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Effects of Motivationally Significant Stimuli on the Regulation of Dominant Responses

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In 4 experiments, Ss responded as quickly as possible to indicate whether character strings consisted of letters or numbers. Following a warning stimulus that was or was not designed to trigger a motivational-emotional response in particular subgroups (viz., those with high anxiety, discrepant self-concepts, and eating disorders), strings were presented in a central (dominant) location on 75% of the trials or in 1 of 4 peripheral (nondominant) locations. Consistent with hypotheses, response times to peripherally located strings were significantly slower following motivationally significant than following neutral warning stimuli. Contrary to hypotheses, such stimuli did not facilitate responding to centrally located strings. It is proposed that motivationally significant stimuli engender a temporary reduction in control processing that hinders regulation of dominant responses.

The law of effect, one of the most powerful principles of psychology, holds that behaviors that are ineffective or lead to negative consequences will be abandoned in favor of more adaptive responses. In the light of this principle, the maintenance of maladaptive behavior represents a fundamental paradox of some importance. Why do people persist in maladaptive response strategies? A wide range of explanations has been proposed, including a desire for self-punishment (Fenichel, 1945), temporal gradients of reinforcement that cause people to place short-term needs above long-term goals (Dollard & Miller, 1950), and distorted interpretations of environmental events which lead a person to believe that inappropriate responses are warranted (Dodge & Crick, 1990). Each of these accounts of maladaptive behavior takes for granted that behavior is an accurate reflection of intention (i.e., personal choice).

An alternative perspective is that maladaptive behavior reflects a situation-specific deficit in information processing that interferes with thorough analysis of the situation and evaluation of response alternatives. In other words, maladaptive behavior may reflect a breakdown in the self-regulation process, those psychological mechanisms responsible for monitoring and adjusting ongoing behavior to ensure that it is in accord with feedback from the environment and long-term goals (see Kanfer & Gaelick, 1986). According to this perspective, the perseveration of maladaptive behavior may reflect an automatic or "default" reaction to particular situations that persists because aspects of the situation somehow impair information processing and interfere with regulation of the defective response.

An excellent example of this formulation was outlined recently by Tiffany (1990), who characterized the relapse process seen in substance abusers as a situation-specific breakdown in the control information processing resources necessary to inhibit their overlearned drug use responses. Because the inhibition of dominant-habitual responses requires control processing (Kanfer & Gaelick, 1986) and drug stimuli interfere with such processing, the drug stimuli place addicts at high risk for relapse despite their intention to abstain. As noted by Tiffany (1990), this proposal is not intended to explain the development of maladaptive behavior, but it may provide a reasonable account of its persistence.

If motivationally-emotionally significant stimuli (henceforth *motivationally significant stimuli*) can disrupt self-regulation and facilitate the expression of dominant responses, it should be possible to observe this process in the laboratory. Toward this end, we examined self-regulation in impulsive and anxious subjects as they attempted to trace a circle pattern as slowly as possible (i.e., regulate tracing speed) in the presence of motivationally significant cues. Based on Gray's (1981) proposal that neurotic extraverts (impulsive subjects) are particularly sensitive to approach-reward cues and that neurotic introverts (anxious subjects) are particularly sensitive to cues for punishment and response uncertainty (see also Wallace, Bachorowski, & Newman, 1991), we predicted that these groups would trace more quickly under conditions that corresponded to their stimulus sensitivities. Consistent with predictions, we observed poorer regulation of tracing speed in impulsive than in nonimpulsive subjects (stable introverts) under conditions involving salient approach-reward cues. In addition, the tracings of anxious subjects tended to be faster (i.e., poorer regulation) than those of nonanxious controls (stable extraverts) under conditions involving cues for punishment and response uncertainty (Bachorowski & Newman, 1990; Wallace & Newman, 1990). It is important that subjects did not differ under condi-

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tions that did not correspond to their stimulus sensitivities (see Wallace et al., 1991 for review).

