

# PSYCHOPHYSIOLOGIC RESPONSES TO THE RORSCHACH IN PTSD PATIENTS, NONCOMBAT AND COMBAT CONTROLS

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*While psychophysiological studies of posttraumatic stress disorder (PTSD) have investigated the effects of trauma-related stimuli on arousal, none have explored the development of intrusive imagery and affect states in the absence of such specific cues. The present study compares autonomic arousal during PTSD-related Rorschach responses in PTSD veterans vs. combat controls and noncombat controls. It was found that Rorschach responses containing traumatic content were found only in the PTSD group, and that these responses showed elevations in skin conductance (SC) and heart rate (HR). Our data also suggest that PTSD patients are more easily hyperaroused, especially under conditions of experienced stress and helplessness. Finally, combat control subjects exhibited lower baseline SC and HR than their counterparts, as well as decelerated HR during trauma- and stress-related Rorschach responses, suggesting a physiologic resilience in this group. Depression and Anxiety 8:112-120, 1998. © 1998 Wiley-Liss, Inc.*

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## INTRODUCTION

In the last 15 years, Rorschach studies of posttraumatic stress disorder (PTSD) have found indications of experienced stress, tension, and helplessness, as well as poor affect modulation, perceptual inaccuracy, and intrusive traumatic imagery [Bersoff, 1970; Burch, 1993; Hartman et al., 1990; Levin, 1993; Salley and Tieling, 1984; Sloan et al., 1995, 1996; Souffront, 1987; Swanson et al., 1990; van der Kolk and Ducey, 1984, 1989]. Since hyperarousal symptoms are required in order to diagnose PTSD, it might be expected that PTSD patients would exhibit heightened physiologic arousal during affect-toned Rorschach responses. However, no investigation to date has explored this hypothesis.

Psychophysiology has proven to be useful in the study of PTSD, both in identifying trauma-specific reactions, and in making diagnostic discriminations. It has been shown that on a diverse selection of physiologic indicators, PTSD subjects hyperreact to trauma-linked stimuli (e.g., battle sounds and personal script-driven imagery) but respond normally to neutral or anxiety-provoking stimuli unrelated to the trauma (e.g., arithmetic problems) [Blanchard et al., 1982; Malloy et al., 1983; Pitman et al., 1987]. Furthermore, trauma-specific hyperreactivity can effectively discriminate PTSD subjects from combat and normal controls, with multivariate discrimina-

tions ranging between 70% and 100% [Blanchard et al., 1991].

While combat veterans suffering from PTSD tend to react with acute anxiety to stimuli reminiscent of their trauma, they also report intrusion symptoms in the absence of any identifiable sensory precipitant. Horowitz [1993] notes that unbidden images accompanied by fear tend to occur most frequently in PTSD patients during states of mental relaxation, such as "lying down to sleep or closing the eyes to rest" (p. 52). This suggests that the freer flow of thought emerging under conditions of loosened cognitive control might itself produce intrusive imagery and concomitant arousal in these individuals. The Rorschach is a potentially useful tool for assessing this hypothesis, since the test's low-structure, ambiguous stimuli demand a relaxation of objective reality testing and incorporation of subjective imagery for a response process [Schafer, 1954]. Traumatic or arousing Rorschach percepts appearing in PTSD protocols might, in this way,

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be considered analogous to intrusion symptoms occurring during other relaxed states of consciousness such as daydreaming, hypnagogic drowsiness, and REM sleep.

