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The Effects of Relaxation Plus Imaginal Flooding Versus Relaxation Only on Panic Attacks in Veterans with Post-Traumatic Stress Disorder

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THE EFFECTS OF RELAXATION PLUS IMAGINAL FLOODING VERSUS
RELAXATION ONLY ON PANIC ATTACKS IN VETERANS
WITH POST-TRAUMATIC STRESS DISORDER

by

Jan E. Bachman

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
December 1991

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Many Vietnam veterans experience intrusive recollections of combat-related events in the form of nightmares and flashbacks, a primary symptom of Post-traumatic Stress Disorder (PTSD). Imaginal flooding has shown some promise in reducing the frequency and intensity of these. Cognitive-behavioral therapies have also been used, but their effectiveness has not been studied. Experiment 1 attempted to determine whether a self-imposed version of imaginal flooding (called Self-Imaginal Flooding) could be used rather than the usual therapist-led procedure, and whether treatment effects could generalize from the treated to untreated intrusive memories. In a between groups design, with six Vietnam veteran subjects in each group, the effects of Self-Imaginal Flooding were compared with Relaxation Only. Following relaxation training for both groups, three intrusive memories were presented for treatment to the Flooding Group in a multiple baseline fashion. The Relaxation Group received extended relaxation training. Probes, in which subjective and physiological measures were
obtained, were conducted prior to treatment, after relaxation training, and following treatment of each of the three intrusive memories. Results indicated that Self-Imaginal Flooding was more effective than Relaxation Only in reducing the frequency and intensity of intrusive memories outside of treatment, neither anxiety nor depression were decreased, generalization of treatment effects did not occur, and EDG was the only physiological measure which changed significantly as a result of the Self-Imaginal Flooding treatment. In Experiment 2, six subjects were taught the Self-Imaginal Flooding technique and four cognitive-behavioral coping strategies. Subjects received training for each of these techniques and selected one strategy for extended practice. Probes, similar to those in Experiment 1, were conducted before and after training. The results showed that strategy preferences were related to the amount of discomfort reduction. In addition, there were significant within-group decreases in the frequency of intrusive memories and measures of anxiety and depression. As measured in the probes, self-selected coping strategies were more effective than previously used coping methods in reducing subjective discomfort and heart rates. The implications of the results of both experiments are discussed.
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The effects of relaxation plus imaginal flooding versus relaxation only on panic attacks in veterans with post-traumatic stress disorder

Bachman, Jan E., Ph.D.

Western Michigan University, 1991
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Jan E. Bachman
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CHAPTER I

INTRODUCTION

Statement of the Problem

Post-traumatic Stress Disorder (PTSD) is characterized by reexperiencing a “traumatic event, avoidance of stimuli associated with the event or numbing of general responsiveness, and increased arousal” (American Psychiatric Association, 1987, p. 247). The critical feature is that the symptoms follow a traumatic event that is an uncommon human experience (American Psychiatric Association, 1987). For veterans with PTSD the traumatic event(s) typically relate to killing or maiming during combat activities or witnessing or experiencing physical brutality. These events are “reexperienced” at later points in time as intrusive recollections (nightmares and/or flashbacks) when the veteran is exposed to stimuli similar to those during the original event (American Psychiatric Association, 1987).

The emergence of symptoms may be delayed for many years. Thus, it had been assumed that veterans adjusted well upon leaving Vietnam, and PTSD was not widespread (Horowitz & Solomon, 1978). However, the recent National Vietnam Veterans Readjustment Study (see Keane, Fairbank, Caddell, & Zimering, 1989), reported 36% of "high combat
exposed" males experienced psychological problems. Other estimates differ somewhat due to sampling methods and diagnostic criteria (Foy, Resnick, Sipprelle, & Carroll, 1987), with the prevalence of PTSD projected from 30% in the low combat exposed subjects (Foy et al., 1987) to 60% in high combat exposed veterans (Helzer, Robins, & McEvoy, 1987). Regardless, it is generally accepted that in excess of 500,000 Vietnam veterans need intensive treatment for PTSD-related problems (Egendorf, Kadushin, Laufer, Rothbart, & Sloan, 1981; Figley, 1978; Jelinek & Williams, 1984; Wilson, 1978).

As the magnitude of PTSD in Vietnam veterans became apparent over the last 10 years, treatment professionals responded with the development of improved diagnostic methods (Blanchard, Gerardi, Kolb, & Barlow, 1986; Brett, Spitzer, & Williams, 1988; Keane, Caddell, & Taylor, 1988; Lund, Foy, Sipprelle, & Strachan, 1984) and specialty treatment programs at Veterans Administration (VA) medical centers (Bains, Frazee, Amidon, Hare, & Munley, 1988; Berman, Rice, & Gusman, 1982; Schwartz & Doherty, 1987; Starkey & Ashlock, 1984). A National Center for Post-traumatic Stress Disorder was developed that, according to Lehman (1990), treated 3,485 combat veterans between October 1, 1989 and March 30, 1990. Of these veterans 2,307 had never been treated before.
Psychology has played a key role in the treatment of PTSD. Among psychological techniques that have been applied to PTSD are the following: narcosynthesis (e.g., Kolb & Mutalipassi, 1982), hypnosis (Balson & Dempster, 1980; Brende & Benedict, 1980; Eichelman, 1985; Parson, 1984, 1988; Spiegel, 1981), imagery (Grigsby, 1987), relaxation (e.g., Hickling, Sison, & Vanderpleog, 1986; Parson, 1984), desensitization (Brodsky, Doerman, Palmer, Slade, & Munasifi, 1987; Peniston, 1986; Schindler, 1980), imaginal flooding (e.g., Fairbank, Gross, & Keane, 1983; Fairbank & Keane, 1982; Keane & Kaloupek, 1982; Lyons & Keane, 1989), cognitive-behavioral therapy (e.g., Alford, Mahone, & Fielstein, 1988; Besyner, 1985; McCormack, 1985; Nezu & Carnevale, 1987), and psychotherapy (e.g., Hendin, 1983; Hendin, Pollinger, Singer, & Ulman, 1981; Ulman & Brothers, 1987; Wilmer, 1986). These methods are generally used in conjunction with other psychological treatment and/or with pharmacotherapy.

While attempts to assess the efficacy of each of these modalities continue to be made, increasing emphasis has been given to those therapies, particularly imaginal flooding, in which the veterans are required to “relive” the traumatic event(s) first experienced in combat (e.g., Fairbank & Nicholson, 1987; Keane et al., 1989). In fact, the inclusion of the “reliving” experience is fast becoming a common ingredient across therapies supported by diverse
theoretical biases. Another common ingredient is the use of cognitively oriented techniques, but studies on these have yet to be done. These two treatment modalities are the focus of the following research.

Review of Related Literature

The defining feature of imaginal flooding is the programmed "reliving" of traumatic event(s) through verbal and imaginary processes. It is a derivative of flooding (Malleson, 1959), a procedure that directly exposes patients to anxiety-provoking conditioned stimuli for prolonged periods in an effort to reduce or extinguish anxiety-related responses. Imaginal flooding is used when direct exposure to the conditioned stimuli thought to elicit symptoms is difficult or impossible to arrange. Instead of being directly exposed to stimuli, patients are asked to imagine them, often with the help of verbal directions from a therapist.

The use of imaginal flooding in the treatment of combat-related PTSD was first reported in 1982 (Black & Keane, 1982). The typical procedure requires an initial period of relaxation, following which the therapist provides a series of "hypnotic-like" statements suggesting that the patient will be able to "relive" a combat experience as though he were actually there (Lyons & Keane, 1989). The patient is asked to imagine himself engaging in a specific combat-re-
lated scene as it is described by the therapist (Shielkh, 1983). The patient is prompted to interact with the therapist (e.g., stating what he is experiencing as though it were happening now) to intensify the effects of the stimuli and to keep him from attending to other stimuli during the process (Rainey et al, 1986). The patient is encouraged to hold onto these images until the anxiety diminishes. A detailed description of the way in which imaginal flooding treatment with Vietnam veterans is conducted has been presented by Lyons and Keane (1989).

Several case studies on the efficacy of flooding techniques exist. Keane and Kaloupek (1982) and Fairbank and Keane (1982) reported significant improvements in self-reported sleep measures, anxiety levels, nightmares, and flashbacks as a function of flooding. Significant decreases in depression, the number of endorsed items on a symptom rating scale, symptom intensity (Fairbank, Gross, & Keane, 1983), and frequencies (Fairbank & Keane, 1982) and intensities (Fairbank, Gross, & Keane, 1983) of intrusive recollections have also been noted. Gains have been maintained at 3 and 12 (Keane & Kaloupek, 1982) and 6 months (Fairbank, Gross, & Keane, 1983) posttreatment. While these case study results appear promising, they suffer limitations which have been addressed by more recent between group designs.
Compared with no treatment, imaginal flooding is more effective in reducing depression, state anxiety, and fear (Keane et al., 1989). Sleep disturbances and physiological responses (heart rate) to traumatic stimuli decrease more significantly when flooding is used adjunctively with a combination of group and individual treatment (Cooper & Clum, in press) than when flooding is not included; and self-reported measures of adjustment (Boudewyns & Hyer, 1990) and depression, state anxiety, and fear (Keane et al., 1989) were significantly better at posttreatment for those treated with imaginal flooding than for those receiving only individualized counseling (Boudewyns & Hyer, 1990) or no treatment (Keane et al., 1989). These studies demonstrate the superiority of flooding over no treatment controls and a variety of alternative psychotherapeutic interventions.

Because many veterans report the occurrences of multiple traumatic memories, a concern in treatment is the extent to which treatment effects generalize to untreated traumatic memories. Keane and Kaloupek (1982) noticed that, for one subject, pulse rates for an untreated traumatic memory decreased across successive assessment sessions. It is possible that either the successive assessments of that scene constituted a form of treatment, or, due to some similarities with the treated scenes, there was a generalization of treatment effects to the untreated
scene. Following the latter line of thinking Fairbank and Keane (1982) attempted to determine whether treatment of one traumatic memory could result in diminished reactions to untreated memories. Using imaginal flooding to treat two subjects, they found that extinction of anxiety generalized only to an untreated scene that had similar characteristics (common "stimulus and response cues") with the traumatic events presented during earlier flooding sessions. Unfortunately, these results must be interpreted cautiously as replications have not been reported, and criteria for determining common characteristics were not cited. The studies using imaginal flooding contain some critical methodological problems. In Fairbank and Keane (1982), for example, probe phases, in which subjects were exposed to evocative stimuli, immediately preceded treatment phases of a session. This confounds the results as the scenes treated later were presented more times than the earlier treated scenes. Probe and treatment session lengths each varied across the study, criteria for session termination were unclear, and subjective units of discomfort (SUDS) ratings were "periodic." Some treatment comparison groups have not been exposed to probe sessions (e.g., Keane et al., 1989). Exposing both groups in a between groups design to an equal number and quality of probe sessions would help to limit arguments regarding confounding and uncontrolled treatment variables.
Many studies have not obtained subjective (e.g., Boudewyns & Hyer, 1990; Keane & Kaloupek, 1982) or physiological (e.g., Keane et al., 1989) data, or have collected and not reported them (e.g., Cooper & Clum, in press; Keane & Kaloupek, 1982). The absence of measures of the intensity of the traumatic stimuli during the flooding or assessment procedure (e.g., Boudewyns & Hyer, 1990; Bowen & Lambert, 1986; Cooper & Clum, in press; Keane et al., 1989) weakens the support for any functional relationship between the procedure and outcome. SUDS scores may be an indication of the extent to which a veteran feels he has been positively affected, regardless of other behavioral or physiological measures, and these measures are important to substantiate clinical significance for the consumer. The lack of these also disallows the confirmation of the acquisition of the relaxation skills (e.g., Boudewyns & Hyer, 1990; Bowen & Lambert, 1986; Keane & Kaloupek, 1982; Keane et al., 1989) which are an integral part of the treatment.

