

## A SEMANTIC DIFFERENTIAL ANALYSIS OF THE RELATION BETWEEN BULIMIA AND DEPRESSION

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### ABSTRACT

Cognitive-behavioral assessment of response covariation of binge eating and depression in bulimics was investigated using a schema paradigm. Consistent with the hypothesis in the psychiatric literature that bulimia is "closely related to" affective disorder, similar semantic structures were expected to underly ratings of conceptions of binge eating and depression. The assessment of schemata involved 10 bulimic, 10 dysphoric control, and 10 normal control females rating the concepts "BINGE EATING" and "DEPRESSION" on nine semantic differential scales. The semantic differential ratings for each concept were subjected to multivariate analysis of variance (MANOVA) and discriminant function analysis. MANOVA results in conjunction with Duncan's multiple range test indicated that dysphoric subjects rated "DEPRESSION" as being stronger and less unpleasant than the other two groups. Classification of subjects based on the discriminant function from the semantic ratings of "BINGE EATING" achieved 57% accuracy, whereas the semantic ratings of "DEPRESSION" yielded 100% accuracy in classifying subjects. Canonical correlations revealed that the overall semantic structure underlying subjects' conceptions of binge eating versus depression were different. The results failed to support the hypothesis that similar semantic structures underly conceptions of binge eating and depression.

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#### INTRODUCTION

In recent years, there is a growing body of literature suggesting a relation between bulimia and depression. Parallels between bulimia and depression have been noted with regard to family history (Hudson, Laffer, and Pope, 1982; Hudson, Pope, Jonas, and Yurgelun-Todd, 1983; Pyle, Mitchell, and Eckert, 1981),

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biochemical abnormalities (Gwirtsman, Roy-Byrne, Yager, and Garner, 1983; Hudson, Pope, Jonas, Laffer, Hudson, and Melby, 1983), and reactions to antidepressant medications (Hudson, Pope, and Jonas, 1984; Pope and Hudson, 1982; Walsh, Stewart, Wright, Harrison, Roose, and Glassman, 1982). Based on similarities in these areas, Hudson et al. (1984) hypothesized that bulimia is "closely related" to major affective disorder. However, methodological issues temper the strength of the findings in support of the affective disorder hypothesis (see e.g. Wilson, 1986; Wolf, 1982). One major confound in studies of the relation between bulimia and depression is the prevalence of depressive symptoms in bulimic individuals.

Hudson, et al. (1984) reported, for example, in a diagnostic survey of 74 consecutive bulimic patients that 89% met DSM III criteria for some type of major or minor affective disorder. The presence of concomitant affective disorder in bulimic subjects has caused some researchers to question their positive results. Gwirtsman et al. (1983) noted that their findings may have been "a result of the concomitant presence of disorders in the affective and borderline spectrum rather than the bulimic syndrome itself" (p. 562). Similarly, Walsh et al. (1982) concluded, "whether bulimia and atypical depression are separate entities, both treatable by MAOIs, or two aspects of the same underlying disturbance is unclear" (p. 1630). Hudson et al. (1984), on the other hand, consider the presence of concomitant depression in bulimics as additional support for the affective disorder hypothesis.

Hudson et al.'s (1984) hypothesis that bulimia and depression are similar disorders relies heavily on observations of concurrent changes in binge eating and mood in bulimic patients after antidepressant medication treatment. Observations of simultaneous behavioral and emotional changes simply reflects "response covariation" (Kazdin, 1982). The use of the concept of response covariation to describe concurrent changes in distinct behaviors is advantageous for several reasons. First, covariation makes no assumptions about the nature of these simultaneous changes. Second, and more importantly, Kazdin (1982) revealed that the concept is related to an interactional model of human behavior which suggests guidelines for the assessment of response covariation.

The interactional approach to human behavior is a fairly recent development in personality research (see e.g. Magnusson and Endler, 1977). A key concept in this model of personality is that behavior is a function of the interplay between internal (cognitive) and external (environmental) factors. That is, an individual's reactions or responses to persons, situations, or objects partially reflect their interpretations of them or their meaning to that individual. From this perspective, an adequate assessment of behavior would involve the study of both individuals' perceptions and environmental factors. Although the interactional assessment model has not been applied explicitly to abnormal behavior, it is compatible with the theoretical underpinnings of cognitive behavior therapy. Cognitive behavior therapists emphasize the importance of individuals' interpretations or perceptions of environmental stimuli in the etiology and maintenance of behavioral and emotional disorders (cf. Beck, 1970; Ellis, 1962). In this way, cognitive models of abnormal behavior are analogous to interactional models of personality.