Psychophysiological investigations of the Rorschach began to appear in the late 1940s, when researchers sought to validate hypothesized associations between color and emotionality, and between shading and anxiety. Studies exploring the affective value of objective stimulus features (i.e., card chromaticity and heavy shading) produced negative findings in every case [Goodman, 1950; Levy, 1948; Rockwell, et al., 1947], while studies exploring the affective value of perceptual response features (i.e., the subject's attentional focus on chromatic color or shading) produced mixed results. While several studies failed to find elevated autonomic arousal in color-dominant (CD) responses [Forrest and Diamond, 1967; Goodman, 1950; Hughes et al., 1951], others did yield corroborative evidence for the CD hypothesis [Broekmann, 1970; Lacey et al., 1953]. In a two-phase experiment, Lacey et al. [1953] first assessed the autonomic response specificity of 22 college students by administering four stress tests while measuring palmar conductance, heart rate, and heart rate variability. Subjects were then administered the Rorschach by using the Beck [1950] system. The authors found that when subjects' autonomic response specificity were factored in, there was a significant correlation between heightened physiologic reactivity and negativity of the Rorschach Form-Color Index, suggesting that CD responses are more arousing than color-subordinate responses. [Beck's Form-Color Index differs little from Exner's [1993] counterpart: the  $FC:CF + C$  ratio.] Broekmann [1970] administered a subset of Rorschach cards to 42 subjects while respiration, vasomotor changes, skin resistance, and heart rate were continually recorded. He found that responses accompanied by high vasomotor arousal scores were associated with a significantly larger percentage of CD scores than those with low vasomotor changes. Regarding Rorschach indicators of stress and anxiety, Forrest and Diamond [1967] found that elevated GSR is associated with the inanimate movement determinant ( $m$ ) and a shading determinant ( $FK$ ) described by Klopfer [1954], ( $FY$  in Exner's [1993] system).

While there have been no physiologic investigations of the Rorschach by using PTSD subjects, two studies have compared psychophysiological responses to the Rorschach in different clinical populations, yielding contradictory findings. Rockwell et al. [1947] found the Rorschach overall to be less arousing on palmar skin conductance for "psychoneurotic" subjects than for normal subjects. In contrast, Brodsky et al. [1969] found that neurotics and schizophrenics responded to the Rorschach with higher GSR arousal than normals.

To summarize, while no psychophysiological study of the Rorschach has found arousal to be associated with objective stimulus variables such as card color or shading, several investigations have found associations between arousal and perceptual response variables.

These variables have included Rorschach responses indicative of emotionality ( $C$  and  $CF$ ), experienced stress and helplessness ( $m$ ), and anxiety ( $FY$ ). These studies offer partial validation of certain Rorschach scores assumed to indicate high-arousal affect states. However, all were conducted before the advent of Exner's [1974, 1986, 1993] Comprehensive System of Rorschach administration and scoring, and therefore could not benefit from the new system's standardization and improved parameters of reliability and validity.

In order to further explore the relationship between psychophysiological arousal and PTSD-related Rorschach responses, we administered the Rorschach to three groups (PTSD, combat controls, and noncombat controls) by using Exner's [1993] system, measuring their heart rate (HR) and skin conductance (SC). The primary purpose of this study was to examine physiological responses of PTSD patients during the Rorschach, a perceptual task involving ambiguous, low-structure stimuli. This could be useful in understanding the development of intrusive images and affect states in the absence of obvious trauma-related cues. Our hypotheses were threefold: 1) we expected PTSD subjects to respond to the Rorschach stimuli with greater arousal than controls; 2) we hypothesized that affect-toned Rorschach responses would be associated with higher levels of physiologic arousal than affect-neutral counterparts. Specifically we expected  $CF$  and  $C$  responses (indicating undermodulated affect) to be more arousing than  $F$  and  $FC$  responses,  $m$  responses (indicating experienced stress) to be more arousing than non- $m$ ,  $Y$  responses (indicating anxiety) to be more arousing than non- $y$ , poor form quality responses ( $-$  and  $u$ , indicating poor reality testing) to be more arousing than good form quality ( $+$  and  $o$ ),  $CRC$  responses (indicating combat-related content) to be more arousing than non- $CRC$ , and  $TC$  responses (indicating traumatic content) to be more arousing than non- $TC$ ; 3) finally, we predicted that the PTSD group would demonstrate larger physiologic differences between affect-toned and affect-neutral Rorschach scores than control subjects. In order to examine potential differences between groups in psychophysiological arousal during percept formation vs. verbal responding, we examined arousal scores at three time periods across all Rorschach variables, as specified in the Methods section below.

## METHODS

### SUBJECTS

Participants of this study were 37 males between the ages of 37 and 57, including 16 Vietnam combat veterans with PTSD, 9 Vietnam combat controls, and 12 noncombat controls. The latter group included VA employees and family members of medical patients who responded to flyers posted in the VAMC hospital. Subjects in the combat control and noncombat control

groups had no psychiatric diagnoses and were not VA patients. All subjects were recruited through psychiatric outpatient services at the Ann Arbor VAMC and through advertisements in the local media. Exclusion criteria included active substance dependence, psychotic disorders, primary major depression, and organic mental disorders. PTSD was diagnosed by using the Structured Interview for DSMIII-R (SCID, PTSD module). Additional self-report inventories were used to assess severity of symptoms, including the Dissociative Experiences Scale [DES; Bernstein and Putnam, 1986; Carlson and Putnam, 1993], the Impact of Events Scale [IOES; Horowitz et al., 1979], the Mississippi Scale for War Zone Personnel [Keane et al., 1988], and the MMPI-2 Subscale for PTSD [Keane et al., 1984] (Table 1). All subjects gave written informed consent for participation in the study, approved by the local IRB.

