Questionnaire. Values in parentheses are standard errors.

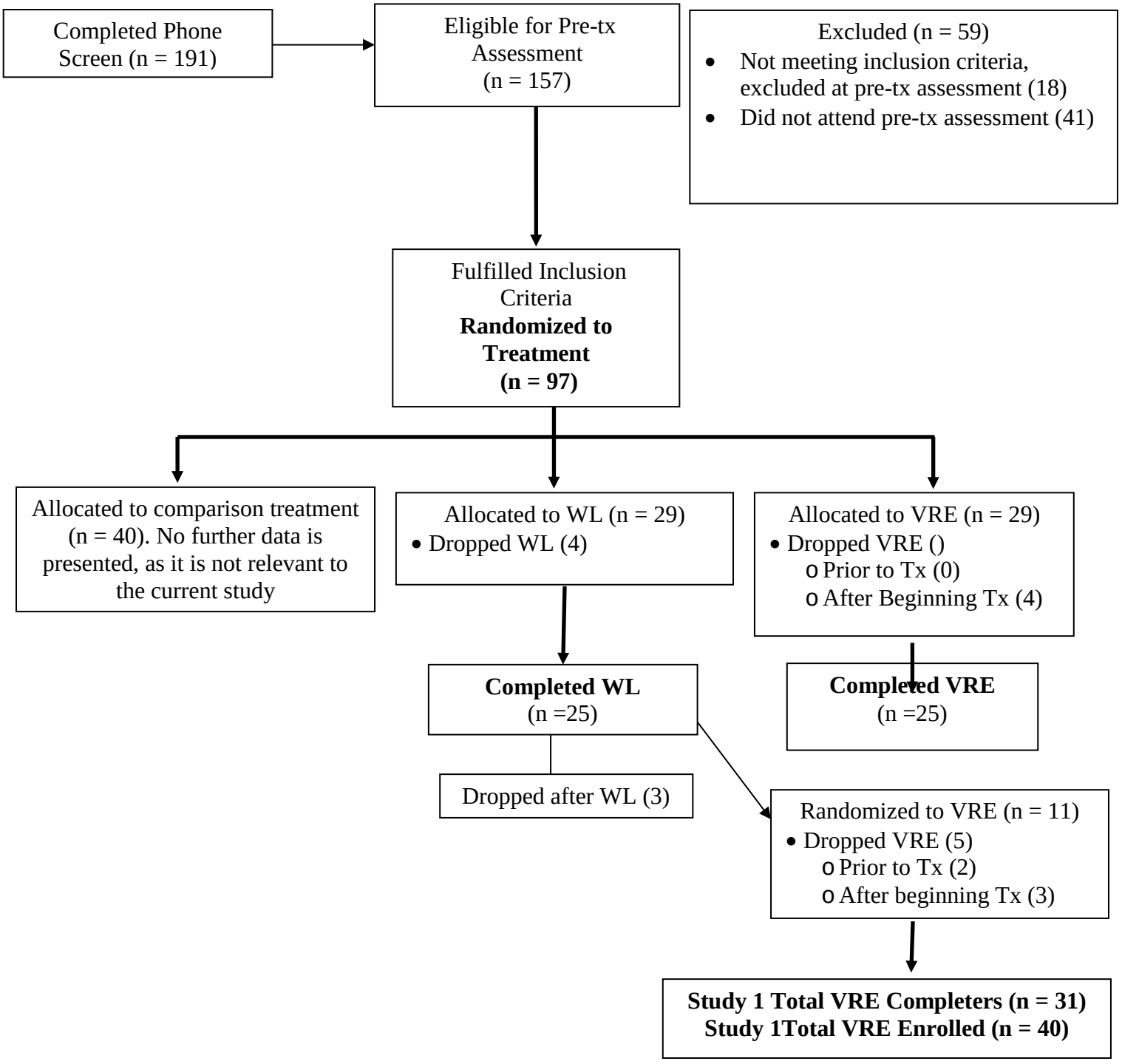

Figure 1. Flow of participants through Study 1, RCT.