Motivationally significant stimuli are likely to affect allocation of attention as well as motor behavior (Easterbrook, 1959; Eysenck, 1982). On the basis of a series of well-controlled studies, Hockey and others (Geen, 1976; Hockey, 1970; Hockey & Hamilton, 1970) concluded that experimental manipulations, such as the administration of noise and incentives that increase arousal, effort, or both, cause subjects to allocate attention differentially to the primary or central elements of a task or stimulus array. For example, when subjects were instructed simply to memorize a list of words that were presented in one of the four corners of a display, subjects in a high-arousal condition were less able to recall the spatial location of the words than those in the low-arousal condition. Apparently, subjects allocated less attention to the secondary, or nondominant, aspect of the stimulus display when arousal was high (Davies & Jones, 1975).

The data outlined above, along with many similar reports, lead us to speculate that motivationally significant stimuli reduce attention to secondary cues and facilitate dominant attentional and motor response sets. Moreover, our results for circle tracing suggest that there are important individual differences influencing which stimuli are regarded as motivationally significant. Thus, we theorized that it should be possible to (a) assess a person's particular stimulus sensitivity and (b) engender a motivational state by triggering the particular sensitivity, which in turn, will (c) bias a person's response style as noted above. In other words, just as neurotic extraverts' reaction to reward cues was found to interfere with inhibition of a dominant motor response, we believe that a wide variety of cues may interfere with self-control of motor behavior and the flexible allocation of attention if they are relevant to a person's specific sensitivities (i.e., of high motivational significance).

The present research was designed to provide a more explicit test of the hypothesis that motivationally significant cues interfere with a subject's ability to alter a dominant response set. In each of four studies, we manipulated the presence of motivationally significant cues while assessing a subject's ability to shift attention from dominant to nondominant features of a task. Toward this end, we used a visual reaction time task involving a discrimination between letter and number strings. Each trial began with a centrally located warning stimulus that was either motivationally significant or neutral, followed immediately by a character string of five letters or numbers. Subjects pressed a button corresponding to the type of character string as quickly as possible. Character strings appeared either in the center of the visual display or in one of the four corners. To establish a dominant response set involving allocation of attention to the central location, character strings were presented in the center location on 75% of the trials.

Following the theoretical perspective outlined above, we predicted that, relative to performance following the neutral warning stimuli, presentation of motivationally significant stimuli would result in faster response times to centrally located character strings and slower response times to peripherally located strings.

Experiment 1

To test the hypothesis that particular stimuli will, by virtue of their motivational significance, facilitate behavior consistent with a dominant response set while disrupting readiness to process and respond to nondominant information, we had to select subjects with particular stimulus sensitivities.

Matthews and his colleagues (see Matthews, 1990) have demonstrated that the attention of trait-anxious and clinically anxious subjects is allocated preferentially and automatically to words that evoke physical danger or social threat. Within the present framework, such words may engender a motivational state in trait-anxious subjects while leaving low-anxious subjects relatively unaffected. In Experiment 1, we selected subjects with high, moderate, or low levels of trait anxiety using the State–Trait Anxiety Inventory (STAI, Spielberger, Gorsuch, & Lushene, 1970),[1] and motivationally significant cues were chosen from the lists of "physically threatening" and "socially threatening" words used by MacLeod, Matthews, and Tata (1986). Control words were selected from the "nonthreat" nouns used by Matthews and MacLeod (1986).

In comparison with low-anxious subjects, we predicted that high-anxious subjects would respond more quickly when character strings were presented in the dominant, central location and more slowly when strings were presented in the nondominant, peripheral locations, particularly on trials initiated by motivationally significant warning stimuli.

Method

Subjects. Subjects were 74 male[2] undergraduate students recruited from introductory psychology classes at the University of Wisconsin—Madison. Subjects volunteered to participate in this study to gain experience and earn extra credit points. Alternative methods for earning extra credit points were made available to all students. Using the Trait form of the STAI and cutoff scores of 44 and 35, subjects were divided into approximate thirds. There were 25 high-anxious, 25 moderate-anxious, and 24 low-anxious subjects. However, seven high-anxious, three moderate-anxious, and six low-anxious subjects had to be eliminated because of missing data.[3]

[1] In prior research, we typically have regarded neurotic introverts as anxious and neurotic extraverts as impulsive. Because a primary goal of this study was to extend the generality of our findings regarding the range of motivational cues that affect performance, we used the STAI. This procedure enabled us to use verbal threat cues as opposed to the monetary punishments that we have used in past research. The trait form of the inventory was used because it is most relevant for predicting stable stimulus sensitivities. Although repeated presentations of threat stimuli might be expected to increase state anxiety, pilot work indicated that the effects did not appear to carry over from trial to trial. Thus, it did not seem relevant to assess state anxiety.