Contemporary cognitive-behavioral views have expanded beyond their

emphasis on conscious cognitions — i.e., self-statements, irrational beliefs, internal dialogue, etc. — to include more automatic, unconscious cognitions and enduring cognitive structures (Arnkoff, 1980; Bergh and Eelen, 1984; Kihlstrom and Nasby, 1981; Landau and Goldfried, 1981; Turk and Salovey, 1985; Turk and Speers, 1983). They adopt the notion of *schema* from experimental cognitive psychology most frequently to describe the latter type of cognitions. Schema theories propose that the encoding and storing of information about experiences is heavily determined by a guiding schema or knowledge structure that selects and actively modifies the information in order to arrive at a coherent, unified, expectation-confirming and knowledge-consistent representation of the experience (Alba and Hasher, 1983). Applications of this type of information processing model to clinical phenomena draws the cognitive-behavioral approach to abnormal behavior even closer in form to the interactional model in personality research. This increased similarity is best exemplified by the recent adoption of methods of data collection and analysis, which have been used extensively in personality and social psychology research, by cognitive behavior therapists to assess semantic schemata. Among the more popular methods is the semantic differential technique (SD: Osgood, Suci, and Tannenbaum, 1957).

The SD rating is considered a "representational mediating response" with a stimulus equivalent in other behavioral, perceptual, and physiological modalities. Osgood et al. (1957) hypothesized that the stimuli from various modalities may have shared meanings along dimensions which are organized in semantic space, which is not unlike current information-processing models (cf. Bower, 1981; Lang, 1979). The SD approach is basically a combination of controlled association and scaling procedures (Osgood et al., 1957). The SD requires subjects to rate a given set of concepts using a variety of 7-point bipolar scales, the endpoints of which consist of opposite adjectives such as "good-bad". Factor analytic studies have consistently revealed a 3-dimensional solution of "evaluation", "potency", and "activity" for SD ratings (Mann, Philips, and Thompson, 1979; Osgood et al., 1957). Consequently, researchers group scales according to these factor-analyzed dimensions to interpret SD results. Miron (1972) asserted that the SD scales cannot be assumed to be invariantly stable in meaning, because "their meaning is critically dependent on the substantives they are used to modify" (p. 318). Consistent with this view, Rosenberg (1977) found only the "evaluation" dimension to be stable in his application of SD to person perception/implicit personality research. Researchers should heed Miron's caveat and not take SD ratings *prima facie* as reflecting the evaluation-potency-activity triad. Cognitive-behavioral assessments of clinical populations with the SD technique have yielded encouraging results. Karoly and Ruehlman (1983) found, in a SD analysis of depression, that depressed subjects rated personal and impersonal concepts as less evaluative positive, potent, and active than nondepressed subjects.

Since recent developments in cognitive behavior therapy parallel the interactional model of personality, cognitive-behavior assessment of response covariation is warranted. Specifically, assessment of semantic schemata representing maladaptive behavioral (i.e., bulimia) and affective (i.e., depression) responses may provide some insight into the basis of covariation between them. The purpose of the present investigation was to examine the semantic structure's for

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the concepts of bulimia and depression among bulimics, dysphorics, and normal controls to determine whether they are similar disorders. If the two disorders are "strongly related", then their cognitive representations should be similar across these three groups. In other words, these two disorders should be associated with the same behavioral, affective, and cognitive responses in the semantic network (cf. Bower, 1981; Lang, 1979; Osgood et al., 1957). From this perspective, it was hypothesized that similar semantic schemata would underly conceptions of binge eating and depression. It then follows that behavioral manifestations of these concepts in the form of semantic ratings should reflect similar response patterns when elicited by identical contextual cues (i.e., bipolar adjectives).

### METHOD

#### SUBJECTS

**BULIMIC GROUP.** Subjects were 10 females with bulimia nervosa seeking treatment at the Rutgers Eating Disorder Clinic. They were respondents to advertising for a treatment program for bulimia nervosa. All clients met DSM III criteria as well as other selection criteria (see Wilson, Rossiter, Kleifield, and Lindholm, 1986). The mean binge/purge frequency for this clinical group was 7.4/7.8 per week.