There is variation of the length of treatment sessions (e.g., Boudewyns & Hyer, 1990; Cooper & Clum, in press; Fairbank & Keane, 1982; Keane & Kaloupek, 1982; Keane et al., 1989) and in the number of sessions (e.g., Boudewyns & Hyer, 1990; Cooper & Clum, in press; Keane et al., 1989) within studies (from subject to subject). This is particularly critical, as there is evidence that length (Chaplin & Levine, 1981; Foa & Chambless, 1978; Stern & Marks, 1973)
and repetition (Chaplin & Levine, 1981) of exposure affect outcome. This may have contributed to inconsistencies in some earlier studies.

In addition to the above methodological limitations, the clinical application of imaginal flooding is limited by the need for individualized intervention, a time consuming and cost intensive procedure. Improved treatment efficiency would be possible if symptom reduction were obtained by using similar procedures with a group of subjects. Such a technique would require that the patient repetitively expose himself (rather than being exposed during an interaction with the therapist) to the personal, evocative stimuli (Dowd & Govaerts, 1985). There already exists a foundation for the effective use of self-desensitization (frequently referred to as "self-control desensitization") (e.g., Baker, Cohen, & Saunders, 1973; Rosen, Glasgow, & Barrera, 1976) and in self-flooding (e.g., McDonald et al, 1979) for the treatment of anxiety disorders unrelated to combat experiences. It is believed that such self-exposure techniques facilitate learning of a coping strategy (Dowd & Govaerts, 1985; Williams, Dooseman, & Kleifield, 1984) that can be applied outside of treatment. These techniques have yet to be evaluated for the treatment of Vietnam veterans with symptoms of PTSD.

In summary, imaginal flooding has more empirical support than other treatments for PTSD. Limitations include
the lack of comparative research, methodological problems, and efficiency of its application in treatment.

Purposes of Experiment 1

In Experiment 1 the effects of relaxation and relaxation plus self-imaginal flooding on PTSD symptoms were compared. One purpose was to determine if the imaginal flooding procedure typically used with individuals could be conducted in a group format with similar clinical benefits as reported with traditional 1:1 procedures. (This modified procedure is referred to as Self-Imaginal Flooding throughout the remainder of the paper.) A successful application in this format would be more cost efficient for the treatment facility and less demanding in time and effort and less anxiety arousing for the therapist.

Other purposes were related to the questions, "Does relaxation alone reduce symptomatology?" and "Does the combination of Relaxation and Self-Imaginal Flooding produce a greater effect than Relaxation alone?" Relaxation was chosen for a comparison treatment because it is frequently used as a component of PTSD treatment (e.g., Lyons & Keane, 1989), and there is a precedence for comparing two currently used clinical treatment procedures (e.g., Miller & DiPilato, 1983). It is also known to affect some PTSD symptoms such as sleep latency (Keane, Fairbank, Caddell, Zimering, & Bender, 1985) and sleep disruptions (Figley &
Southerly, 1977; Keane et al., 1985), nightmares (Miller & DiPilato, 1983), anxiety following intrusive thoughts (Zimering, Caddell, Fairbank, & Keane, 1984), irritability and anger (McDermott, 1981), and the probability of aggressive episodes accompanying anger (Keane et al., 1985).

A final purpose was to determine whether the effects of treatment following Self-Imaginal Flooding of one traumatic event would generalize to another traumatic event. This study phenomenon has been reported but not replicated in other studies.

In seeking to answer the above questions several methodological improvements over other studies were incorporated. The VA treatment program in which subjects were involved remained consistent across groups. Similarly, relaxation training and probe sessions were identical for both groups. These restrictions were necessary to rule out major confounding treatment variables.

Improvements were also made in the data collection procedures and in the probe format. Probe data following relaxation training can demonstrate the extent to which relaxation alone affected the dependent measures in the probe sessions. The probe session format differed from previous studies. For instance, the order of presentation of the critical events was selected randomly in order to limit the possible effects which may be related to intentional sequencing. The length of exposure to traumatic imagery in
each probe was held constant across critical events, sub­jects and groups. This provided consistency of procedures and the recording of dependent measures absent in much of the prior research.
CHAPTER II

EXPERIMENT 1

Method

Subjects

Volunteers were solicited from a group of 20 Vietnam veterans in an inpatient PTSD Stress Recovery Treatment Program at a VA medical center. Of these 20, four veterans elected not to participate, two elected to leave the program before completion, and two were dismissed from the program for rules infringements. The remaining 12 served as subjects, six in each of two groups.

A psychologist and a social worker, who were not involved in the study, conducted the assessments and determined whether veterans were to be admitted to the Stress Recovery Treatment Program. The experimenter was not involved in either of the assessment or admission processes. Diagnoses and decisions to admit veterans were based upon information gathered from structured interviews, DSM-III-R (American Psychiatric Association, 1987) criteria, and results of several assessment instruments including the MMPI-PTSD Scale (Keane, Malloy, & Fairbank, 1984), the Mississippi Scale for PTSD (Keane et al., 1988), Impact of
Events Scale (Horowitz, Wilner, & Alvarez, 1979), and Exposure to Combat Scale (Lund et al., 1984). The Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Spielberger State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, & Lushene, 1970) were also administered.

Prior to the inception of the study, the first group of veterans was arbitrarily designated as the Relaxation Group, and veterans in the second group constituted the Self-Imaginal Flooding Group, hereafter referred to as the Flooding Group.

The data in Table 1 indicate that the groups were essentially equivalent in all non-PTSD measures. Statistically significant differences were found on two of the four PTSD measures, the Mississippi Scale ($t_{10} = -2.72, p = .022$) and the Avoidance ($t_{10} = -2.63, p = .025$) and Intrusion ($t_{10} = -3.85, p = .003$) subscales of the Impact of Events Scale. This may be an indication that the Flooding Group was more severely affected. However, no significant differences were found on the MMPI-PTSD scale and the Exposure to Combat Scale.

Approval of Study

This dissertation study was approved by the Research and Development Committee and the Director of the Battle Creek Michigan Veterans Administration Medical Center (Ap-
Appendix A) and by the Human Subjects Institutional Review Board (HSIRB) of Western Michigan University, Kalamazoo (Appendix B).

Table 1
Subject Characteristics (Experiment 1)

<table>
<thead>
<tr>
<th></th>
<th>Relaxation Group</th>
<th>Flooding Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>IQ</td>
<td>99.67 13.02</td>
<td>102.00 11.15</td>
</tr>
<tr>
<td>BDI</td>
<td>23.83 12.61</td>
<td>28.83 12.97</td>
</tr>
<tr>
<td>STAI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>46.32 8.87</td>
<td>50.3 11.99</td>
</tr>
<tr>
<td>Trait</td>
<td>50.17 12.80</td>
<td>56.00 14.10</td>
</tr>
<tr>
<td>PTSD Scale (MMPI)</td>
<td>26.17 12.77</td>
<td>33.83 7.41</td>
</tr>
<tr>
<td>Mississippi Scale</td>
<td>101.5 17.36</td>
<td>127.2 12.24**</td>
</tr>
<tr>
<td>Exposure to Combat Scale</td>
<td>23.17 12.77</td>
<td>31.67 2.73</td>
</tr>
<tr>
<td>Impact of Events Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoidance</td>
<td>14.83 6.88</td>
<td>26.50 8.43*</td>
</tr>
<tr>
<td>Intrusion</td>
<td>16.67 6.35</td>
<td>29.67 5.32**</td>
</tr>
<tr>
<td>Intrusions (Week 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>11.1 7.64</td>
<td>7.17 5.98</td>
</tr>
<tr>
<td>SUDS</td>
<td>6.11 3.39</td>
<td>8.00 1.64</td>
</tr>
</tbody>
</table>

Setting

All introductory and relaxation training sessions were held in a group therapy room. The room was equipped with two exhaust fans that were used to maintain a comfortable temperature and to block out extraneous noise. Chairs for the veterans were arranged in a U-shape with a chair for the experimenter at the top. A licensed staff psychologist was available for assistance during the training and probe sessions.

Probes were conducted in a room that contained a reclining chair, physiological monitoring equipment on a movable table, a dim light, and a desk. Windows were covered with blinds that were adjusted to maintain a relatively subdued level of light.

Equipment

Equipment for electrodermography (EDG), electromyography (EMG), and digital skin temperature (TMP) was manufactured by J&J Equipment (Models R-73, M-53, and D-200, respectively), and the heart rate (HR) monitoring instrument was a Cardiotach Series 4600 (Applied Sciences Laboratory).
Treatment Conditions

Stress Recovery Treatment Program

All subjects participated in an ongoing Stress Recovery Treatment Program five days per week. Components consisted of self-development, leisure education, occupational and social skills development, physical conditioning, group planning, anger management and assertiveness training, group therapy, and discharge planning. This program has been described elsewhere in more detail (Bains et al., 1988).

Experimental Treatments

Relaxation Group. Following the initial relaxation training, this group received additional relaxation training on two consecutive days during each of the last three experimental phases.

Flooding Group. Participants also received the same initial relaxation training as the Relaxation Group. In addition, during the treatment sessions in the last three experimental phases, subjects practiced the Self-Imaginal Flooding technique.
**Procedure**

**General Procedure**

Group treatment sessions occurred on the first two days of the week and lasted approximately 1.5 hours. Each subject attended one individually conducted, weekly probe session during one of the last three days of each week. When not attending a session as a part of this study, subjects attended the regularly scheduled Stress Recovery Treatment Program sessions.

**Baseline**

**Introduction.** During the first two sessions veterans in both groups were introduced to the study and its rationale as a part of the Stress Recovery Treatment Program. They were informed that participation was voluntary. Volunteers signed the VA Form 10-1086, “Agreement to Participate in Research by or under the Direction of the Veterans Administration,” (Appendix C) and an information sheet (Appendix D) which served as the informed consent.

**Development of Critical Events (CEs) and Pleasant Imagery.** Subjects in both groups wrote descriptions of the three most anxiety producing CEs that were experienced as intrusive memories. Descriptions for each CE included five progressive scenes. The first three scenes consisted of
sequential events leading to the fourth scene, which was the one during which the veterans experienced the most discomfort. This was referred to as the Vital Scene (VS). The fifth scene was the event(s) which followed the VS and during which arousal and discomfort were diminished. The scene descriptions were reviewed and discussed privately with each subject. A sentence representing each scene was written on a 3" x 5" index card (see example in Appendix E), and cards were placed in order within each CE.