[2] Because pilot work with related paradigms yielded complex interactions with sex of subject and sex of experimenter, we elected to hold both variables constant by using a male experimenter (Patric W. Mattek) and male subjects. Although this strategy limits the generalizability of our findings, similar findings were obtained using female subjects (see Experiments 2 and 3).

[3] To establish a dominant attentional response set, imperative stimuli were presented in the central location on 75% of the trials. Moreover, physical threat and social threat warning stimuli occurred on only 25% of the trials, independent of imperative stimulus location. Thus, the number of trials in which a peripheral imperative stimulus followed a particular motivationally significant warning stimulus in each block of trials was quite small. Subjects were eliminated by the BMDP analysis of variance (ANOVA) program whenever they were

Procedure. Subjects completed a small battery of personality questionnaires that included the STAI before they were conducted to a laboratory room where they were tested individually. Subjects were seated in front of a computer monitor and response box with four response keys mounted on the top side. The presentation of stimuli and recording of responses were controlled by personal-computer-based, Micro-Experimental Laboratory software (MEL; Schneider, 1988). Although MEL is capable of millisecond accuracy, the monochrome monitors and video cards used in these studies introduced nonsystematic error averaging approximately 8 ms. No special procedure was used to control the distance between subjects and the visual stimuli.

Task instructions were displayed on the monitor. Only two of the four response keys were used. Subjects were instructed to place their left index finger on the first, leftmost button and their right index finger on the fourth, rightmost button. The task consisted of four blocks of 50 trials: a practice block and three blocks of test trials. During the test trials, a word appeared in brackets in the middle of the screen for either 250 or 1000 ms, depending on a subject's condition. We used two stimulus durations because we were uncertain about the time course of subjects' reactions to motivationally significant stimuli. These warning stimuli, which signaled the beginning of a trial, were of three types: physical threat words (*fatal, injury, hazard,* or *violence*), social threat words (*criticized, failure, foolish,* or *ridiculed*), and nonthreatening, safety words (*security, sanctuary, refuge, greetings, friend, welcome, safety,* or *harmony*). As noted above, these words represent a subset of the words used by MacLeod et al. (1986) in their study of anxiety.

Immediately after the warning stimulus, a character string of 5 letters or 5 numbers appeared for 2000 ms. For each trial, the string type (i.e., number or letter) and string composition (i.e., which letters and numbers) were determined using MEL's randomization procedures. Strings appeared either in the center of the screen or peripherally. Using quasirandomization procedures, approximately 75% of the strings were displayed in the center of the screen and 25% were displayed in the peripheral locations. The high probability of centrally located strings was intended to establish a dominant attentional set. On average, each block of 50 test trials contained 12.5 physical threat, 12.5 social threat, and 25 nonthreat warning stimuli.

Warning stimuli always appeared in the center of the monitor. Centrally located character strings appeared either one line (.40 cm) above or one line (.40 cm) below the warning stimuli. Peripheral character strings were centered on one of the four corners of an invisible rectangle that measured 12.06 cm high and 13.65 cm wide. The actual characters were .40 cm high and .24 cm wide.

The subjects' task was to determine the string type and press the corresponding button to indicate whether the string was comprised of letters or numbers. Subjects were advised to respond as quickly and as accurately as possible. The dependent measure was response time. Subjects received a 1000-ms feedback display (i.e., the word *correct* or *incorrect*) after every response, and if they were correct, their response time was displayed for an additional 1000 ms.

Practice trials were identical to test trials except for the warning stimuli. Warning stimuli in the practice phase involved eight neutral words (*company, kitchen, finger, coat, exercise, paragraph, shoulder,* and *community*) selected from the word frequency list of Carroll, Davies, and Richman (1971).