## APPARATUS

All physiological responses were recorded using the I-330 psychophysiology monitoring system (J&J Instruments, Poulsbo Island, WA), with computer interface converting analog electrophysiological signals into digital information, and the I-330 Use software program. HR was measured with a photoplethysmograph attached to the second phalange of the middle finger, and SC with AG/AGCL electrodes placed on the second phalange of the index and ring fingers. HR and SC were selected on the basis of earlier research, which show these responses to yield good discrimination between PTSD and control sub-

jects [Blanchard et al., 1982; Malloy et al., 1983; Pitman et al., 1987]. The Rorschach inkblots were presented in slide form on a Kodak Ektagraphic Viewer with a built-in 12" viewing screen. Verbal responses were recorded on cassette for later verbatim transcription.

## PROCEDURE

The subject was seated in a 6' by 10' room, facing the viewing screen at a distance of 3'. The experimenter sat at the subject's side at the periphery of his visual field. After the subject was oriented, electrodes were attached to fingers two through four of his dominant hand and a 3 min baselining period followed, during which the subject was instructed to relax. The Rorschach was administered in slide form, using the standard Exner administration, while HR and SC were continuously recorded at a sampling rate of 17 Hz, with averages computed for each 2 sec interval. Since both measures of autonomic reactivity are sensitive to physical exertion, the subject was instructed to remain motionless during the response phase of the Rorschach. The examiner visually monitored the subjects' movement during this time, documenting gross motor events so that coinciding responses could later be discarded. One minute baseline periods preceded the subject's exposure to each of the nine subsequent Rorschach slides.

The subject was given the modified Exner [1993] Rorschach instructions: "I'm going to show you the first slide, and I want you to tell me what it might be. When you are through, let me know and I will shut off the slide" (to indicate when the subject was fin-

TABLE 1. Demographic and psychometric data [ANOVA (F) or chi square ( $\chi^2$ )]

Variable	PTSD subjects (n = 16)		Combat controls (n = 9)		Noncombat controls (n = 12)		Significance tests
	Mean	(SD)	Mean	(SD)	Mean	(SD)	
Age in years	46.50	(2.53)	51.89	(3.98)	45.00	(5.89)	$F(2,36) = 7.40^{**}$
Education in years	13.13	(1.26)	14.89	(2.47)	16.33	(1.83)	$F(2,36) = 11.14^{***}$
Ethnicity <sup>a</sup>							$\chi^2(2, N = 37) = 2.50$
White	14 (87.50%)		8 (88.89%)		10 (83.33%)		
Black	2 (12.50%)		1 (11.11%)		1 (8.33%)		
Hispanic	—		—		1 (8.33%)		
Marital status <sup>a</sup>							$\chi^2(2, N = 37) = 3.25$
Married	14 (87.50%)		7 (77.78%)		7 (58.33%)		
Divorced	1 (6.25%)		1 (11.11%)		3 (25.00%)		
Never married	1 (6.25%)		1 (11.11%)		2 (16.67%)		
IOES							
Intrusion	25.57	(7.08)	.75	(.96)	2.56	(2.51)	$F(2,36) = 63.96^{***}$
Avoidance	46.86	(30.24)	20.75	(19.93)	25.50	(17.60)	$F(2,36) = 3.91^*$
Miss. PTSD scale	135.21	(19.38)	65.31	(13.71)	63.18	(14.12)	$F(2,36) = 74.73^{***}$
MMPI-2 PTSD scale	49.00	(10.16)	9.00	(11.55)	7.83	(9.63)	$F(2,36) = 64.19^{***}$
DES	26.75	(11.24)	7.25	(5.87)	9.50	(4.98)	$F(2,36) = 19.68^{***}$
Baseline physiological levels							
SC $\mu$ mhos	9.89	(7.53)	3.66	(2.55)	7.21	(5.17)	$F(2,36) = 3.20^*$
HR bpm	81.33	(11.99)	74.66	(14.82)	77.07	(9.63)	$F(2,36) = .98$

\* $P \leq .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$

<sup>a</sup>For Ethnicity and Marital Status, table cells include the number (and percentage) of subjects within each group.

ished responding). Rorschach verbal responses were recorded and scored using the Exner Comprehensive System. Electrodes were disconnected during the inquiry phase of the Rorschach, at which point the subject was encouraged to move freely, and to point out percept locations as in standard administration.