A description of a pleasant scene, which would be used as a part of relaxation training, was also developed. Subjects completed a form (Appendix F) detailing specific sensual modalities, physiological responses, and covert verbal behavior. This form was also reviewed with each subject to ensure that a pleasant scene was developed.

**Relaxation Training**

Subjects in both groups were taught progressive deep muscle relaxation during four group sessions on successive treatment days. The relaxation instructions were essentially the same as Bernstein and Borkovec’s (1973) with the addition of a breathing component (Poppen, 1988, p. 66). When subjects reached a relaxed state in the third and fourth sessions, they were prompted to recall their personalized pleasant scene, and the experimenter provided general cues relating to the sensual, physiological, and covert
verbal details to enhance the imagery. It has been suggested that the addition of guided imagery to relaxation training is useful in cases where attentional control is particularly difficult (Poppen, 1988). The focus on sensory events provides alternative stimuli in place of the anxiety arousing ones. Subjects were instructed to practice the relaxation technique at least once each day throughout the study.

Self-Imaginal Flooding Training

Following 15 minutes of relaxation, each subject was instructed to view a 3” x 5” card on which was written the sentence describing the first scene of a CE. Cues (Lang, 1977) were given throughout a five minute period by the experimenter to enhance the imagery, and subjects were instructed to retain the image regardless of its intensity. The sentence describing the second scene was then viewed, and cues were presented as before. This procedure continued until each of the five scenes was imaged, and the fifth scene was followed by 10 minutes of relaxation. A different CE was presented in each of the three weeks of treatment. The Flooding procedure was presented twice in each session, resulting in four presentations of each CE.
Probes

Probes were conducted at the end of phases to obtain measures of baseline responses (Probe 1) and to determine the acquisition of relaxation training (Probe 2). A series of probes was used to ascertain the combined effect of relaxation plus Self-Imaginal Flooding (for the Flooding Group) or continued relaxation training (for the Relaxation Group).

Subjects sat in a recliner in a semi-recumbent position, and sensors for physiological monitors were attached. In Probe 1 subjects were told to relax using any method they could. After 10 minutes the five scenes for a CE were sequentially presented by the therapist at one minute intervals. (The portion of each probe during which CEs are imaged is referred to as the exposure component.) Subjects were told to see the scenes as if they were really there and the events were happening now. Cues like those used to evoke imagery relating to sensual, physiological, and covert verbal details of the pleasant image were given continuously to enhance the imagery. Subjects were prompted to verbally respond to the cues. At the end of each of the three imaged CEs the subjects were told to relax in any way they could for a five minute period (referred to as the relaxation component). Following their own attempt to relax after exposure to the third CE, subjects were assisted in
therapist-led relaxation. Procedures for the remaining probes (2-5) were identical, except in the relaxation components, during which subjects used the relaxation technique taught as a part of the study. The order of presentation of CEs was randomly determined, but identical for each probe. The total length of each probe session was approximately 1.5 hours.

**Dependent Measures**

**Subjective Units of Discomfort (SUDS) Levels**

On one minute intervals during probe sessions subjects were prompted to indicate on an 11 point (0-10) Subjective Units of Discomfort Scale (SUDS) (Foa & Chambless, 1978) the extent to which they felt anxious or disturbed by the imaged CE during the exposure component and an amount of discomfort during the relaxation component.

**Physiological Measures**

Physiological measures obtained during probe sessions consisted of EDG, EMG, TMP, and HR. While evidence is mixed, previous studies have shown that there is a relationship between levels of autonomic arousal and a diagnosis of PTSD, and that these measures may detect fluctuations in arousal when veterans are presented with stressful imagery (Boudewyns & Hyer, 1990; Pitman, Orr, Forgue, de
Jong, & Claiborn, 1987). All data were recorded on one minute intervals during both exposure and relaxation components.

**EDG.** EDG levels provide an indirect measure of sweat gland activity (Beck, 1987). Electrodes, with electrode gel, were placed on the second most distal phalange of the index and ring fingers of the left hand.

**EMG.** EMG levels, which indicate the extent to which muscles are contracted (Beck, 1987), were obtained from two Ag/AgCl electrodes, with electrode gel, placed approximately 2.5 cm above the center of the eyebrows with the ground electrode at a midpoint between them. The forehead was cleansed with isopropyl alcohol and a mild abrasive.

**TMP.** The measure of peripheral temperature is a correlate of peripheral vasoconstriction (Beck, 1987). TMP was recorded by attaching the sensor to the index finger of the left hand.

**HR.** Heart rates are directly influenced by changes in the autonomic nervous system (Olton & Noonberg, 1980). HR was recorded via a sensor attached to the index finger of the right hand.
Self-Report Data

Pre- and posttreatment measures were obtained on the BDI (Beck et al., 1961) and the STAI (Speilberger et al., 1970). The frequencies and associated SUDS levels of intrusive recollections were reported by the subjects during the first and last weeks of the study.

Design and Data Analysis

A between groups design was used to compare the dependent variables between the two treatment groups. A three-way ANOVA (Group x Probe x CE) was used to examine the groups' physiological responses to the presentation of the CEs during the exposure and subsequent relaxation components. This analysis provided the basis for discriminating the effects of Self-Imaginal Flooding apart from relaxation. Within group treatment effects across probes and between components were analyzed with one-way ANOVAs. Tukey HSD analyses were used to determine interprobe differences when ANOVAs yielded significant values. For purposes of examining the generalization of treatment in the Flooding Group, a multiple baseline across CEs design was used (see Figure 1).
Figure 1. Design Configuration.
Results of Experiment 1

Symptom Reduction

Pre- and posttest self-report data for the STAI, BDI, and intrusive memories are shown in Table 2. The extent to which each of these variables was reduced within a group is support for the efficacy of the associated treatment, and significant differences between groups indicates superiority of one treatment over the other.

STAI

Mean pretest scores for the State and Trait tests were 46.32 and 50.17, respectively, for the Relaxation Group and 50.3 and 56.00, respectively, for the Flooding Group prior to treatment. Reductions in anxiety, as measured by the STAI, did not occur, as posttest scores were higher than pretest scores. Differences within and between groups for pre- to posttreatment were not statistically significant.

BDI

Mean scores on the BDI were indicative of moderate levels of depression at pretest and posttest for the Relaxation Group (23.83 and 21.50) and the Flooding Group (28.83 and 26.83), and slight decreases occurred in both groups at the end of treatment. There were no statistically significant differences within or between groups from pretest to
Table 2
Mean Self-Report Data (Experiment 1)

<table>
<thead>
<tr>
<th></th>
<th>Relaxation Group</th>
<th>Flooding Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest (SD)</td>
<td>Posttest (SD)</td>
</tr>
<tr>
<td><strong>STAI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>46.32 (8.87)</td>
<td>54.67 (4.27)</td>
</tr>
<tr>
<td>Trait</td>
<td>50.17 (12.8)</td>
<td>56.00 (8.79)</td>
</tr>
<tr>
<td>BDI</td>
<td>23.83 (12.61)</td>
<td>21.50 (7.09)</td>
</tr>
<tr>
<td><strong>Intrusions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency per Subject</td>
<td>11.00 (7.64)</td>
<td>3.83* (6.11)</td>
</tr>
<tr>
<td></td>
<td>6.11 (3.39)</td>
<td>4.83 (2.80)</td>
</tr>
</tbody>
</table>

Intrusive Recollections

There were pre- to posttreatment reductions in the frequencies of intrusive memories for both groups. For the Relaxation Group frequencies were reduced to 3.83 from 11.0 per week. The Flooding Group experienced decreases from 7.17 to 0.67 per week. These reductions were statistically significant for the Relaxation Group ($t[5]=2.84$, $p=.036$) and for the Flooding Group ($t[5]=2.84$, $p=.036$). Pre- to posttreatment reductions in the SUDS levels associated with these memories for the Relaxation Group (6.11 to 4.83) and the Flooding Group (8.00 to 6.50) were also evident. Only the reduction for the Flooding Group was significant ($t[5]=2.95$, $p=.032$). (Note that these SUDS levels are calculated per intrusion and not per subject, the latter of which would result in artificially low values, particularly at posttreatment.)

The mean percentage of reduction in frequencies of intrusions and associated SUDS offers a measure of clinical significance. The Flooding Group had greater mean reductions in both frequencies and SUDS levels (87.03% [SD=26.7] and 64.58% [61.25], respectively) than the Relaxation Group (60.5% [43.36] and 39.26% [43.67], respectively). Another measure of clinical significance is the number of individual subjects who experienced significant improvement. Five
of the Flooding Group experienced reductions of more than 75% in frequencies, while only two in the Relaxation Group did.

**Probe Data**

**SUDS Levels**

Figure 2 shows the mean SUDS levels for all CEs in each probe for the exposure and relaxation components. SUDS levels decreased slightly for both groups across the probes in each component. An examination of the mean values of the SUDS levels shows there were no significant differences between groups in either component. For the Relaxation Group significant differences in SUDS levels during the exposure component were found across the probes.

![Figure 2. Mean SUDS Levels of All Events in Exposure and Relaxation Components in Each Probe.](image-url)
($E(4,72)=3.104, p=.0205$), yet no two probes differed significantly from each other. Significant differences for both the exposure ($E(4,85)=7.2083, p \leq 0.0001$) and relaxation ($E(4,85)=5.43, p=.0119$) components were found for the Flooding Group. Significant SUDS level differences (Tukey HSD, $p \leq 0.05$) in the exposure component existed between Probe 1 and Probes 3, 4, and 5, suggesting subjective improvement. A significant difference also existed between Probes 2 and 5. For the SUDS levels during the relaxation component, significant differences were found between Probes 1 and 5 and between Probes 2 and 5.

**Physiological Measures**

**EDG.** Figure 3 shows the mean EDG levels in each probe for the exposure and relaxation components. Decreases from Probe 1 to Probe 2 in EDG levels were similar for both
groups in each component following relaxation training. However, in the subsequent three probes, EDG levels for the Relaxation Group increased to Probe 1 levels while the levels for the Flooding Group remained low and stable. Differences between groups were statistically significant in both the exposure \((F[1,29]=43.616, p<.001)\) and relaxation \((F[1,29]=39.973, p<.001)\) components. Statistically significant main effects were also found for probes in the exposure \((F[4,29]=3.061, p<.001)\) and relaxation \((F[4,29]=2.987, p=.021)\) components, with differences in Probes 3, 4, and 5 (see Table 3).