Results and Discussion

Preliminary analyses indicated that the condition effect (duration of warning stimulus) was relatively unimportant (all $ps > .10$), and this factor was dropped from subsequent analyses. Data were analyzed using a $3 \times 3 \times 2 \times 3$ mixed model analysis of variance (ANOVA). The between-subjects variable was level of anxiety (high, moderate, or low) and the within-subjects factors included type of warning stimulus (physical threat, social threat, or nonthreat/safety), location of the target stimulus (central or peripheral), and the three trial blocks.

Planned comparisons for this experiment as well as all others presented in this report are based on performance during the first block of trials, because pilot work indicated that group differences generally disappeared by the second block of trials. All statistical tests were two-tailed and were done using error terms derived from the overall ANOVAs.

Planned comparisons were conducted to test the hypothesis that high-anxious subjects would respond to the centrally located imperative stimuli more quickly than low-anxious subjects when the stimuli were preceded by a threat stimulus. As shown in Figure 1, high-anxious subjects responded 14 ms faster following the physical threat than following the nonthreat words, whereas low-anxious subjects responded 18 ms faster. For the social threat versus nonthreat comparison, the high-anxious group was 13 ms slower and the low-anxious group was 1 ms slower following the social threat words. Neither difference approached statistical significance, $ts(34) < 1.0$.

Planned comparisons were also used to test the hypothesis that high-anxious subjects would respond to the peripherally presented imperative stimulus more slowly than low-anxious subjects when the stimuli were preceded by a threat stimulus. High-anxious subjects responded 51 ms slower following the physical threat than following the nonthreat words, whereas low-anxious subjects responded 22 ms faster. This difference was significant at the .025 level, $t(34) = 2.42$. For the social

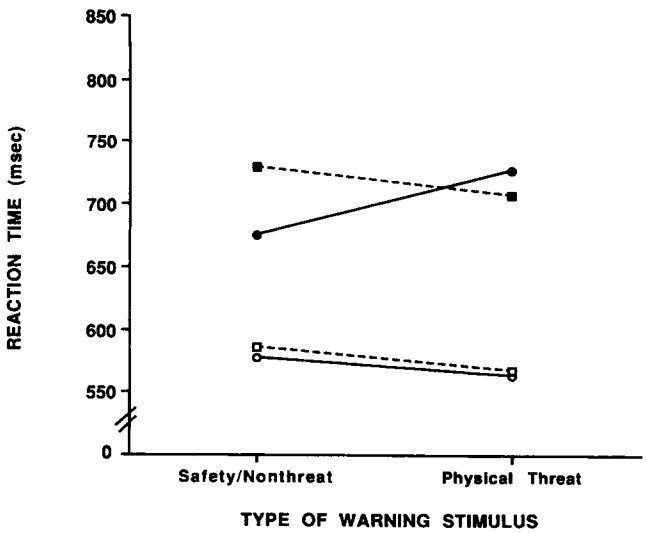

Figure 1. Mean reaction time as a function of group and type of warning stimulus. (Solid symbols represent data for peripheral imperative stimuli, and open symbols represent data for central imperative stimuli.)

missing data in any cell of the design. Consequently, even small variation in the randomization procedures or number of correct responses could result in missing data.

threat versus nonthreat comparison, high-anxious subjects responded 6 ms slower, whereas the low-anxious subjects responded 26 ms faster following the social threat words. The group means were not significantly different, $t(34) = 1.07$.

Although we made no prediction for moderate-anxious subjects, similar analyses are reported for comparison purposes. Moderate-anxious subjects ($M = 58$ ms slower) responded significantly more slowly than low-anxious subjects ($M = 22$ ms faster) following the physical threat stimuli, $t(38) = 2.86$, $p < .01$. In addition, they ($M = 39$ ms slower) responded significantly more slowly than low-anxious subjects ($M = 26$ ms faster) following social threat stimuli, $t(38) = 2.32$, $p < .05$. None of the analyses for centrally located stimuli approached statistical significance.

Experiment 1 provided partial support for our hypotheses: Relative to low-anxious subjects, high-anxious subjects were significantly slower to respond to information presented in the nondominant locations on trials involving the motivationally significant stimuli. However, there was no evidence that motivationally significant cues facilitated expression of the dominant response set. In addition, comparisons involving the high- and low-anxious groups revealed that the interference effect for the processing of nondominant information was specific to the physical threat condition.