### DATA REDUCTION AND ANALYSIS

Once transcribed, each Rorschach protocol was independently scored by two Exner-trained doctoral candidates, using the Rorschach Comprehensive System [Exner, 1993]. The two raters included the examiner and a scorer blinded to subject diagnosis and research hypothesis, as suggested by Exner [1991: p. 459]. Kappa coefficients of 80% or better were achieved between raters in each of the scoring categories (see Table 2), thereby meeting the reliability standards proposed by McDowell and Acklin [1996]. The scores of the blind rater were used in all analyses. To index combat-related content, we used Burch's [1993] *CRC* variable, which codes responses containing reference to blood, anatomy, incomplete human forms, fire, or explosions. We additionally assigned Traumatic Content (*TC*) to responses containing autobiographical reference to combat trauma.

The psychophysiological data were collected for three periods for each Rorschach response analyzed: stimulus (*ST*), pre-response (*P*), and response (*R*), with baseline scores subtracted. *ST* was recorded during the 4 sec following the subject's exposure to the Rorschach slide; *P* was recorded during the 4 sec preceding the subject's verbal response; and *R* was recorded during the full length of the subject's verbal response, which was varied across responses. Only the first Rorschach response to each slide was analyzed to insure the presence of a clear pre-stimulus baseline. We wanted to assess both the stimulus effect, presumably before the subject has formulated a percept (*ST*), and the response effect, presumably after the subject has a percept in mind (*P* & *R*). Repeated measures ANOVAs were used to examine Rorschach variables with two within-subject factors, time interval (i.e., *ST*, *P*, and *R*) and Rorschach variable (e.g., *m* vs. *non-m*), and one between-subjects factor, group (i.e., PTSD vs. combat and noncombat controls). Since only a few subjects

produced *TC* scores, we compared the *R* response score for each *TC* response to the distribution of arousal scores for that subject by computing the mean arousal score and confidence intervals for each subject. *TC* arousal scores falling outside the 95% confidence interval for that subject were considered significantly different from that subject's mean arousal scores.

To test group differences in overall physiologic responsivity to the Rorschach (hypothesis 1), physiological responses to all ten Rorschach cards were examined using repeated measures ANOVAs. The affect modulation (in hypothesis 2) was tested by comparing arousal scores for *CD* vs. *FD* responses to chromatic slides only, to avoid the possibility of a stimulus confound. The rest of the hypothesis regarding affect-toned vs. affect-neutral Rorschach scores were tested using all Rorschach slides. To test whether the PTSD group showed larger physiologic differences between affect-toned and affect-neutral Rorschach scores than control subjects (hypothesis 3), interaction effects for group, Rorschach variable, and time interval were examined.

## RESULTS

A total of 352 Rorschach responses were analyzed out of the possible 370 (37 subjects  $\times$  10) initial slide responses. The rest were excluded due to slide rejection (no response given by subject) or gross motor activity.

### PHYSIOLOGIC RESPONSES TO THE RORSCHACH

PTSD patients had the highest baseline *SC* levels among the three groups, while the combat controls had the lowest ones [ $F(2,36) = 3.20, P = .05$ ] (see Table 1). Baseline *HR* was also highest in PTSD subjects ( $M = 81.33$ ) and lowest in combat controls ( $M = 74.66$ ) but with wide variability on this score, the difference did not approach statistical significance. With regard to hypothesis 1, we found no group differences however in the subjects' *SC* response to the Rorschach overall. Interestingly, the noncombat control group showed higher overall *HR* response to the Rorschach ( $M = 2.69$  bpm.) than either the PTSD group ( $M = .70$  bpm.) or the combat control group ( $M = .71$ ), [ $F(2, 36) = 8.03, P < .01$ ].