Table 3

<table>
<thead>
<tr>
<th>Probe</th>
<th>Component</th>
<th>Group 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Relaxation</td>
<td>9.31</td>
<td>6.04</td>
<td>7.51</td>
<td>8.38</td>
<td>9.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.17)</td>
<td>(4.15)</td>
<td>(3.98)</td>
<td>(4.83)</td>
<td>(3.79)</td>
</tr>
<tr>
<td>Exposure</td>
<td>Flooding</td>
<td>6.87</td>
<td>4.63</td>
<td>4.30**</td>
<td>3.93**</td>
<td>4.09**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.70)</td>
<td>(0.83)</td>
<td>(1.47)</td>
<td>(1.68)</td>
<td>(0.94)</td>
</tr>
<tr>
<td>Relaxation</td>
<td>9.34</td>
<td>6.23</td>
<td>7.11</td>
<td>8.67</td>
<td>9.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.89)</td>
<td>(4.42)</td>
<td>(3.87)</td>
<td>(4.94)</td>
<td>(3.76)</td>
<td></td>
</tr>
<tr>
<td>Relaxation</td>
<td>Flooding</td>
<td>6.89</td>
<td>4.27</td>
<td>4.40**</td>
<td>3.93**</td>
<td>4.44**</td>
</tr>
<tr>
<td></td>
<td>(3.84)</td>
<td>(0.97)</td>
<td>(1.50)</td>
<td>(1.72)</td>
<td>(2.11)</td>
<td></td>
</tr>
</tbody>
</table>

Note. Comparisons between groups for probe by probe differences within each component.
*\(p<.01\). **\(p<.001\).
As may be seen in Figure 3, EDG levels differed little between the components within groups. Positive within group differences across the probes were found only for the Flooding Group in both the exposure ($\bar{F}[4,85]=6.803$, $p=\leq .001$) and relaxation ($\bar{F}[4,85]=5.06$, $p=\leq .001$) components. The Tukey HSD analyses indicated that baseline levels differed significantly ($\leq .05$) from each of the subsequent probes in both relaxation and exposure components.

**EMG.** Figure 4 shows the mean EMG levels across the

![Graph](image_url)

Figure 4. Mean EMG Levels of All Events in Exposure and Relaxation Components in Each Probe.

probes for the exposure and relaxation components. Except for Probe 2, EMG levels for both groups in the exposure component were similar. Levels during the relaxation component were consistently lower for the Relaxation Group than the Flooding Group ($\bar{F}[1,29]=31.290$, $p=\leq .001$). Those

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which differed were Probes 2, 3, and 4 (see Table 4).

Table 4

Mean EMG and Standard Deviation Values During the Relaxation Components in Each Probe

<table>
<thead>
<tr>
<th>Probe</th>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>0.58*</td>
<td>0.51*</td>
<td>0.47**</td>
<td>0.44***</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.022)</td>
<td>(.25)</td>
<td>(.23)</td>
<td>(.18)</td>
<td>(.23)</td>
<td></td>
</tr>
<tr>
<td>Flooding</td>
<td>0.83</td>
<td>0.90</td>
<td>0.80</td>
<td>0.74</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.36)</td>
<td>(.38)</td>
<td>(.37)</td>
<td>(.26)</td>
<td>(.49)</td>
<td></td>
</tr>
</tbody>
</table>

*p<.05. **p<.01. ***p<.001.

Each group had lower EMG levels in the relaxation component compared to the exposure component. However, this between component difference was only significant for the Relaxation Group (F[4,72]=6.5374, p=.0002).

TMP. Figure 5 shows the mean TMP levels in each probe for the exposure and relaxation components. The Relaxation Group had consistently higher TMP levels than the Flooding Group in both components. Significant between group main effects were found for Group (F[1,29]=29.232, p=.001) and Probe (F[4,29]=2.65, p=.036) only during the exposure component. t tests comparing TMP at each probe (see Table 5) show that differences existed at baseline and Probes 2, 4, and 5.
Figure 5. Mean Temperature Levels of All Events in Exposure and Relaxation Components in Each Probe.

Table 5

Mean TMP and Standard Deviation Values During Exposure Component in Each Probe

<table>
<thead>
<tr>
<th>Group</th>
<th>Probe 1</th>
<th>Probe 2</th>
<th>Probe 3</th>
<th>Probe 4</th>
<th>Probe 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>91.76*</td>
<td>92.87*</td>
<td>91.25</td>
<td>93.38***</td>
<td>93.88**</td>
</tr>
<tr>
<td></td>
<td>(2.09)</td>
<td>(2.08)</td>
<td>(1.38)</td>
<td>(1.8)</td>
<td>(1.12)</td>
</tr>
<tr>
<td>Flooding</td>
<td>88.14</td>
<td>91.26</td>
<td>90.98</td>
<td>88.80</td>
<td>90.42</td>
</tr>
<tr>
<td></td>
<td>(2.08)</td>
<td>(1.81)</td>
<td>(1.45)</td>
<td>(3.52)</td>
<td>(1.00)</td>
</tr>
</tbody>
</table>

*p<.05. **p≤.002. ***p≤.001.

Within each group the TMP levels show no consistent pattern across probes. The differences between components are minimal. The only significant within group change was in the exposure component for the Relaxation Group ($\bar{E}[4,72]=7.0916$, $p<.001$). Further analysis (Tukey HSD)
yielded differences from the baseline with Probe 5 and from Probe 3 with Probes 4 and 5.

These results must be interpreted cautiously, since the validity of the TMP levels is questionable. Aber­rant TMP levels may be produced by allowing the TMP sensor to have contact with other parts of the body (particularly the thigh area) or chair. The experimenter prompted the subjects to move the hand when contact was noticed. However, it cannot be assumed that all contacts were of short duration without causing an increase or decrease in TMP levels. Anecdotally, it appeared that contact was more frequently with the thighs during the relaxation component (producing artificially high temperatures) and with the chair during the exposure component (producing lower TMP levels).

HR. No between or within group differences were found for HR in either component nor in the differences between components.

**Generalization Across CEs**

Generalization may be said to have occurred if changes in a dependent variable for an untreated CE correspond with changes in the treated CE. Employing an examination of the SUDS data similar to that of Fairbank and Keane (1982) (i.e., ignoring data for the Relaxation Group while consid-
ering only those for the Flooding Group), Figure 6 minimal-
ly suggests such a relationship, as decreased SUDS levels
during the exposure components for untreated scenes (CEs 2
and 3) in Probe 3 correspond with decreased SUDS levels
following treatment of CE 1. However, support for gener­
alization is lost when Relaxation Group data are also exam­
ined, as a similar relationship between treated and un­
treated CEs is apparent. Comparable relationships within
and between groups were evident during the relaxation com­
ponent (see Appendix G). Generalization is also not sup­
ported by other physiological measures (see Appendix G).

Discussion of Experiment 1

The first purpose of Experiment 1 was to determine
whether the Self-Imaginal Flooding procedure could reduce
subjective and physiological responding in probes of traum­
matic memories. Only one physiological measure, EDG, was
significantly affected. Reasons for the lack of signifi­
cant changes in the other measures are not clear. However,
these results are not unlike those reported previously
(e.g., Boudewyns & Hyer, 1990), that have suggested that
the lack of change in physiological responding following
repeated exposure indicates that PTSD may be associated
with neurological changes that will remain unaffected by
repeated exposure. There have been no studies to determine
this yet. Although the reductions in the associated SUDS
Figure 6. Mean SUDS Levels During Exposure Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
levels were statistically significant, the lowest SUDS level continued to remain elevated as compared to others’ reports of posttreatment responding (e.g., Fairbank & Keane, 1982). As stated earlier, calculating SUDS levels per subject, as done in most studies, results in artificially low values. Values here were calculated per intrusion.

This study also aimed to determine the effect of Self-Imaginal Flooding on the general levels of depression and anxiety. The fact that STAI State scores did not change, particularly when compared to results in other studies, could be due to several reasons. The posttreatment measures were completed immediately prior to leaving the Stress Recovery Treatment Program. At that time several subjects reported being quite anxious about leaving, because they felt unprepared to return to environments which were associated with numerous problems and included stimuli affiliated with intrusive memories. It is unlikely that scores on the BDI would decrease as a result of flooding alone. Decreases reported in other studies could have been due to adjunctive treatments. Since no part of the Stress Recovery Treatment Program directly targeted the treatment of depression, and since subjects used the extra-treatment setting as the frame of reference for which to answer the items on the BDI, the lack of changes in BDI scores is not surprising.
The lack of generalization of effects from treated to untreated CEs does not support the findings of Fairbank and Keane (1982). Their case study failed to account for the effects of relaxation, and were that done with the data in this study (by ignoring Probe 2 data and between group comparisons), similar conclusions might be suggested. Fairbank and Keane (1982) suggested that generalization occurred when events shared common features. A review of the scene descriptions in this study revealed many common features, yet the data did not fit the pattern of that presented by Keane and Fairbank (1982).

It appears that the initial decrease in EDG levels for both groups could have been due to relaxation training. Further between group comparison shows that maintenance of this decrease was related to the Self-Imaginal Flooding procedure rather than continued relaxation practice alone. For the Flooding Group, the decreases in EDG levels were accompanied by similar decreases in associated SUDS levels. This was not true for the Relaxation Group. Lack of correspondence between subjective and physiological measures has been reported in other studies (e.g., Burish & Horn, 1979), suggesting that some measures of anxiety vary independently from subjects' self-reports. In this experiment, for example, SUDS reports in probe sessions may have been based upon those physiological responses which did not change across probes or on some other unknown variable.
The data in this study favor the Self-Imaginal Flooding treatment over Relaxation Only for several reasons. One measure of effectiveness is the extent to which subjects' subjective and physiological responses diminished across the probes when confronted with imaged intrusive memories. In the exposure component, SUDS levels were reduced across the study for both groups, more significantly for the Flooding Group. Also across the probes, EDG levels were reduced for the Flooding Group and TMP levels improved for the Relaxation Group. However, TMP levels may be suspect as mentioned earlier. Another measure of effectiveness is the extent to which the relaxation response following exposure improves across the study. Only the Flooding Group showed such improvement, with decreased SUDS and EDG levels. Perhaps the strongest support for Self-Imaginal Flooding is the fact that those in the Flooding Group had more positive extra-treatment gains. Both the frequency and intensity of intrusive memories outside of the treatment sessions decreased significantly. These measures are likely to be the critical determinants of treatment success from the veteran's perspective, as they are most concerned with their responses in the extra-treatment environment. It is unlikely that differences between groups could be attributed to differences in expectancies, as both groups were given identical instructions, and the Relaxation Group understood that the probes were a part of the treatment.
Subjects also did not have the opportunity to share information between groups, as there was a one week lapse between their treatment. Unfortunately, there were no reliability data for self-report measures, but it is unlikely that subjects could have benefited by reporting decreases. Reported decreases were also not reinforced by the experimenter. In addition, it is unlikely that subjects reported decreases in order to avoid the flooding training and probe procedures, as they could have accomplished this by merely refusing to continue in the study.

More veterans were positively affected to a greater degree in the extra-treatment environment. In the last week of treatment when compared to the Relaxation Group, the Flooding Group had one fourth the number of men report intrusions. The improvement for the Flooding Group was two times better for intrusions and 1.6 times better for associated SUDS levels than that experienced by the Relaxation Group.

In summary, Self-Imaginal Flooding is a procedure which can be used to reduce some symptoms of PTSD, particularly the frequency and intensity of intrusive memories which occur outside of treatment. This procedure was more effective than Relaxation Only in reducing the impact of the intrusive stimuli and in improving the subjects’ ability to relax following exposure to these stimuli. As has been found in some other recent studies, this experiment
also shows that positive physiological changes for each measure did not result from an exposure-based treatment, in spite of subjective reports which suggest otherwise.