**DYSPHORIC CONTROLS.** Subjects in the dysphoric control group were 10 undergraduate female controls who scored in the depressed range (12 or higher) on the Beck Inventory (see Table 1). They were students in an introductory psychology class participating in an experiment for research credit.

**NORMAL CONTROLS.** This group consisted of 10 undergraduate females from introductory psychology who scored in the nondepressed range (below 9) on the Beck Inventory (see Table 1). They were tested in the same experiment as the dysphoric controls.

#### MEASURES

**RESTRAINED EATING.** The measure of restrained eating was the Stunkard and Messick's (1985) Three-factor Eating Questionnaire. The 51-item questionnaire measures dietary restraint, disinhibition, and hunger. Each item is scored as 0 or 1 and summed up for each factor. The three factors are summed to obtain a total restraint score. Total restraint scores range from 0 (unrestrained) to 51 (highly restrained).

**BINGE EATING.** Severity of binge eating was assessed with the Eating Habits Checklist (ECH; Gormally, Black, Datson, and Randin, 1982). This self-report questionnaire contains 16 items describing feelings/cognitions and behaviors characteristic of binge eating. Each item consists of four statements that reflect a range of severity for that characteristic. The statements are assigned independent weights (0-3) to indicate no binge-eating problem (0) or a severe binge-eating problem (3). The scale is scored by summing the individual weights for the 16 items. High scores indicate more severe binge-eating problems.

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**Table 1**

**DESCRIPTIVE STATISTICS FOR DEMOGRAPHIC  
AND CLINICAL VARIABLES BY GROUP**

Variable	Group					
	Bulimics		Dysphoric		Normals	
	MEAN	SD	MEAN	SD	MEAN	SD
Age	19.9 <sup>a</sup>	1.27	18.5 <sup>b</sup>	1.08	18.5 <sup>b</sup>	1.27
Weight	122.8 <sup>a</sup>	13.65	125.7 <sup>a</sup>	9.19	130.7 <sup>a</sup>	19.13
Percent of Ideal Weight	94.6 <sup>a</sup>	7.49	92.8 <sup>a</sup>	8.05	98.7 <sup>a</sup>	9.72
Restraint Eating	36.7 <sup>a</sup>	6.43	30.5 <sup>ab</sup>	8.86	27.9 <sup>b</sup>	9.24
Binge Eating	35.2 <sup>a</sup>	9.05	17.22 <sup>b</sup>	10.88	12.6 <sup>b</sup>	10.20
Depression	18.1 <sup>a</sup>	6.35	17.7 <sup>a</sup>	4.76	4.6 <sup>b</sup>	3.24
Body Image	55.9 <sup>a</sup>	21.60	66.9 <sup>ab</sup>	18.37	77.7 <sup>b</sup>	12.37

NOTE: Means with the same superscript are not significantly different from each other.

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**DEPRESSION.** The 21-item version of the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, and Erbaugh, 1961) was the measure of depression. Each item consists of a set of four statements ordered and weighted (0-3) according to severity of symptom measured. Scale scores are derived by summing individual weights. High scores are indicative of more severe depression.

**BODY IMAGE.** A SD scale composed of 16 bipolar adjectives for evaluating "my body right now" (Leon, Eckart, Teed, and Buchwald, 1979) was included. The adjective ratings were scored from 1 (negative) to 7 (positive). The total body image scores were the sum of the 16 adjectives with higher scores indicating more positive views.

**ASSESSMENT OF SEMANTIC SCHEMATA.** All subjects rated the concepts of "BINGE EATING" and "DEPRESSION" on nine bipolar 7-point scales. The nine scales were: good-bad, strong-weak, fast-slow, pleasant-unpleasant, large-small, active-passive, sweet-sour, heavy-light, and sharp-dull. These scales were selected because they produced the highest factor loadings across a variety of concepts in two distinct factor analytic studies using different techniques (see Osgood et al., 1957).

### PROCEDURE

**BULIMIC GROUP.** The measures used in the current study were administered to the bulimic clients as a part of a larger assessment battery (see Wilson et al., 1986). During the first personal interview, clients were required to complete a variety of self-report questionnaires. The SD rating scales for the assessment of schemata were added to the assessment battery for this study. All of the remaining measures were standard for the intake procedure. The measures were administered to individual clients by their therapists. All subjects were given code numbers that were used to identify their clinical data. Their personal information and the clinical data were both kept in locked files.