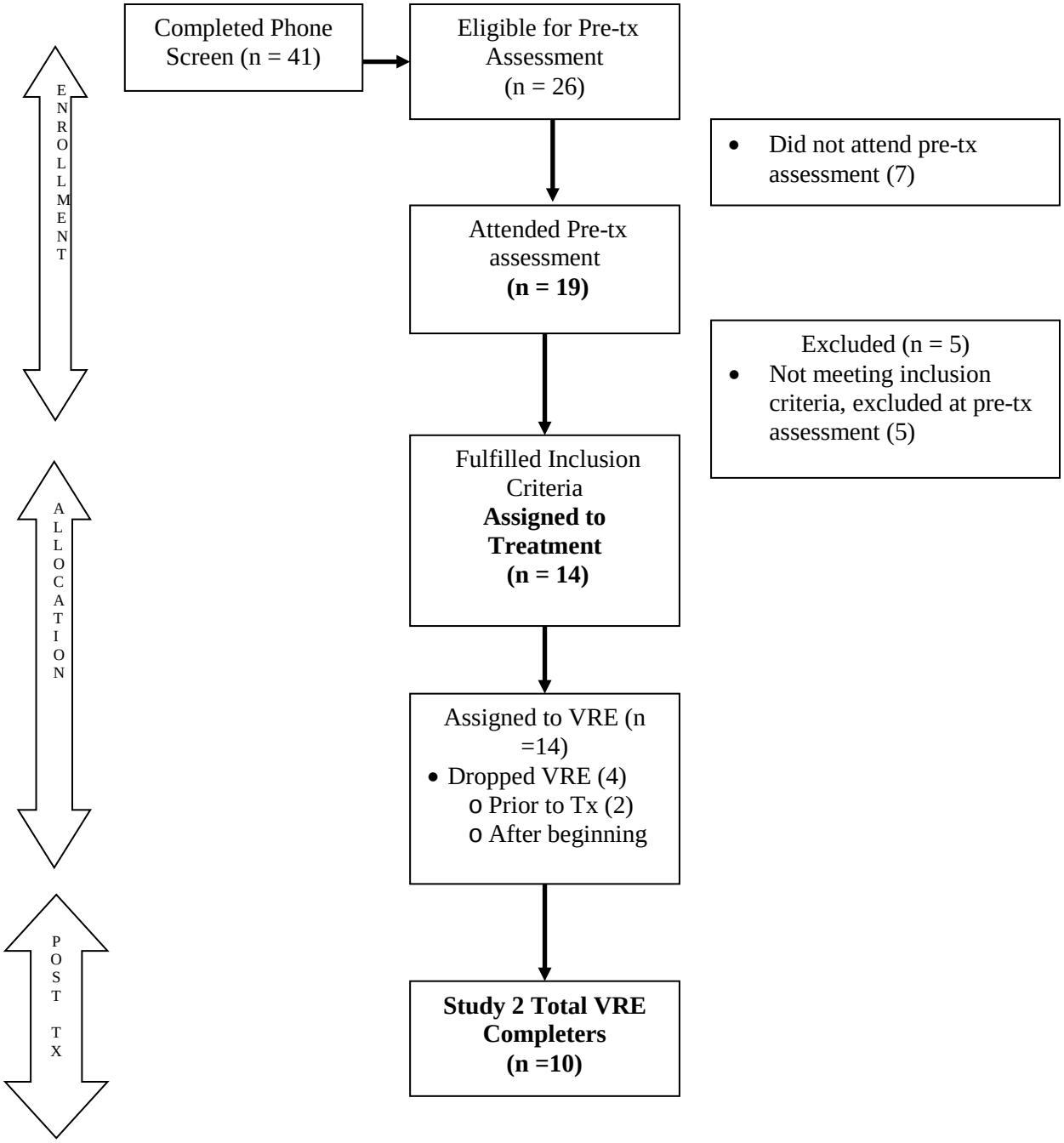

Figure 2. Flow of participants through Study 2, fMRI clinical trial.