In the absence of treatment, veterans have some ability to control the effects of the traumatic memories. Some subjects in Experiment 1 indicated they were able to respond constructively to intrusive memories for a while after the traumatic experiences in Vietnam. It is also known that many veterans with similar experiences report occurrences of intrusive memories, but are not negatively affected by them (e.g., Foy et al., 1987). In Experiment 1 an ability to cope was seen during Probe 1, as between-component responses for the physiological measures and associated SUDS levels were reduced following each CE. Anecdotal data gathered during the course of the study indicated that veterans, when confronted with intrusive memories, "block them out." For the most part, the veterans' descriptions of this included cognitive activities like talking to oneself, thinking about something else, or making "my mind go blank." These descriptions of self-imposed methods suggested the subsequent study, in which several cognitively oriented coping strategies were taught, and veterans were given the option to choose among them. The efficacy of this technique was evaluated.
CHAPTER III

EXPERIMENT 2

Introduction

The use of cognitive-behavioral techniques, in which a patient's cognitions, feelings and behaviors are modified with behavior therapy procedures (Turk, Meichenbaum & Genest, 1983), is mentioned in many PTSD treatment program descriptions (e.g., Alford et al., 1988; Besyner, 1985; Nezu & Carnevale, 1987). They are used because it is thought that relationships between environmental stimuli and anxiety are modified with cognitive responses (Keane et al., 1985). Among the techniques are irrational thought (Green, Lindy, & Grace, 1988; McCormack, 1985; Parson, 1988) and irrational behavior (Keane et al., 1985) replacement, cognitive restructuring (McCormack, 1985; Parson, 1984, 1988; Williams, 1987), and problem-solving (Keane et al., 1985). Unfortunately, while cognitive techniques are frequently used, they are seldom described in the detail required for replication or application, and since they have been generally viewed as adjunctive modalities, their influence on treatment outcome has been largely ignored.

McCormack (1985) reported a case study in which a veteran was taught to recognize the environmental stimuli
reminiscent of Vietnam and to reduce the impact of these stimuli by replacing irrational covert thoughts with rational ones. At the end of five months of treatment the frequency and severity of intrusive recollections decreased, the veteran had more control of angry outbursts, and the frequency and severity of depressive episodes decreased. Gains in relationships with his family, quite likely as a result of the attenuation of PTSD symptoms, were also noticed. While impressive, these results must be interpreted as merely suggestive, because of the well known limits of uncontrolled case studies.

An additional self-control, cognitive-behavioral technique, thought stopping, has been used to eliminate covert verbal behaviors and the undesirable overt behaviors which typically follow (Wisocki, 1985; Wolpe, 1969), particularly with symptoms similar to those exhibited during intrusive memories (e.g., Anthony & Edelstein, 1975; Cox & Klinge, 1976; Rimm, 1973). It has been found to be equally as effective as imaginary flooding in nonveteran populations (Emmelkamp & Kwee, 1977; Hackman & McLean, 1975). Thought stopping, while sometimes used alone, is more frequently used with other cognitive and behavioral techniques (e.g., Cautela & Baron, 1973; Cox & Klinge, 1976; Holmes, Delprato, & Aleh, 1979).

In addition to the above, pleasant imagery, time projection, and attention diversion may also be useful in
treating some PTSD symptoms. "Pleasant imagery," a form of "imaginative inattention" (Turk et al., 1983), incorporates the use of an incompatible image and is accompanied by pleasantly arousing subjective changes. "Covert assertion" (Rimm & Masters, 1979) or "time projection" (Beck & Emery, 1985) procedures are similar, but the image is of some future behavior. Another technique, attention diversion (Hanson & Gerber, 1990; Meichenbaum, 1985), requires that attention be focused on actual, rather than imagined, stimuli in the environment (Turk et al., 1983). Each of these techniques serves to replace the unwanted image (in this case, a combat-related memory) with an incompatible one.

No attempts to apply these techniques to the treatment of PTSD in combat veterans have been reported in the treatment literature, although it is possible that veterans have used similar, "common sense" techniques themselves (e.g., "blocking it out"). The assessment of their efficacy in reducing symptoms would be desirable, as they are coping strategies which are easily learned and which do not require intensive exposure to aversive stimuli as in flooding techniques.

Purposes of Experiment 2

In addition to the notion that cognitive coping strategies may effectively reduce some PTSD symptoms, it is possible that veterans may have individual preferences for
them. Once taught several of them, veterans could select, practice, and use one to respond to intrusive memories. Therefore, a primary purpose of Experiment 2 was to determine whether significant symptom reductions could be obtained using a variety of self-imposed coping strategies, including Self-Imaginal Flooding and several cognitively-based ones. Given the variety of these self-directed strategies, another purpose was to determine if there were preferences for any of these. The final purpose was to determine whether self-selected coping strategies were as effective as program-imposed treatments of relaxation and Self-Imaginal Flooding used in Experiment 1.

Method

Subjects

Ten Vietnam combat veterans from the Stress Recovery Treatment Program volunteered as subjects. Prior to the first probe four veterans elected not to participate in the probes but did attend most of the relaxation training and coping strategy training sessions. The remaining six served as subjects. They ranged in age from 39-49 (\(\bar{x}=41.8\)), and in IQ from 83-115 (\(\bar{x}=101.2\)). Additional subject characteristics are included in Table 6.
Table 6
Subject Characteristics (Experiment 2)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
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<td>3.71</td>
</tr>
<tr>
<td>BDI</td>
<td>29.00</td>
<td>9.08</td>
</tr>
<tr>
<td>STAI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>67.00</td>
<td>11.03</td>
</tr>
<tr>
<td>Trait</td>
<td>61.17</td>
<td>10.72</td>
</tr>
<tr>
<td>PTSD Scale (MMPI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mississippi Scale</td>
<td>120.83</td>
<td>16.43</td>
</tr>
<tr>
<td>Exposure to Combat Scale</td>
<td>20.33</td>
<td>4.23</td>
</tr>
<tr>
<td>Impact of Events Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoidance</td>
<td>19.67</td>
<td>7.77</td>
</tr>
<tr>
<td>Intrusion</td>
<td>19.33</td>
<td>9.31</td>
</tr>
<tr>
<td>Intrusions (1st week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>12.83</td>
<td>6.31</td>
</tr>
<tr>
<td>SUDS</td>
<td>6.54</td>
<td>1.15</td>
</tr>
</tbody>
</table>

**Setting**

The setting was identical to that described in the first study. Coping strategy training sessions were held.
in the same room as relaxation training.

Procedure

General Procedure

Group training sessions for this study occurred as the first daily session of the Stress Recovery Treatment Program and lasted approximately 1.5 hours. Baseline and relaxation training conditions were identical to those in Experiment 1. During the introduction session, subjects identified one scene from each CE as the "crucial scene." This scene was the one which was most frequently experienced at the onset of the intrusive recollection of the CE. Following coping strategy training, subjects selected a coping strategy to practice outside of sessions and to use when confronted with intrusive recollections. Each subject attended an individually conducted Pretest Probe before relaxation training and subsequent coping strategy training and a Posttest Probe after the last coping strategy practice session.

Coping Strategies

Self-Imaginal Flooding. This strategy was taught using the same procedure as described for the Flooding Group in Experiment 1.
**Thought Stopping.** Subjects read the crucial scene card and imaged the event. When all signaled an associated heightened SUDS level, the therapist shouted "STOP." Subjects had earlier been instructed to also covertly shout the same to themselves. For the remainder of a five minute coping period they could use any strategy they wished (e.g., relaxation) and were to covertly shout "stop" at any time they began to image any part of that or another unpleasant scene.

**Pleasant Imagery.** On the back of each crucial scene card was the statement, "I would rather think about (scene used in relaxation training or some other self-selected pleasant scene)." After viewing the crucial scene card and experiencing heightened arousal, subjects turned the card over, read the sentence, and imaged the pleasant scene. They were also instructed to reread the prompt if the pleasant scene was replaced by an unpleasant image.

**Projection.** This strategy used a similar prompt procedure as in Pleasant Imagery. The prompt of the back of the crucial scene card was read when arousal was heightened. It stated, "That happened to me a long time ago, and it is behind me now. Because I practice coping strategies, next month at this time I will be much improved. I see myself (personal objective, positive message about functioning in the future)."
**Diversion.** This procedure was also referred to as "distraction." Upon experiencing heightened arousal while imaging the crucial scene, subjects opened their eyes and looked around the room and out the windows, allowing themselves to become distracted by the sights and sounds. They were also instructed to enhance the distraction by making covert statements about these stimuli.

**Coping Strategy Training**

One coping strategy training session was conducted for each of the five coping strategies. Each session began with an explanation of and rationale for the coping strategy presented. Ten minutes of therapist-prompted relaxation with pleasant imagery was included immediately prior to and following the training segment. Relaxation between the presentations of each event was self-directed by the subjects. CESs were presented during these sessions in random order within each group of three events, and each was presented twice per session. Sessions ended with a discussion of the strategy and a prompt to practice it outside of the session.

**Coping Strategy Selection and Practice**

Three, therapist-led coping strategy practice sessions were conducted on consecutive days following coping
strategy training. At the beginning of the first practice session subjects selected a preferred coping strategy. They were also given personalized SUDS data collected by the experimenter during the training sessions. These data included the highest level of subjective discomfort while imaging the crucial scene, the discomfort level five minutes after initiating a coping response, and the mean level of discomfort during the coping response. Subjects were told that a lower "Mean Coping" value was an indication of getting rid of the anxiety more quickly; a lower "Final Coping" value meant they had less anxiety after 5 minutes than when using other strategies; higher values of "% Reduced" indicated a better overall strategy in reducing anxiety levels; and if "% Reduced" and "Final Coping" were each about equal across strategies, a selection based upon the lower "Mean Coping" value may be preferred. They were also told that they could ignore these data and select a strategy by any method they desired. In each session the selected coping strategy was practiced following each of three presentations of each CE.

Except for Self-Imaginal Flooding, the selected coping strategies were practiced in a procedure similar to training. Those who chose Self-Imaginal Flooding were instructed to image the crucial scene and those following, using self-provided cues as presented in training. After imaging the last scene of the CE, a relaxation response was to be
initiated.

Subjects were given copies of the CE cards. They received instructions on practicing the coping strategy outside of sessions, on coping with actual intrusive memories, and on using these procedures for coping with intrusive recollections that were not targeted in treatment.

**Dependent Measures**

The pre- and posttreatment, within probe self-report measures, and physiological measures used in Experiment 1 were also used in Experiment 2. Subjects also reported occurrences of intrusive recollections, the associated SUDS levels, and SUDS levels five minutes later during their attempt to "cope" (coping SUDS). A locally designed Symptom Severity Checklist (Appendix H) was completed at the beginning and end of the study. During coping strategy training sessions, maximum SUDS levels associated with crucial scenes during exposure and SUDS levels during the coping component were also recorded.