### AFFECT-TONED RORSCHACH RESPONSES

When hypothesis 2 was investigated, no differences were found between affect-toned and affect-neutral responses in the areas of affect modulation, experienced stress, anxiety, perceptual accuracy, and combat related content, no differences in physiologic arousal were found when affect-toned Rorschach responses were compared with their affect-neutral counterparts. Elevated arousal was, however, found in responses containing traumatic content. A total of five *TC* responses were given, all by PTSD subjects, including one by subject 4, one by subject 9, and three by sub-

**TABLE 2. Interrater agreement for Rorschach scoring categories**

Scoring category	Cohen's kappa
Location	.90
Developmental quality	.86
Determinant(s)	.80
Form quality	.81
(2)	.93
Content(s)	.87
Popular	.92
Z Score	.90
Special scores	.81

ject 18. Subject 4's *TC* response was associated with significant elevations in both SC and HR, falling above the 99.9% confidence interval for both physiologic indicators. Subject 9's *TC* response fell above the 99.9% confidence interval for HR but was not significant for SC. Lastly, subject 18's *TC* responses, when averaged together, fell above the 90% confidence interval for SC, indicating a trend, but did not approach significance for HR. While only first slide responses were used for these analyses, it is worth noting that when all Rorschach responses were counted, a total of 11 contained *TC*, all of which were contributed by PTSD subjects.

Regarding hypothesis 3, psychophysiological measures of certain affect-toned vs. affect-neutral Rorschach responses differed across time between the diagnostic groups. Specifically, significant 3-way interaction effects were found when the affect modulation (CD vs. FD) and stress (*m* vs. non-*m*) hypotheses were examined, and trend level interaction effects were found when the anxiety (*Y* vs. non-*Y*) and combat relatedness (*CRC* vs. non-*CRC*) hypotheses were examined. No significant interaction effects for perceptual accuracy were found for either physiologic indicator, suggesting that there were no group differences in physiologic arousal over time between perceptually accurate vs. perceptually distorted responses.

With respect to experienced stress, it was found that all three diagnostic groups varied in their SC patterns over time during stress-related (*m*) and non-stress-related (non-*m*) responses, [ $F(4, 42) = 3.89, P < .01$ ], while no differences were found for HR. Figure 1 shows that for SC, the PTSD group showed the highest overall arousal, and greatest intra-group differences between *m* and non-*m* responses over time. For this group, arousal for *m* responses began below that of non-*m* responses at S, then rose steeply above non-*m* responses from

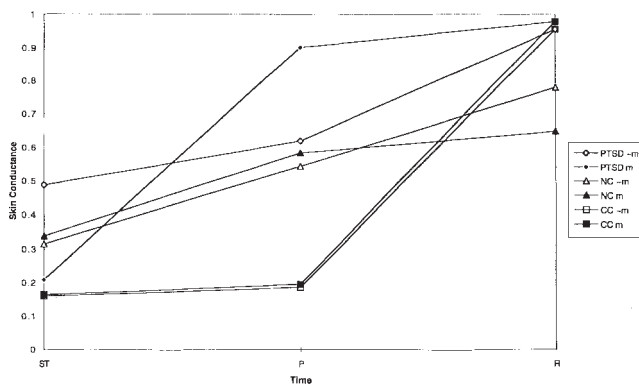


Figure 1. Skin conductance over time during *m* vs. non-*m* responses for PTSD, combat control (CC), and noncombat control (NC) groups. ST, 4 sec time interval following exposure to Rorschach stimulus; P, 4 sec time interval preceding verbal Rorschach responses; R, time interval of verbal Rorschach response.

ST to P, and finally leveled out from P to R. The combat control group had identical SC patterns over time for both response types, with low arousal at ST and P ( $< .2 \mu\text{hos}$ ) and then an increase of roughly  $.8 \mu\text{hos}$  between P and R. Finally, noncombat controls also showed similar arousal patterns for the two response types, with a flatter and more consistent overall slope than either of the other two diagnostic groups.

Regarding affect modulation, it was found that for SC, the two combat groups had significantly smaller physiologic changes on both CD and FD responses when compared with the noncombat control group, [ $F(4,28) = 5.09, P < .01$ ], (Fig. 2). Furthermore, only the noncombat control group had differential physiologic responses to CD vs. FD responses over time in their SC, whereas for both combat groups, SC responses were similar over time for the two response types, [ $F(4,28) = 3.60, P = .01$ ].