It is difficult to interpret the absence of group differences on trials involving social threat words. One possibility is that high-anxious subjects in this study were differentially sensitive to physical but not to social threats. This speculation appears at odds with Spielberger's (1972) conclusion that trait-anxious subjects are more reactive to social threats than to physical threats, but is consistent with findings obtained by Eysenck and Byrne (1992) using a similar procedure. Indeed, the nomothetic approach, whereby investigators make general predictions about the characteristics of an entire group of subjects, has been criticized for its lack of specificity (e.g., Strauman, 1989). Without a more specific assessment of each subject's stimulus sensitivity, uncertainty necessarily exists regarding the motivational significance of the cues used. An alternative approach involves the use of idiographic assessments to select priming stimuli. Such procedures, by virtue of matching priming stimuli to the specific concerns of a given individual, appear to be especially powerful as well as specific (see, for example, Strauman, 1990, 1992).

Experiment 2

In Experiment 2, we used an idiographic approach to generating stimuli that would trigger or "prime" personal conflicts. The idiographic assessments and priming procedures used in this study were based on self-discrepancy theory (Higgins, 1987). The theory postulates that there are several basic domains of the self including (a) *actual* self—those qualities a person believes she or he actually possesses; (b) *ideal* self—those qualities that a person would like to possess or significant others ideally would like her or him to possess; and (c) *ought* self—those attributes a person or significant others believe it is her or his responsibility to possess. Self-discrepancy theory proposes that individuals are motivated to reduce any discrepancy between their actual self (self-concept) and their ought self or ideal self (self-guides). In other words, self-discrepancy theory implies that differences between who you believe you are and who you think you ought to be or ideally should be are motivating. These discrepancies induce motivational states and elicit emotions because of their implications for use in self-evaluation (see also Carver & Scheier, 1990).

In addition, Strauman and Higgins (1987) found that mismatches or discrepancies between a self-concept and a self-guide can be activated automatically (i.e., without an individual's awareness) using contextual priming. Moreover, the type of emotional discomfort experienced depends on the type of discrepancy that is activated. In particular, and of importance to the current research, priming an individual's actual:ought (AO) discrepancy has been shown to increase agitation-related emotions and to be associated with trait anxiety. This has been demonstrated by behavioral indicators such as an increase in writing speed (Higgins, Bond, Klein, & Strauman, 1986, Study 1) and has also been indicated by self-reports of increased tension and nervousness, increased autonomic arousal (as measured by skin conductance), and increased speed and duration of verbalization (Strauman, 1989; Strauman & Higgins, 1987).

Our assessments yielded two groups of subjects: those with relatively large AO discrepancies and those with no AO discrepancies. In addition, we used two priming conditions. In the *relevant* condition, subjects received words designed to prime their self-discrepancies on 25% of the trials; or, if they were in the no-discrepancy group, to prime the *match*, or congruence, between their actual and ought selves. In the *yoked control* condition, subjects received words that had relevance for another subject in the study but that had no personal meaning for that subject.

As in Experiment 1, we predicted that the presentation of motivationally significant stimuli would enhance response speed to centrally presented stimuli and interfere with processing of peripherally presented stimuli. Thus, relative to high-discrepancy subjects in the yoked condition, we predicted that high-discrepancy subjects in the relevant condition would respond more slowly to peripherally located stimuli and more quickly to centrally located stimuli following motivationally significant words. Although subjects in the yoked condition were also characterized by large self-discrepancies, the words used as primes were selected to have no particular significance for the subject, and so the type of warning stimulus was not expected to affect performance.

Our predictions for the no-discrepancy groups were somewhat more complex. Because these subjects believed that their self-concepts and self-guides matched (i.e., AO congruence), the relevant adjectives do not activate self-discrepancies and, therefore, cannot be expected to have the same degree of motivational significance that they have for high-discrepancy subjects. Nevertheless, these words were described by these subjects as self-guides and thus may be presumed to have personal significance for them. Thus, analyses comparing the performance of nondiscrepant subjects in the relevant condition with that of nondiscrepant subjects in the yoked condition were considered exploratory.

Method

Subjects. Subjects were recruited from an upper level undergraduate psychology course at the University of Wisconsin—Madison.