**Probes**

Two probes were conducted, the first (Pretest Probe) as a baseline measure prior to relaxation and coping strategy training and the second (Posttest Probe) as a posttreatment measure at the end of the study. For the most part the probe procedures were identical to Experiment 1.
Differences were as follows: at the end of the exposure component for each CE, subjects were told to cope (coping component) with the anxiety in any way they could for five minutes (relaxation was not suggested); after the five minute coping period following the third CE, therapist-led relaxation was conducted; and during the Posttest Probe, subjects were told to cope with the anxiety using the strategy they elected to use in training.

Design

A within-subjects, pre- and posttest design (Johnson & Solso, 1971) was used to evaluate changes in outcome measures as a result of using a selected treatment. \( t \) tests (paired comparisons) were employed to examine the statistical significance of the within group changes.

Results

Coping Strategy Training and Selection

Table 7 shows the data for the SUDS levels recorded during training sessions for each coping technique. Reductions in SUDS levels were noticed for each technique. In the order of the most to least effective strategies, the percentage reductions in reported SUDS levels were 93.54% for Diversion (range=85.6-100%), 91.47% for Pleasant Imagery (59.7-100%), 81.92% for Thought Stopping (62.5-100%).
Table 7
Mean SUDS Levels Reported During Training for Each Coping Technique

<table>
<thead>
<tr>
<th>S#</th>
<th>Phase</th>
<th>Self-Imaginal Flooding</th>
<th>Pleasant Imagery</th>
<th>Thought Stopping</th>
<th>Projection</th>
<th>Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imagery</td>
<td>10</td>
<td>9</td>
<td>8.7</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>1.7</td>
<td>0.3</td>
<td>1.7</td>
<td>2.7</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>4.4</td>
<td>2.9</td>
<td>4.1</td>
<td>4.8</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>83.0</td>
<td>96.7*</td>
<td>80.5</td>
<td>70.0</td>
<td>86.6</td>
</tr>
<tr>
<td>2</td>
<td>Imagery</td>
<td>-</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>-</td>
<td>0.3</td>
<td>3</td>
<td>2.3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>-</td>
<td>3</td>
<td>5.9</td>
<td>4.9</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>-</td>
<td>95.7*</td>
<td>62.5</td>
<td>74.4</td>
<td>88.5</td>
</tr>
<tr>
<td>3</td>
<td>Imagery</td>
<td>6.7</td>
<td>6.7</td>
<td>7</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>0.3</td>
<td>2.7</td>
<td>1.7</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>1.8</td>
<td>4.7</td>
<td>5.7</td>
<td>4.3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>95.5*</td>
<td>59.7</td>
<td>75.7</td>
<td>50.0</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Imagery</td>
<td>1.7</td>
<td>3.7</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>0.7</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>1.1</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>58.8</td>
<td>100.0*</td>
<td>-</td>
<td>-</td>
<td>100.0*</td>
</tr>
<tr>
<td>5</td>
<td>Imagery</td>
<td>8.5</td>
<td>9</td>
<td>7.7</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>2.5</td>
<td>0.3</td>
<td>0.7</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>3.8</td>
<td>1.8</td>
<td>3.5</td>
<td>-</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>70.6</td>
<td>96.7</td>
<td>90.9</td>
<td>-</td>
<td>100.0*</td>
</tr>
<tr>
<td>6</td>
<td>Imagery</td>
<td>9.3</td>
<td>5.7</td>
<td>8</td>
<td>6.7</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Final Coping</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Mean Coping</td>
<td>1.7</td>
<td>1.7</td>
<td>1</td>
<td>1.2</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>% Reduced</td>
<td>96.7</td>
<td>100.0*</td>
<td>100.0*</td>
<td>95.5</td>
<td>93.6</td>
</tr>
<tr>
<td>Mean</td>
<td>% Reduced</td>
<td>80.92</td>
<td>91.47</td>
<td>81.92</td>
<td>72.55</td>
<td>93.54</td>
</tr>
</tbody>
</table>

Note. Imagery = maximum SUDS level associated with crucial scene; Final Coping = SUDS level at end of five minute coping phases; Mean Coping = mean of all SUDS during coping phases. Asterisked numbers indicate maximal reductions. Larger bold numbers are the percentage reductions associated with the subject-selected coping strategy.
80.92% for Self-Imaginal Flooding (58.8-95.5%), and 72.55% for Projection (50.0-95.5%). The rank order of the strategies by the number of subjects receiving maximal benefit from the strategies was Pleasant Imagery (4), Diversion (2), Self-Imaginal Flooding (1), Thought Stopping (1), and Projection (0). (Note that 2 subjects each had equal reductions in 2 strategies.)

Following training and prior to practicing a selected technique, subjects were asked to rank order the strategies according to their preference using any criteria they wished. Using Spearman Rho (nonparametric, two-tailed) to calculate the correlation between ranked levels and SUDS data, the strongest relationship was found between final coping SUDS and rank level ($r=.666$, $p<.001$).

Personalized SUDS data (those which appear in Table 7) were provided in order to assist in the selection of a coping strategy. Subjects 2, 4, 5, and 6 selected techniques which appeared to give them greatest relief during training (Pleasant Imagery for Subjects 2, 5, & 6, and Diversion for Subject 4). In spite of the data Subject 1 chose Self-Imaginal Flooding, and Subject 3 chose Pleasant Imagery, strategies which did not produce maximum reductions in their SUDS ratings.
Sel£-Rep.or.t_Pat a
BDJ.-and STAI

Self-report data appear in Table 8. Pretreatment BDI scores (\(\bar{x}=29.00\)) were significantly reduced (\(\bar{x}=16.17\),

<table>
<thead>
<tr>
<th>Table 8</th>
</tr>
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<tbody>
<tr>
<td>Self-report Data (Experiment #2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Week 1</th>
<th></th>
<th>Week 5</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>BDI</td>
<td>29.00</td>
<td>9.08</td>
<td>16.17*</td>
<td>11.16</td>
</tr>
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<td>STAI</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>67.00</td>
<td>11.03</td>
<td>51.67***</td>
<td>6.92</td>
</tr>
<tr>
<td>Trait</td>
<td>61.17</td>
<td>10.72</td>
<td>53.83**</td>
<td>13.53</td>
</tr>
<tr>
<td>Intrusions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>12.83</td>
<td>6.31</td>
<td>6.33*</td>
<td>4.32</td>
</tr>
<tr>
<td>SUDS</td>
<td>6.54</td>
<td>1.15</td>
<td>7.64</td>
<td>1.52</td>
</tr>
<tr>
<td>Coping SUDS</td>
<td>5.52</td>
<td>1.67</td>
<td>4.42</td>
<td>0.68</td>
</tr>
<tr>
<td>Symptom Checklist Score</td>
<td>156.50</td>
<td>46.18</td>
<td>135.33</td>
<td>44.86</td>
</tr>
</tbody>
</table>

\(\text{t}[5]=2.68, p=.044\). Reductions also occurred for both state (67.0 to 51.67) and trait (61.17 to 53.83) measures.
of the STAI. These reductions were found to be statistically significant ($t[5]=6.92$, $p=.001$, for state, and $t[5]=5.13$, $p=.004$, for trait); however, the posttreatment scores indicated the continued presence of anxiety.

**Intrusive Recollections**

The mean frequency of intrusive recollections declined from 12.83 to 6.33 per week, a reduction of 50.7% ($t[5]=3.26$, $p=.023$). Reductions were reported by 5 of the 6 subjects. Five subjects experienced an increase ($\bar{x}=16.8\%$) in SUDS levels associated with these recollections. Five minutes into the coping period, subjects reported decreases ($\bar{x}=23.1\%$) from Week 1 to Week 5 in SUDS levels, and for the five subjects who showed improvement, decreases ranged from 6.3%–56.5%. When intrusive recollection SUDS levels were compared to coping SUDS levels within Weeks 1 and 5, mean reductions of 16.3% and 40.7% were found (Weeks 1 and 5, respectively). Only the reduction in Week 5 was significant ($t[5]=4.03$, $p=.01$). In addition it should be noted that intrusion SUDS levels in Week 5 ($\bar{x}=7.6$) were higher than Week 1 ($\bar{x}=6.5$), yet SUDS levels five minutes into coping in Week 5 ($\bar{x}=4.24$) were lower than Week 1 ($\bar{x}=5.52$).
Symptom Severity Checklist

To obtain a score on this checklist the ratings of each symptom were summed, with a maximum possible score of 230. The mean score (with associated ranges) was reduced from 156.5 (89-212) to 135.3 (65-183) for a mean improvement of 13.5% (7%-32.5%). Two subjects reported increases of 5% and 7% in severity ratings.

Probes

To examine the differences between the probes, individual comparisons (t tests) were conducted between the respective exposure and coping components in the two probes. t tests were also used to examine the significance of reductions between components within each probe.

SUDS Levels

Figure 7 shows the SUDS levels reported by each subject during the exposure and coping components of the Pre- and Posttest probes. The reductions in SUDS from the exposure to coping components were significant within both pretest (t[5]=7.20, p=≤.001) and posttest (t[5]=5.36, p=.003) probes. Between-probe reductions in coping component SUDS levels were reported for 5 of the 6 subjects; however, these were not statistically significant. Lack of significance was also found for between-probe differences
in the SUDS levels experienced during the exposure components. Figure 8 shows the mean SUDS levels during each of the successive components within each of the probes. Following training (Posttest Probe) subjects reported lower
SUDS levels in the initial relaxation phase (Relax A) than before training (Pretest Probe). They also reported lower SUDS levels during the coping components (Coping 1, 2, & 3) in the Posttest Probe, even though the SUDS levels in the associated exposure components were at least as high prior to training. There is an ordered increase in SUDS levels during flooding and coping components of successive scenes in both probes. It is undiscernible whether the increase in SUDS levels during the coping components is a function of increased intensity during the exposure component or due to successive presentations or related to both.

**Physiological Measures**

Figure 9 shows the HR for subjects during both exposure and coping components of each probe. There were no

![Figure 9](image)

**Figure 9.** Mean HR Levels in Pre- and Posttreatment Probe Sessions.

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statistical differences between exposure and coping component HR levels in the Pretest Probe, indicating that subjects' own coping responses were insufficient to produce a reduction. Only two subjects were able to decrease their HR more than one beat per minute with their coping strategies. Subjects 5 and 6 experienced an increase in HR during the coping component and Subject 3's HR remained equally elevated. The learned coping strategies appeared to be more effective, as statistically significant decreases were found between coping components ($t[5]=2.82, p=.037$) in the Pre- and Posttest Probes and between the exposure and coping components in the Posttest Probe ($t[5]=13.25, p<.001$). Figure 10 shows the mean HR for all subjects across the components of each probe. 

![Figure 10. Mean HR Levels for All Subjects Within Consecutive Components of Each Probe.](image)
was much less than the respective Pretest components. The reductions from exposure to coping components during Posttest Probe are not evident in the Pretest Probe. It is clear that heart rates were accelerated during the Posttest Probe but never reached the lowest levels of the Pretest Probe.