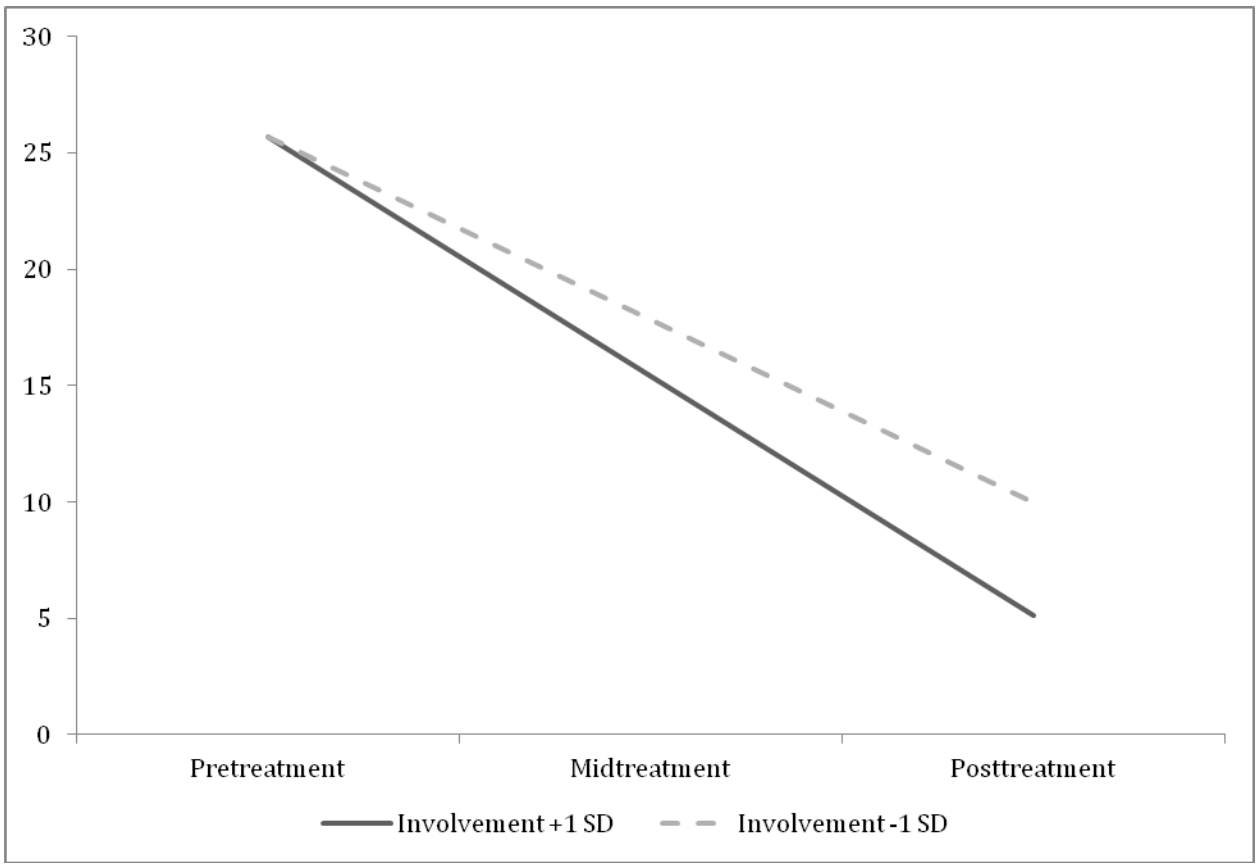

Figure 3. Treatment response for PRCS at +/- 1 standard deviation of the involvement subscale of the IPQ.