The Selves Questionnaire (Higgins et al., 1986) asks subjects to list attributes that they feel they have and attributes that they believe that they ought to have or ideally would like to have. Using the questionnaire responses, it is possible to identify AO discrepancies. For example, individuals may describe themselves as shy but believe that they ought to be outgoing. These attributes are antonyms and represent a discrepancy between their self-concept and their ought self-standard. According to Higgins (1987), agitation-related emotions can be induced by presenting subjects with the positively valenced self-standard attribute involved in the AO discrepancy. In this example, the positive attribute would be the ought self-guide "outgoing."

The Selves Questionnaire was administered to the class approximately 1 month before the experimental session. Subjects were recruited for the study if their scores on the Selves Questionnaire revealed a strong AO discrepancy or no evidence of self-discrepancies in the AO or the actual:ideal domains. Of the 72 subjects recruited for the experiment, 55 agreed to participate and completed the experimental testing. Twenty-four of these subjects had strong AO discrepancies ($M = 4.6$), and 29 were in the nondiscrepant group ($M = -5.2$).[4] In addition to their group membership, subjects were randomly assigned to conditions. Thirteen discrepant subjects and 18 nondiscrepant subjects performed the task under conditions involving the presentation of self-relevant adjectives. The discrepant subjects in the relevant condition, for instance, received words that were expected to prime or activate their AO discrepancies. Eleven discrepant and 11 nondiscrepant subjects performed the task under conditions involving presentation of "yoked" adjectives (i.e., adjectives with specific relevance for subjects in the former condition). This quasi-yoking procedure has been used successfully by Strauman and Higgins (1987) and others to demonstrate that it is not the attribute itself, but its meaning for the individual, that is responsible for priming effects. Data from two nondiscrepant subjects were omitted because of missing data.

Procedure. Subjects were contacted by telephone and scheduled for individual testing. They were seated in front of a computer monitor and keyboard and asked to read the instructions on the monitor. They were then instructed to place one index finger on each of the two response keys. The keys were the lower left (i.e., z) and the lower right (i.e., ?/) keys of the keyboard. Both keys had been replaced with caps labeled *L* and *N* for ease of designation (i.e., L for letters and N for numbers). In addition, both keys were raised slightly above the other keyboard keys.

The task consisted of 180 trials. During each trial, a word appeared in brackets in the middle of the screen for 1000 ms. This warning stimulus was either a word that had been listed as a self-relevant adjective by one of the subjects (i.e., assumed to have affective–motivational significance for particular subjects) or a word with no apparent affective significance (i.e., neutral word) selected from a word frequency list (Carroll et al., 1971). The task used 16 warning stimuli in all: four self-relevant (or yoked control) adjectives specifically selected for each subject and 12 neutral words (nouns) that were the same for all subjects.

Immediately following the warning stimulus, a character string of 5 letters or 5 numbers appeared for 3000 ms. For each trial, the string type (i.e., number or letter) and specific composition (i.e., which letters and numbers) were determined by the computer program as in Experiment 1. As in Experiment 1, approximately 75% of the strings appeared in the center of the screen and 25% of the strings appeared in the peripheral locations to establish a dominant attentional set. In contrast to Experiment 1, there were three blocks of 60 trials, no practice trials, and character strings appeared in the center of the monitor rather than one line above or below the warning stimulus.

The subjects' task was to determine the string type and to press L for letters and N for numbers. All subjects were advised to respond as quickly and as accurately as possible. The dependent measure was response time. Subjects received feedback (i.e., the word *correct* or *incorrect*) after every response and, if they were correct, they were informed of their response time.

Results and Discussion

Data were analyzed using a $2 \times 2 \times 2 \times 3$ ANOVA with high versus no AO discrepancy being the between-subjects factor. Within-subjects factors included the location of imperative stimulus (central or peripheral), relevance of the warning stimulus (self-relevant prime or yoked stimulus), and trial block (three levels).