Both the PTSD and noncombat control groups showed greater HR for anxiety-related (*Y*) vs. non-anxiety-related (*N*) responses over time, whereas this pattern was reversed for combat control subjects [ $F(4, 32) = 2.45, P = .07$ ]. This latter group showed lower HR arousal for *Y* than non-*Y* responses, and even a cardiac deceleration from baseline during *Y* responses (Fig. 3).

Finally, regarding combat related content, a trend similar to the one found on the *Y* variable appeared in the group by *CRC* interaction for HR [ $F(2, 27) = 3.26, P = .06$ ], but not SC. As can be seen in Figure 4, the noncombat group showed considerably higher HR arousal for combat-related content (*CRC*) than non-combat related content (non-*CRC*) responses, whereas the combat control group exhibited the opposite pattern, and again showed cardiac deceleration from baseline during the affect-associated (*CRC*) responses. The PTSD group showed little difference between response types.

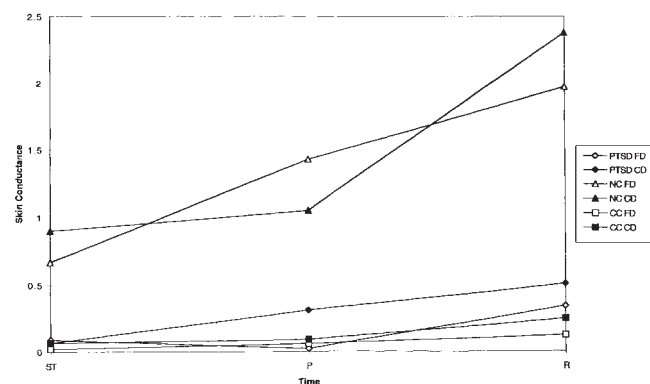


Figure 2. Skin conductance over time during CD vs. FD responses for PTSD, combat control (CC), and noncombat control (NC) groups. ST, 4 sec time interval following exposure to Rorschach stimulus; P, 4 sec time interval preceding verbal Rorschach responses; R, time interval of verbal Rorschach response.

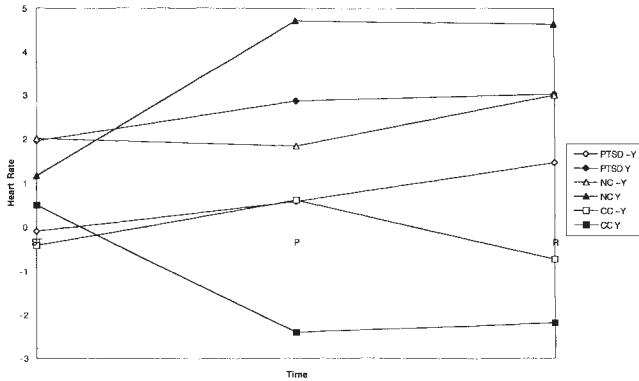


Figure 3. Heart rate over time during Y vs. non-Y responses for PTSD, combat control (CC), and noncombat control (NC) groups. ST, 4 sec time interval following exposure to Rorschach stimulus; P, 4 sec time interval preceding verbal Rorschach responses; R, time interval of verbal Rorschach response.

### DISCUSSION

In this first Rorschach study of PTSD to incorporate physiologic measures, we found that our three diagnostic groups showed differences in both their baseline physiology and their patterns of psychophysiological response to certain affect-toned Rorschach variables. Certain of these differences show PTSD-specific characteristics, others distinguish combat veterans from noncombat controls, and still others suggest unique features of the combat control group.

#### BASELINE PHYSIOLOGY

PTSD patients had elevated baselines for SC and HR in this study. Combat control subjects had the lowest values among the three groups, with noncombat subjects occupying the middle position. While only SC was significant, together these results suggest

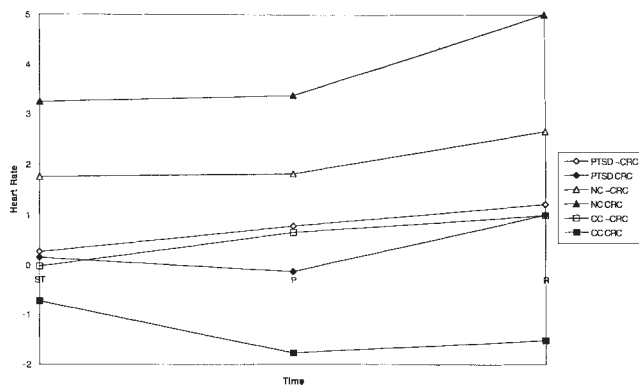


Figure 4. Heart rate over time during CRC vs. non-CRC responses for PTSD, combat control (CC), and noncombat control (NC) groups. ST, 4 sec time interval following exposure to Rorschach stimulus; P, 4 sec time interval preceding verbal Rorschach responses; R, time interval of verbal Rorschach response.