No other statistically significant differences existed between the exposure components and the coping components in the two probes nor between the exposure and coping components within each probe for EMG, EDG, and TMP measures.
CHAPTER IV

DISCUSSION

In Experiment 2 subjects were taught Self-Imaginal Flooding and several cognitive-behavioral techniques, and each subject selected and practiced one as a coping strategy for intrusive recollections. These strategies were effective in reducing subjective discomfort between 72.6% to 93.5% in the training sessions. More specifically, individual subjects experienced SUDS reductions ranging from 50.0% to 100%. SUDS level reductions were also evident in the Posttest Probe. Three subjects had significant reductions by the end of treatment during the exposure component, indicating they were not affected as greatly by intrusive memory presentations. The significant decreases in SUDS levels during the relaxation component for five subjects indicate they had acquired an improved coping strategy over their own original one.

HR was the only physiological measure which modulated. The way in which it did, with lower rates in both components during the Posttest Probe, offers support for the effectiveness of the coping strategies. Subjects could more quickly attenuate the discomfort related to the traumatic memory.
Finally, similar to some other studies (e.g., Fairbank & Keane, 1982), subjects experienced a decrease in the frequency of intrusive memories and an increase in associated SUDS levels in the extra-treatment environment. It is important to note, however, that these SUDS levels could be more quickly reduced after coping strategies training than during the first week of treatment.

Whether any of the noted improvements would have occurred in the Stress Recovery Treatment Program without the added experimental component or would have occurred in the absence of any treatment is unknown. The constraints imposed within the research setting prevented a design which could have controlled for this. However, anecdotal observations by Stress Recovery Treatment Program staff suggest that similar improvements had not been noticed in earlier treatment groups.

The extent to which the subjective and self-reported data were valid and reliable may be questioned since confirmation of the subjects' reports was not obtained. It is difficult to obtain independent data on the occurrences of intrusive memories and impossible to confirm subjective experiences. However, the importance of these data is not diminished for two reasons. First, there were no obvious incentives for subjects to report decreases in intrusions or SUDS levels. On the contrary, report of maintenance or worsening of these levels would have been to the advantage
of the subjects, as benefits (continued absence from work and family, more financial support, continued hospitalization on another ward, etc.) could have continued or improved. In light of this, these self-reports may be adequate for measuring the effects of treatment.

Second, changes in the HR mirrored the reported changes in subjective measures. Because HR has been found to be a sensitive measure of the effects of traumatic stimuli (e.g., Blanchard, Kolb, Gerardi, Ryan, & Pallmeyer, 1986; Boudewyns & Hyer, 1990; Cooper & Clum, in press; Keane & Kaloupek, 1982), this adds validity to the results based on subjective measures. Similar covariation between subjective measures and HR has been reported by others (e.g., Boudewyns & Hyer, 1990; Pitman et al., 1987).

One purpose of the experiment was to determine the preferences for coping strategies. Pleasant Imagery (chosen by four of six subjects) was the most preferred technique, although Diversion produced slightly better overall effects. The superiority of Diversion, however, may be misleading, as the one subject, who more consistently had lower percentages of improvement in coping phases, was not present during the training of this technique. The scores from those present may have produced a higher mean than if all subjects were present. The effectiveness of Pleasant Imagery could be related to the fact that it was incorporated into the relaxation portion of the training sessions.
Pleasant Imagery was chosen by four of the six subjects. The correlational analyses and anecdotal reports suggest that four subjects selected a strategy based primarily upon the extent to which discomfort was reduced within the coping period and secondarily on the rapidity with which SUDS levels decreased. Preferences did not consistently coincide with the strategies that produced maximal effects during coping strategy training sessions. Subject 1 preferred Self-Imaginal Flooding over Pleasant Imagery and Diversion because "it seemed like a more logical treatment for treating flashbacks," Subject 3 chose Pleasant Imagery because "it was more pleasant to do." He chose this over Thought Stopping, which "didn’t reduce any discomfort" (SUDS levels indicate a 75.7% reduction compared to 59.7% for his preferred strategy) and Self-Imaginal Flooding, because "it doesn’t make any sense to treat intrusive memories this way" (in spite of the fact that SUDS levels were about 35% better with the Self-Imaginal Flooding technique). That four subjects did choose the predicted strategy may be coincidental and independent of the fact that it produced maximal reductions.

It is appropriate to briefly compare the outcome of these two experiments. Based upon the percentage of reduction of intrusions reported, Self-Imaginal Flooding was 20% and 45% better than Relaxation and cognitive coping strate-
gies, respectively. Considering SUDS levels associated with the intrusions, most to least effective treatments were Relaxation, Self-Imaginal Flooding, and cognitive coping strategies. The fact that Relaxation SUDS levels were reduced more than those for the Self-Imaginal Flooding group may be insignificant, since, as discussed earlier, fewer posttreatment intrusions were experienced by fewer subjects in the Flooding Group.

The reasons for superiority of relaxation-only over cognitive coping strategies in reducing the frequency and intensity of intrusions are not clear, as the latter treatment included relaxation training plus the coping strategy. One reason may be that to be maximally effective, coping strategies should occur simultaneously with deep muscle relaxation rather than be taught separately. Another possibility is that in Experiment 1, the Relaxation Group participated in three more probes than the group in Experiment 2. These probes could have contributed to treatment effects, particularly because they were essentially exposure-based trials. It is also possible that in Experiment 2, subjects used one or more different coping strategies, yet reported using only one.

Significant decreases in depression and anxiety (measured by the BDI and STAI, respectively) were seen only in Experiment 2. This might be attributed to the addition of cognitive components to the treatment. Reductions in
anxiety (e.g., Barlow et al., 1984) and depression (e.g., Beck, Rush, Shaw, & Emory, 1979) have both been enhanced when cognitive therapies are combined with behavioral procedures.

While these experiments produced intrusion frequency and SUDS level reductions similar to those in other studies, physiological response reductions were not as dramatic. This may be due in part to treatment or unknown subject differences, but other reasons may also be offered. In these two experiments statistical analyses of the probe data were based upon mean values from each of the components. This is likely to produce a much more conservative outcome than methods used in other studies in which comparisons are made between extreme values. For example, Boudewyns and Hyer (1990) used the lowest value for physiological measures during baseline components and highest values during components, and Fairbank and Keane (1982) compared mean values of the first and last minute during flooding with the values during the last minute of the relaxation component. These methods are more likely to result in statistical differences.

Another reason for differences may be due to the duration of exposure to stimuli. Subjects in the Flooding Group of Experiment 1 were exposed to each CE four times for approximately 25 minutes each during training, with additional exposure during structured and self-practice ses-
sions. This differs from most exposure-based treatments which report session durations of up to 120 minutes. There is some evidence that longer sessions produce more pronounced subjective (Foa & Chambless, 1978) and physiological changes than shorter ones (Stern & Marks, 1973), with physiological (McCutcheon & Adams, 1975; Orenstein & Carr, 1975) and subjective (Foa & Chambless, 1978) responses diminishing only after a period of about 50 minutes. Perhaps the Self-Imaginal Flooding sessions were too short to produce optimal results.

Still, an additional reason is offered. Unlike most other studies the probes were not identical to treatment sessions, particularly in the length of exposure during the probes, nor were probes conducted within the same session as treatment. This was intentional, as probes were designed to gather data on the effects of the treatment at various stages, and contributions of exposure in the probes to treatment outcome were to be minimized. The fact that probes contribute significantly to outcome (i.e., they are capable of producing treatment effects themselves) has been the criticism of some other studies (e.g., Keane & Kaloupek, 1982). Thus, exposure to CEs in this study was intentionally kept at five minutes, a duration which may be more like the duration of "naturally occurring" intrusive memories. Had the length of the exposure in the probes been increased, results approximating those of other stud-
ies may have been obtained.

In conclusion, these experiments contributed to the current state of knowledge about the treatment of PTSD. The usefulness of a self-exposure technique was demonstrated. Such a technique may prove to be cost efficient, as compared to current treatment methods. In addition the preference for cognitive oriented treatments was determined. While the results of these techniques were not as drastic as Self-Imaginal Flooding, significant decreases in the frequency of intrusive memories were also evident.

The results of these experiments provide additional considerations for future treatment of PTSD. Professionals may want to consider that veterans may have preferences for the type of treatment they receive. While it is not known whether this preference would improve the compliance, attrition rates, and outcome with this population, treatment preferences have improved outcome in other areas (e.g., alcohol treatment). Therefore, treatment/patient-preference matching research and treatment may be useful. Some concern related to this is apparently being shown, as guidelines for the selective use of exposure-based treatment are being suggested (Litz, Blake, Gerardi, & Keane, 1990).

The Self-Imaginal Flooding procedure reported herein may provide some benefits over existing flooding treatments. It is a procedure that once taught can be implemented without the aid of a therapist, and the procedure
could be used to treat intrusive memories not presented in the formal treatment setting. It also allows the veteran to take a more active, rather than passive, role in the exposure procedure. There is a potential benefit for the therapist as well. An often discussed, yet not studied, topic among those who lead flooding treatment is that the stimuli presented to the veteran also heighten the anxiety of the therapist. The Self-Imaginal Flooding procedure would prevent that from happening. Because the procedure is self-imposed and private, this allows for group training and treatment, a benefit over current procedures which require one-to-one involvement.

Future treatment should also take into account the results of Experiment 2, in which gains were made by using cognitive techniques. Similar to the Self-Imaginal Flooding procedure, these were active, covert, and easily implemented coping strategies. The possibility exists that the effectiveness of these strategies could be further enhanced with concurrent exposure-based treatment, and that other cognitive techniques not studied here might be equally or more effective.

The interpretations of the results of these experiments and suggestions for future application based upon them must be done while keeping in mind the problems inherent in the studies. While both studies were an improvement over the case study format of most prior flooding research,
each used a small number of subjects. The selection of the subjects may also be questioned, as no clear selection criteria were used (e.g., for baseline physiological responding, scores on specific PTSD assessment instruments, previous treatment history, frequency of intrusions), and subjects were volunteers from those attending three consecutive treatment programs.

A second problem was the lack of reliability data for the implementation of intersession practice for relaxation and coping strategies. Such data would be difficult to obtain. More difficult to obtain would be reliability data for the implementation of the coping strategy at the time intrusive recollections are experienced. As well, during treatment using the Self-Imaginal Flooding and cognitive strategies, there was no certainty that subjects were imaging the events and initiating the coping strategy or relaxation responses as directed.

A third major problem is one which has plagued all similar exposure-based studies with this population to date. Because the probe session procedures are nearly identical to the treatment procedures, the extent to which the probes constitute additional treatment is not clear. While this study attempted to control this problem, there is still no assurance that outcome was not affected by the exposure in the probes.
These experiments have answered a few questions regarding the treatment of PTSD in Vietnam veterans, yet many remain to be answered. In spite of what remains to be done, there is ample evidence for the use of exposure-based and cognitive coping techniques in PTSD treatment programs. Treatment programs may improve their cost effectiveness by using group taught, self-exposure techniques, they may provide a more consumer-acceptable treatment by allowing preferences among effective modalities, and they may offer patients more useful and easily applied coping strategies by teaching those which have been shown here to have more positive effects than the veterans' current strategies.
Appendix A

Notification of Approval From VA Medical Center
Memorandum

Date: April 6, 1989

From: Coordinator, Research and Development

Subj: Approval of Research Proposal, "The Effects of Relaxation Plus Imaginal Flooding Vs Relaxation Only On Panic Attacks in Veterans with PTSD"

Medical Center Director (00)

Thru: Chief of Staff (Itf)

1. The Research and Development Committee and the Subcommittee for Human Studies both met on 4/5/89 and gave a recommendation for your approval of the above study.