**CONTROL GROUPS.** Control subjects were given the measures in a group experiment. They signed up for an experiment for research credit in introductory psychology. Students were told that they would be participating in a test validation study. The measures were administered as a set to the subjects. Subjects were instructed to fill out a demographic sheet including their age, height, weight, and their student number, but, not their names. Subjects were given credit and then debriefed individually upon completion of their questionnaires. They were informed that their responses would be compared to the bulimic group and were given the option to withdraw from the study without penalty. If they still wanted to be included in the study after the debriefing, they were asked to sign a consent form including their student number. The consent forms and questionnaires were recoded and kept in separate files only accessible to the experimenter.

## RESULTS

Group differences on demographic and clinical variables were determined by one-way analysis of variance (ANOVA) and the Duncan multiple-range test. Means and standard deviations for the demographic and clinical variables are presented in Table 1. Bulimics, dysphoric, and normal controls did not differ significantly in terms of actual weight,  $F(2, 27) = 0.75, p < ns$ , or percent of ideal weight,  $F(2, 27) = 1.27, p = ns$ . Bulimics were a little older than depressed and normal controls,  $F(2, 26) = 4.11, p < .05$ . Although bulimics were significantly more restraint than normals, the ANOVA for the restraint eating factor only approached significance,  $F(2, 27) = 2.99, p < .07$ . Bulimics reported more severe binge eating than both dysphoric and normal controls,  $F(2, 26) = 14.04, p < .0001$ . Depressed controls and bulimics were significantly more dysphoric than the normal controls,  $F(2, 27) = 24.09, p = .0001$ . Bulimics had a significantly more negative body image than normal controls,  $F(2, 27) = 3.73, p < .05$ , and the dysphoric controls' body image was more negative than normal subjects but more positive than bulimics.

The discriminating power of the nine semantic differential scales for "BINGE EATING" versus "DEPRESSION" was assessed by multivariate analysis of variance (MANOVA) and discriminant function analysis. MANOVA results based on Roy's Greatest Root criterion was nonsignificant for semantic differential ratings of "BINGE EATING",  $F(9, 20) = 1.33, p < ns$ , but was significant for semantic differential ratings of "DEPRESSION",  $F(9, 20) = 2.59, p < .05$ . Subsequently, univariate tests (ANOVAs) were conducted to determine which semantic differential scales accounted for the significant multivariate effect. The results of the univariate tests for both concepts are summarized in Table 2. As can be seen in Table 2, the "strong-weak" ( $R^2 = .26, F = 4.78, p < .02$ ) and "pleasant-unpleasant" ( $R^2 = .22, F = 3.80, p < .05$ ) scales differentiated the three groups' semantic differential ratings of "DEPRESSION". Class or group means were subjected to Duncan's multiple range test which revealed that dysphoric subjects differed significantly from bulimic and normals, who did not differ from each other significantly. Specifically, dysphoric subjects rated "DEPRESSION" as stronger and less unpleasant than did bulimics or normals.

The relationship between group membership and semantic differential ratings was also examined by separate discriminant function analysis for each concept. Prior to the discriminant analysis, the homogeneity of within covariance matrices was tested to determine whether it would be better suited for use in the discriminant function. The test of homogeneity of within covariance matrices was not significant for "BINGE EATING",  $\chi^2 = 105.15, df = 90, p < ns$ , but was highly significant for "DEPRESSION",  $\chi^2 = 172.63, df = 90, p < .0001$ . Thus the pooled covariance matrices were used in calculation of the discriminant function of the former, while the within covariance matrices were used in the discriminant function of the latter. Classification of subjects into their original groups based the discriminant function was 57% accurate from the semantic differential ratings of "BINGE EATING". In contrast, classification of subjects into the original three groups based on the discriminant function from semantic differential ratings of "DEPRESSION" achieved 100% accuracy. Canonical