that PTSD patients might become more easily hyper-aroused and have more difficulty achieving relaxation. The findings of elevated baseline psychophysiology in PTSD patients has been reported both by our laboratory [Casada et al., in press; Liberzon et al., 1998] and by others [Keane et al., 1998]. The greater physiologic arousal could be a sequela of PTSD [Kolb, 1985; van der Kolk et al., 1985], or a predisposing condition for the development of the disorder. This latter hypothesis is supported by the finding of lowest physiologic baselines in combat control subjects, additionally suggesting that those who survive traumatic experiences without developing PTSD may tend to have a physiologic resilience. According to this hypothesis, the moderate baseline values of the noncombat group would reflect a fuller spectrum of physiologic functioning, including subjects both vulnerable and resilient to the development of PTSD under conditions of extreme stress. The finding of elevated autonomic baselines in PTSD has also been hypothesized to reflect anticipatory fear in this group associated with the testing situation [Prins et al., 1995].

#### COMBAT VS. NONCOMBAT PSYCHOPHYSIOLOGY

The finding of greater HR physiologic changes in the noncombat control group than in the combat groups is more difficult to reconcile, as we had anticipated the PTSD group to be the one that would hyperreact to Rorschach stimuli (hypothesis 1). Similarly, SC differentiated between combat and noncombat groups when the subset of CD and FD responses were examined (to test the affect modulation hypothesis). It is possible that while the PTSD and combat control groups display similarly muted psychophysiological response in comparison with the noncombat group, the reasons for their diminished arousal may nonetheless differ. While the combat controls may have a resilient constitution (consistent with low baseline physiologic functioning), the PTSD subjects may manifest a numbing of physiologic response unless stimuli are very arousing or trauma-related. This account is admittedly speculative and would require further research for support.

In our examination of the affect modulation hypothesis, it was found that only the noncombat control group showed physiologic differentiation between CD and FD responses over time (on SC), while the combat groups showed similarly blunted arousal for both response types. The finding of physiologic differences between these response types in the noncombat control group is consistent with those of previous studies [Broekmann, 1970; Lacey et al., 1953], suggesting that CD and FD responses may evoke different affective processes. However, unlike Broekmann [1970] and Lacey et al. [1953], we did not find a clear elevation of CD over FD arousal so much as differential arousal pathways over time. The association of CD responses with heightened physiologic response

appears fragile at best, given that the majority of studies have reported negative findings [Forrest and Diamond, 1967; Goodman, 1950; Hughes et al., 1951], and that those studies that reported positive findings implemented special modifications in methodology to achieve these results.

### PTSD SPECIFIC PSYCHOPHYSIOLOGY

PTSD specific physiologic arousal patterns were found during Rorschach responses indicating traumatic preoccupation (*TC*) and experienced stress (*m*). As predicted, subjects who responded to the Rorschach with autobiographical images of combat trauma all showed evidence of heightened physiologic arousal during these responses. This finding is consistent with Horowitz' [1993] view that sufferers of PTSD may experience intrusive images with concomitant autonomic arousal in the absence of any identifiable trauma-related cues. Furthermore, only PTSD subjects gave *TC* responses in our study, though non-PTSD veterans also had combat exposure. It appears that non-PTSD veterans have been able to integrate their traumatic experiences, whereas PTSD veterans have failed to fully do so. This account is consistent with the argument that traumatic experience is integrated through recurrent, painful relivings of the traumatic incident(s) [Freud, 1920; Horowitz, 1976, 1993; Janet, 1889; van der Kolk and van der Hart, 1989]. Although PTSD patients may learn to structure their waking lives so as to avoid external trauma-related cues, there may be no similar way to escape internal cues associated with the process of integrating traumatic experience.