Planned comparisons were conducted to test the hypothesis that, in comparison with high-discrepancy subjects in the yoked condition, high-discrepancy subjects receiving relevant primes would respond more quickly to centrally located imperative stimuli that followed such primes than to those that followed neutral words. As in Experiment 1, only data from the first trial block were used in the planned comparisons. As shown in Figure 2, high-discrepancy subjects in the relevant condition responded 19 ms slower following primes than following neutral warning stimuli, whereas those in the yoked condition responded 27 ms slower. Thus, neither group responded more quickly following the warning stimuli designed to trigger self-discrepancies, and the groups did not differ in this regard, $t(22) < 1.0$.

Planned comparisons were also conducted to test the hypothesis that, in comparison with high-discrepancy subjects in the yoked condition, high-discrepancy subjects receiving relevant primes would respond more slowly to peripheral imperative stimuli that followed primes than to peripheral imperative stimuli that followed neutral words. In fact, high-discrepancy subjects in the relevant condition responded 104 ms slower following primes than following neutral stimuli, whereas those in the yoked condition responded 65 ms *faster* following the primes. This group difference was significant at the .001 level, $t(22) = 4.41$.

Similar comparisons were conducted using the two groups whose actual self-concept matched their self-guides. As noted above, these analyses were exploratory. For centrally presented imperative stimuli, subjects in the relevant condition responded 6 ms slower following the relevant warning stimuli than following neutral stimuli, whereas the yoked controls responded 4 ms faster. For peripherally presented imperative stimuli, subjects in the relevant condition responded 21 ms slower following the relevant warning stimuli than following neutral stimuli, whereas the yoked controls responded 8 ms faster. Neither group difference approached statistical significance, $ts(27) < 1.0$.

The results of Experiment 2 were similar to those of Experiment 1 in several respects. First, there was relatively strong support for the prediction that triggering self-relevant concerns would interfere with the processing of information presented in

[4] Volunteers were recruited for this study without regard to sex. Thirty-eight of the 53 subjects were female. Given the extremely small number of male subjects per cell, it seemed unwise to block on sex of subject. However, inspection of cell means suggests that the negative effect of relevant primes on the processing of peripheral stimuli was relatively specific to female subjects.

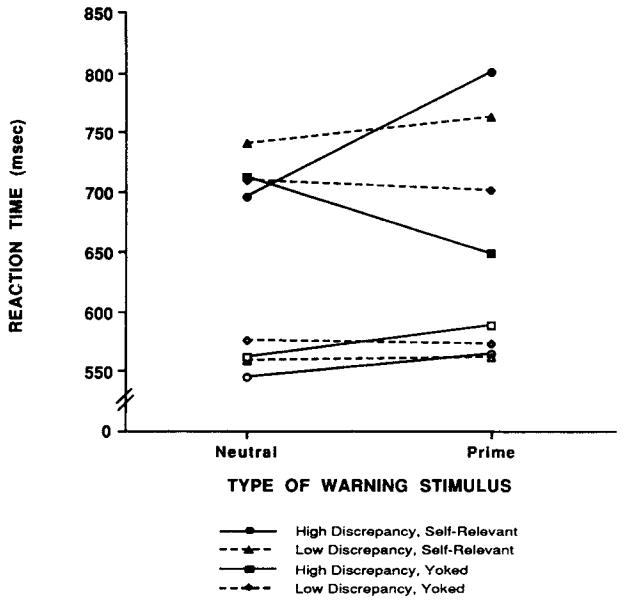

Figure 2. Mean reaction time as a function of group and type of warning stimulus. (Solid symbols represent data for peripheral imperative stimuli, and open symbols represent data for central imperative stimuli.)

the nondominant, peripheral location. Second, neither study provided evidence that such triggers facilitate processing or responding to imperative stimuli presented in the dominant location. Additionally, as predicted by Strauman and his colleagues, the idiographic approach used in Experiment 2, whereby the selection of triggers was based on their specific significance for each subject, seemed to yield clearer results than the nonspecific procedure used in Experiment 1.

Experiment 3

An important implication of our theorizing about interference effects is that situations that activate personal concerns or conflicts may impair a person's ability to self-regulate and generate adaptive responses in that situation. Whereas Experiments 1 and 2 provided evidence that motivationally significant cues interfere with processing of nondominant information, we did not assess whether subjects were behaving maladaptively outside of the lab. In Experiment 3, we report the results of a pilot study in which we examined task performance in subjects who were receiving treatment for their maladaptive reactions to particular motivationally significant cues. Specifically, we recruited subjects from an eating disorders clinic who were being treated because their excessive concerns about body weight and appearance were causing maladaptive behavior.