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Table 2

SUMMARY OF STATISTICS FROM UNIVARIATE ANOVAS  
FOR SEMANTIC DIFFERENTIAL RATINGS  
OF BINGE EATING AND DEPRESSION

Concept/Scale	Mean	Std	R <sup>2</sup>	F	p
<b>BINGE EATING</b>					
good-bad	1.77	1.63	.08	1.23	ns
strong-weak	2.93	2.32	.05	0.77	ns
fast-slow	5.07	2.00	.07	1.04	ns
pleasant-unpleasant	2.57	2.03	.11	1.69	ns
large-small	5.40	1.77	.11	1.59	ns
active-passive	4.10	2.48	.05	0.78	ns
sweet-sour	4.23	2.11	.05	0.66	ns
heavy-light	5.43	1.74	.08	1.15	ns
sharp-dull	3.57	1.90	.02	0.23	ns
<b>DEPRESSION</b>					
good-bad	1.87	1.25	.07	1.05	ns
strong-weak	3.80	2.25	.26	4.78	.02
fast-slow	2.93	1.72	.13	2.04	ns
pleasant-unpleasant	1.90	1.71	.22	3.80	.05
large-small	4.47	2.18	.04	0.50	ns
active-passive	2.43	1.85	.13	2.08	ns
sweet-sour	2.67	1.56	.12	1.79	ns
heavy-light	5.67	1.49	.02	0.23	ns
sharp-dull	2.93	1.78	.05	0.66	ns

correlations were computed to examine the overall semantic structures of subjects' conceptions of binge eating versus depression (see Table 3).<sup>1</sup> For "BINGE EATING", the SD scales of "good-bad", "fast-slow", and "heavy-light" were the loadings for the first canonical variate, and only the "large-small" scale was loaded on the second canonical variate. In contrast, "strong-weak", "fast-slow", "pleasant-unpleasant", and "sharp-dull" loaded on the first canonical variate and only "active-passive" on the second canonical variate, respectively.

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**Table 3**

**STANDARDIZED CANONICAL COEFFICIENTS  
FOR THE SEMANTIC DIFFERENTIAL RATINGS  
OF THE CONCEPTS OF BINGE EATING AND DEPRESSION**

SD Scale	BINGE EATING		DEPRESSION	
	Canonical Variates			
	1	2	1	2
good-bad	-0.74	-0.00	-0.44	-0.18
strong-weak	0.43	0.15	1.01	-0.49
fast-slow	-1.04	0.03	0.77	0.21
pleasant-unpleasant	0.58	0.48	0.80	0.06
large-small	-0.02	-0.62	-0.45	-0.29
active-passive	0.15	-0.19	-0.15	0.84
sweet-sour	0.11	-0.02	0.28	-0.00
heavy-light	0.51	-0.19	0.45	0.26
sharp-dull	0.49	0.43	-0.76	0.32
<b>Statistic</b>				
Canonical Correlation	0.61	0.41	0.73	0.39
Eigenvalue	0.60	0.20	1.17	0.18
Proportion	0.75	0.25	0.87	0.13

### DISCUSSION

The present findings do not support the hypothesis that similar semantic structures underlying individuals' views of binge eating and depression. Moreover, when differences existed between groups, dysphorics differing from bulimics and normals was the source of the differentiation. Dysphoric controls seem to have a more differentiated view of depression compared to bulimics and normal controls, who did not differ from each other along the given semantic dimensions in their conceptions of depression. This is evidence contrary to the conceptualization of bulimia as an affective disorder. Based on the affective disorder hypothesis, one would expect bulimics and dysphoric controls to have similar semantic schemata for depression. The fact that bulimics' semantic ratings reflect a "normal" or nondepressed conception of depression makes a stronger case for the absence of major depression.

Dysphoric subjects viewed depression as stronger and less unpleasant compared to bulimics and normal controls. The rating of depression as less unpleasant by dysphoric subjects seems counterintuitive, particularly because they consider it to be stronger relative to the other two groups. It may be that depression dominates the experience of the dysphoric subjects thus desensitizing them to this negative affective state. Bulimics' experience of depression, on the

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other hand, may be overshadowed by their binge eating resulting in a conception comparable to that of normals. Consistent with this perspective, some clinical literature suggests that depression is secondary to binge eating in the syndrome of bulimia (cf. Rossiter and Wilson, 1985; Russell, 1979; Sabine, Yonace, Farrington, Barratt, and Wakeling, 1983; Wilson, 1986; Wilson et al., 1986). The effects of the cognitive saliency of binge eating on the development of semantic schemata for depression is not discernible from the present data. Dietary restraint, which has been found to mediate the relation between binge eating and depression (see e.g., Ruderman, 1985), was not a significant factor in the present study. Future researchers could conduct assessments of semantic schemata within a longitudinal design to address this question.