2. Jan Bachman, M.A., will be completing this study for his Doctoral Dissertation at Western Michigan University.

3. Mr. Bachman, in order to complete this study before his V.A. appointment expires in August, will be beginning his study on April 10, 1989.

4. The Subcommittee on Human Studies received assurances from Mr. Bachman that his use of flooding and imagery will be supervised by professional staff psychologists at all times. He has revised his informed consent forms to communicate this to study participants.

LAWRENCE T. SCHWARTZ, Ph.D.
Coordinator, Research and Development

( ) Recommend approval
( ) Recommend disapproval

SPENCER FALCON, M.D.
Acting Chief of Staff

( ) Approved
( ) Disapproved

STEPHEN J. HUSHER
Medical Center Director
Appendix B

Notification of Approval from WMU's HSIRB
TO: Jan E. Bachman  
FROM: Ellen Page-Robin, Chair  
RE: Research Protocol  
DATE: March 17, 1989

This letter will serve as confirmation that your research protocol, "The Effects of Relaxation plus Imaginal Flooding versus Relaxation Only on Panic Attacks in Veterans with Posttraumatic Stress Disorder" is now complete and has been signed off by the HSIRB.

If you have any further questions, please contact me at 387-2647.
Appendix C

VA-Form 10-1086 Informed Consent
# PART I - AGREEMENT TO PARTICIPATE IN RESEARCH

## BY OR UNDER THE DIRECTION OF THE VETERANS ADMINISTRATION

1. I, [Type or print subject's name], voluntarily consent to participate as a subject in the investigation entitled [Title of study].

2. I have signed one or more information sheets with this title to show that I have read the description including the purpose and nature of the investigation, the procedures to be used, the risks, inconveniences, side effects and benefits to be expected, as well as other courses of action open to me and my right to withdraw from the investigation at any time. Each of these items has been explained to me by the investigator in the presence of a witness. The investigator has answered my questions concerning the investigation and I believe I understand what is intended.

3. I understand that no guarantees or assurances have been given to me since the results and risks of an investigation are not always known beforehand. I have been told that this investigation has been carefully planned, that the plan has been reviewed by knowledgeable people, and that every reasonable precaution will be taken to protect my well-being.

4. In the event I sustain physical injury as a result of participation in this investigation, if I am eligible for medical care as a veteran, all necessary and appropriate care will be provided. If I am not eligible for medical care as a veteran, humanitarian emergency care will nevertheless be provided.

5. I realize I have not released this institution from liability for negligence. Compensation may or may not be payable, in the event of physical injury arising from such research, under applicable federal laws.

6. I understand that all information obtained about me during the course of this study will be made available only to doctors who are taking care of me and to qualified investigators and their assistants where their access to this information is appropriate and authorized. They will be bound by the same requirements to maintain my privacy and anonymity as apply to all medical personnel within the Veterans Administration.

7. I further understand that, where required by law, the appropriate federal officer or agency will have free access to information obtained in this study should it become necessary. Generally, I may expect the same respect for my privacy and anonymity from these agencies as is afforded by the Veterans Administration and its employees. The provisions of the Privacy Act apply to all agencies.

8. In the event that research in which I participate involves certain new drugs, information concerning my response to the drug(s) will be supplied to the sponsoring pharmaceutical house(s) that made the drug(s) available. This information will be given to them in such a way that I cannot be identified.

---

**NAME OF VOLUNTEER**

HAVE READ THIS CONSENT FORM. ALL MY QUESTIONS HAVE BEEN ANSWERED. AND I FREELY AND VOLUNTARILY CHOOSE TO PARTICIPATE. I UNDERSTAND THAT MY RIGHTS AND PRIVACY WILL BE MAINTAINED. I AGREE TO PARTICIPATE AS A VOLUNTEER IN THIS PROGRAM.

---

9. Nevertheless, I wish to limit my participation in the investigation as follows:

---

**VA FACILITY**

**SUBJECT’S SIGNATURE**

**WITNESS’S NAME AND ADDRESS** (Print or type)

**WITNESS’S SIGNATURE**

**INVESTIGATOR’S NAME** (Print or type)

**INVESTIGATOR’S SIGNATURE**

Signed information sheets attached.

Signed information sheets available at:

---

**SUBJECT’S I.D. NO.**

**WARD**

---

**AGREEMENT TO PARTICIPATE IN RESEARCH BY OR UNDER THE DIRECTION OF THE VETERANS ADMINISTRATION**

**VA FORM 10-1086**

**SUPERSEDES VA FORM 10-1086**

JUN 1976, WHICH WILL NOT BE USED.
Appendix D

"Information about PTSD Study": Informed Consent
Information about PTSD Study: "The effects of relaxation plus imaginal flooding versus relaxation only on panic attacks in veterans with posttraumatic stress disorder"

THIS STUDY HAS BEEN REVIEWED AND APPROVED BY THE VETERANS ADMINISTRATION MEDICAL CENTER, BATTLE CREEK, MICHIGAN.

This study is being done to examine the effectiveness of a treatment on some symptoms which combat veterans notice while experiencing flashbacks and nightmares. Some of these symptoms include increased heart rate, sweating, and increased muscle tension. This treatment has been used successfully in other VA Medical Centers, and the veterans noticed significant decreases in the amount of discomfort associated with flashbacks and panic attacks. The purpose of this study is to determine whether the treatment previously used for individuals can be used to treat groups of veterans. A successful outcome of this study may result in more effective treatment for combat veterans with PTSD.

Veterans will receive this treatment as a part of the Stress Recovery Treatment Program. During treatment sessions veterans may be asked to imagine and talk about scenes which relate to traumatic combat events and which are the subjects of flashbacks and nightmares. Veterans will maintain daily records about flashbacks and nightmares, including their levels of discomfort with certain thoughts and feelings. During several sessions external sensors, which will be placed on the skin (e.g., hand, forehead), will be used to measure pulse rate, skin conductance, skin temperature, and muscle tension. This will indicate the progress the veteran will have made in treatment. This study will begin and end on the same days as the Stress Recovery Treatment Program.

This study has been carefully planned and has been reviewed and approved by the VA Medical Center. The only known risk is the possibility of a temporary increase in the frequency or intensity of flashbacks. This is a possible occurrence in any PTSD program, regardless of the type of treatment. Should such such an incident occur, additional professional staff will be immediately available for support.

The results of your participation in this study will be confidential. Your identity will not be revealed, and your name will be removed from any data sheets after the study is completed. If you participate in this treatment study and for some reason elect at a later date to withdraw, you may do so. Withdrawal from the study will involve no penalty or loss of benefits to which you are otherwise entitled. At the time of withdrawal you may continue to receive treatment, including relaxation training, at the Battle Creek VA Medical Center.

The principal investigator of this study is Jan E. Bachman, M.A., a psychology student and Ph.D. candidate at Western Michigan University. He is also an employee at the Battle Creek VA Medical Center. Any questions about the study should be directed to Mr. Bachman, who will be available each morning during the study. His office is in Building 13, Room 218.

If you are willing to participate, please sign this statement and the following statement (VA Form 10-1066), which further outlines your rights and the responsibilities of the VA and its staff.

( ) I am willing to participate in this treatment study.

Veteran's: ____________________________ Date: _________
Witness' signature: ____________________________ Date: _________
Investigator's signature: ____________________________ Date: _________

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Appendix E

Example of Critical Events Description
Bailey 1-A

I am coming in towards the airport on the plane.

Bailey 1-B

Out the plane window I see a fire fight - Charlie is trying to get on base.

Bailey 1-C

On final search and seizure - shooting enemy - stomping on heads until dead.

Bailey 1-D

Throwing bodies into the hole, covering with lime. I'm crying, throwing up.

Bailey 1-E

I'm in the bar with some other guys.
Appendix F

Pleasant Scene Description
PLEASANT SCENE DESCRIPTION

Describe as clearly as possible the details about a pleasant scene which fit the categories below. The pleasant scene may be one you recall because you experienced it, or it may be one that you would like to imagine because doing so makes you feel good.

I. General Description:

II. Details
   A. Describe what you see:
   B. Describe what you hear:
   C. Describe what you smell:
   D. Describe what you taste:
   E. Describe the sensations you feel against the outside of your body:
   F. Describe any movement you see:
   G. Describe the movements you are making:
   H. Describe your emotions and feelings:
   I. What are you saying to yourself:
   J. What are you feeling inside of your body? (Also think about heart rate, sensations in your throat, stomach, chest, and back; how relaxed or alert you are):
Appendix G

Additional Graphs
Figure 11. Mean SUDS Levels During Relaxation Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 12. Mean BDG Levels During Exposure Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 13. Mean EDG Levels During Relaxation Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 14. Mean EMG Levels During Exposure Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 15. Mean EMG Levels During Relaxation Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 16. Mean TMP Levels During Exposure Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)

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Figure 17. Mean TMP Levels During Relaxation Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 18. Mean HR Levels During Exposure Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Figure 19. Mean HR Levels During Relaxation Component for Each Event in Each Probe. (Although not subjected to a multiple baseline design, Relaxation Group data are included for comparison.)
Appendix H

Weekly Symptom Rating Questionnaire
Weekly Symptom Rating Questionnaire

Name: __________________ SS#: __________ Date: __________

Please answer each of the following questions as they apply to you in the past week. For each symptom you experienced, circle the number on the scale to indicate how disturbed you were by the symptom. If the symptom was

Example for symptom which did not occur: NO 0 - - 1 - - 2 - - 3 - - 4 - - 5 - - 6 - - 7 - - 8 - - 9 - - 10

In the past week did you:

1. feel as if a traumatic event were actually occurring

2. feel distressed when you saw, heard, tasted, felt, or otherwise came into contact with something that symbolized or resembled an aspect of a traumatic event

3. try to avoid thoughts or feelings associated with a traumatic event

4. try to avoid activities or situations that aroused traumatic recollections

5. notice any inability to recall an important aspect of a traumatic event

6. notice that you were not interested in any significant activities

7. feel detached or estranged from others

8. notice an inability to experience certain kinds of feelings

9. think you may not have a long life or not be able to accomplish some things you would like

10. become easily irritated

11. have outbursts due to being angry

12. have difficulty concentrating

13. notice that you were extra watchful or cautious about what was going on around you

14. notice that you were easily startled

15. notice increased heart rate, muscle tension, difficulty with breathing, sweating, or heartburn when something reminded you of a traumatic event

16. experience forgetfulness

17. feel sad

18. feel overwhelmed

19. have any noncombat-related nightmares

20. have any thoughts about combat

21. have troubling thoughts other than those related to combat

22. think about killing yourself

23. think about killing or harming others

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