Regarding experienced stress, the PTSD group exhibited a marked increase in arousal for *m* over non-*m* responses between periods ST and P. Neither of the control groups showed differences in their SC arousal patterns during these two response types. This suggests that the *m* response (the perception of movement in inanimate objects) is differentially arousing for PTSD subjects only. To understand this finding, it is useful to consider earlier conceptualizations of the *m* variable, often cited in Rorschach studies of PTSD. Klopfer [1954] believed that the *m* response represented the experienced pressure of ego-alien thought or fantasy, while Schachtel [1996] thought it indicated the "attitude of the impotent spectator" (p. 186). Both of these qualitative interpretations are congruent with certain dissociative aspects of the trauma and post-trauma experience, including thoughts and affects, as well as feelings of helplessness and detachment. Our finding of heightened SC in PTSD subjects during the formulation of a *m* response suggests that PTSD patients are more threatened than their counterparts by experienced stress, perceived helplessness, and loss of control over either internal or external processes.

### COMBAT CONTROL SPECIFIC PSYCHOPHYSIOLOGY

Psychophysiologic arousal patterns unique to the combat control group were found during Rorschach responses indicating anxiety (*Y*) and combat-related content (*CRC*). Regarding anxiety, it was found that both the PTSD and noncombat control groups showed heightened HR arousal for anxiety-related (*Y*) vs. anxiety-unrelated (non-*Y*) responses, in contrast with the combat control group, who showed the opposite pattern, and a deceleration in HR for *Y* responses. Our finding of elevated *Y* vs. non-*Y* responses for all but the combat control group is consistent with Forrest and Dimond's [1967] finding of elevated arousal associated with Klopfer's [1954] *FK* determinant. Combat control subjects also exhibited a contrasting HR arousal pattern in Rorschach responses associated with combat related content. Specifically, during *CRC* responses, combat controls experienced a deceleration in HR whereas noncombat controls experienced greater arousal (than during non-*CRC* responses). The drop in HR found in the combat control group during *Y* and *CRC* responses is interesting in light of previous research associating cardiac deceleration with sustained attention [Porges, 1992; Richards, 1997]. This suggests that normally anxiety-provoking situations may evoke an attitude of interest or vigilance rather than fear in combat controls, allowing them to process experience more smoothly, and make better decisions. Support for this interpretation of physiologic resilience comes from studies of courage [e.g., Rachman, 1978]. One such study found that bomb disposal operators who were decorated for their gallantry maintained lower HR than those not decorated when making difficult discriminations under the threat of shock [Cox et al., 1983]. Barlow [1988] has suggested that the lowered physiologic activity in the decorated operators may reflect a constitutional asset, allowing those who possess it to act more adaptively under conditions of extreme stress, and protecting them against the development of PTSD.

### STUDY LIMITATIONS

The use of psychophysiologic monitoring in this study necessitated certain alterations of the standard procedure articulated in the Rorschach Comprehensive System [Exner, 1993], including the presentation of Rorschach images in slide form (precluding the subject's manipulation of the stimulus), the attachment of electrodes to three fingers of the subject's dominant hand, and the added instruction during the response phase to remain motionless. Although these modifications might affect the subject's testing experience, the consequences for actual Rorschach scores do not appear large when PTSD and control group summary scores [Goldfinger et al., 1998] are compared with those of other studies [Burch, 1993; Hartman et al., 1990; Swanson et al., 1990]. An additional limitation, common to all Rorschach research,

is the problem of rater subjectivity in scoring. While this problem cannot be totally eliminated, every available precaution was taken in the present study to minimize its influence. These included use of raters trained in the Rorschach Comprehensive System [Exner, 1993], and an interscorer reliability study, the results of which meet currently accepted standards [McDowell and Acklin, 1996].

## SUMMARY

It was found that a subgroup of PTSD subjects produced high-arousal responses containing autobiographical reference to combat trauma, corroborating that some PTSD patients do experience arousing intrusive imagery in ambiguous, low-structured situations devoid of trauma-related cues. Our data also suggest that PTSD patients show more difficulty achieving relaxation than their counterparts and become more easily hyperaroused, especially under conditions of experienced stress, perceived helplessness, and loss of control over either internal or external processes. Finally, the finding that our combat control group exhibited low baseline physiologic values and decelerated HR during anxiety-provoking and combat-related Rorschach percepts lends support to the postulation of a physiologically resilient group [Barlow, 1988], less disposed to developing PTSD, and more able to function adaptively under conditions of extreme stress.

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