Bulimics and dysphoric controls did not differ significantly in terms of their scores on the BDI, so their differential semantic representations of depression cannot be attributed to different levels of depressive mood states. It is also unlikely that the nonclinical nature of the dysphoric group affected the outcome. The BDI has been shown to reliably assess clinical depression in college student samples (Bumberry, Oliver, McClure, 1978; Hammen, 1980). Also, Clark and Teasdale (1982) found clinical depressives to be similar with respect to some cognitive phenomena to analogue depressed subjects. Finally, the finding that bulimics' conception of depression is more like that of normals is inconsistent with this line of reasoning.

The current findings may shed some light on the discrepant results from previous studies attempting to examine the relation between bulimia and depression. Cooper and Fairburn (1986) compared patients with bulimia versus major depression on measures of psychopathology including anxiety and depression. These researchers found that symptom patterns differed for these two groups of patients. Lee, Rush, and Mitchell (1985), in contrast, found a significant relation between bulimia and depression in their study of a group of bulimic patients. Specifically, 77% of the patients in Lee et al.'s study presented with mild depression, which is comparable to the 89% reported in past studies (cf. Hudson et al., 1984). It should be noted that the former findings were based on between-group comparisons (i.e., syndrome level analyses) while the latter were based on within group comparisons (i.e., symptom level analyses).

The present study conducted both type of analyses as well as adding a normal control group and semantic differential assessment. While bulimics and dysphoric controls scored similarly on the self-report measure of depression and dissimilarly on the self-report measure of binge eating, these two symptoms seems to have different meanings in the syndromes of bulimia and depression. Thus the results suggest that differences at the symptom level may not correspond to differences at the syndrome level. It may be for this reason that Cooper and Fairburn (1986) found differences when comparing the syndromes of bulimia and depression, whereas Lee et al. (1985) found similarities when examining the relation at the symptom level.

Canonical correlations revealed that subjects' conceptions of binge eating versus depression differed in terms of overall semantic structures. For both concepts, the first canonical variate consisted of a blend of items representing the evaluation-potency-activity triad, although different items represented these

dimensions in each concept. The second canonical variate reflected primarily a "size" dimension for binge eating and an "activity" dimension for depression by a single item in each case. The results do not reflect Osgood et al.'s (1957) semantic triad with any consistency, thus supporting Miron's (1972) contention that the SD scales should not be considered universal in their meaning. They also do not replicate Rosenberg's (1977) findings of a "pure" evaluation dimension that pervades in individuals' semantic judgment. These failures to replicate may be due to the application of the SD technique to concepts representing abnormality (psychopathology).

In conclusion, the results of the present study failed to support the hypothesis that bulimia is "closely related" to affective disorders. However, the current findings should be interpreted with caution due to several methodological limitations. Cognitive-behavioral assessment of response covariation of behaviors does not provide information about the etiology of their cognitive organization. This approach also assumes that the cognitive representations of covarying behaviors correspond to actual behaviors (Kazdin, 1982). Direct observation or self-monitoring of the target behaviors may be needed to cross-validate data obtained from SD ratings or other analogue behaviors. On a more general level, the strength of the current results is tempered by small sample size. The absence of a neutral concept in the SD ratings leaves room for doubt that the results reflect schematic representations of the two disorders as a function of differential experiences. Replications of this study with other abnormal responses are also needed to establish its external validity.

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## MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

### AUTHOR NOTES

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### FOOTNOTES

<sup>1</sup>The statistical analysis system (SAS; SAS Institute, 1985), which was the statistical package used for the current study, have two distinct procedures for discriminant analysis, "PROC DISCRIM" and "PROC CANDISC". The former procedure does not provide information about the discriminant function, particularly the standardized discriminant weights. The latter procedure, on the other hand, yields as output the canonical correlation coefficients which allows for the determination of each variable's contribution to the discriminant function (i.e., the canonical variates). The use of the two procedures interchangeably is statistically justifiable because discriminant criterion and canonical correlation approaches to discriminant analysis yield the same results (Tatsuoka, 1971).