As in Experiments 1 and 2, we investigated subjects' response to motivationally significant cues. In this experiment, we selected cues with relevance to body weight and appearance. Although it would have been useful to determine specific triggers for each individual, as we did in Experiment 2, we were concerned that it would be unnecessarily intrusive for these clinic patients. Thus, we adopted the nomothetic approach for this preliminary study of psychopathological subjects. In addition to words selected to trigger concerns about body weight and appearance, an additional set of words was selected to assess reactivity to emotionally charged stimuli that were unrelated to body concerns.

We predicted that, in comparison with subjects who expressed relatively few concerns about body weight and appearance, subjects from the eating disorders clinic would respond more quickly to centrally presented words and more slowly to peripherally presented words following stimuli selected to trigger concerns about their body. The same predictions were made for a group of subjects who obtained high scores on a questionnaire assessing body weight and appearance concerns but who, to our knowledge, were not being treated for eating disorders.

Method

Subjects. The subject groups were comprised of (a) 11 women with clinically diagnosed eating disorders, (b) 17 undergraduate women obtaining high scores (in the top 20% of a screening sample) on the Body Shape Questionnaire (BSQ), and (c) 11 undergraduate women with low scores (bottom 20%) on the BSQ. The BSQ (Cooper, Taylor, Cooper, & Fairburn, 1987) assesses an individual's concerns about body shape and, in particular, the experience of "feeling fat." Cooper et al. (1987) reported that women with clinically diagnosed eating disorders scored significantly higher than community control subjects on the measure, supporting a relation between excessive concerns about body shape and vulnerability to pathological eating-related behaviors. The BSQ was used for two purposes. First, because concerns about body shape are common among female undergraduates, we wished to reduce the likelihood that our control subjects would be reactive to body-related words. Second, by testing subjects with high as well as low BSQ scores, we could attempt to replicate any group differences that emerged between eating disordered subjects and subjects with low BSQ scores using samples drawn from the same population (i.e., undergraduate students).

Subjects with eating disorders were recruited by posting an advertisement in the waiting room of the Eating Disorders Clinic. Nine of the 11 subjects had been assigned a diagnosis of bulimia nervosa, using the Diagnostic and Statistical Manual of Mental Disorders (3rd edition, revised; American Psychiatric Association, 1987), and two were classified as "eating disorder not otherwise specified" by clinical staff. Clinic subjects received $10 for their participation in the study. The other 25 subjects were recruited from a sample of 500 women who had completed the BSQ as part of a group-testing session involving the majority of students enrolled in introductory psychology. Undergraduate subjects received extra credit points toward their grade for participating in the study. The same female experimenter tested all subjects. Two eating-disordered subjects, one subject with a high BSQ score, and two subjects with low BSQ scores were eliminated because of missing data.

Procedure. The procedure was identical to that used in Experiment 2 with the exception of the warning stimuli used. All subjects received the same three sets of warning stimuli. The first set consisted of four words (*scale, shape, mirror,* and *figure*) likely to trigger body concerns in individuals with body shape concerns but not likely to trigger such concerns in women without significant concerns about their body weight and appearance. The second set consisted of four words (*sad, guilty, anxious,* and *angry*) selected for their general affective significance (see Strauman, 1990). The third set consisted of eight neutral words (*pattern, degree, order, glass, sky, cabinet, chair,* and *flower*) selected to match approximately the length of the affect and body concern words.

Results and Discussion

Data were analyzed using a 3 × 2 × 2 × 3 ANOVA with subject group (eating disordered subjects, subjects with high BSQ scores, and subjects with low BSQ scores) as the between-subjects factor. Within-subjects factors included the relevance of the warning stimulus (trigger or neutral), location of the imperative stimulus (central or peripheral), and trial block (3 levels). As in Experiment 1, all planned comparisons were based on data from the first trial block only.

Planned comparisons were conducted to test the hypothesis that, in comparison with subjects who had low BSQ scores, eating-disordered subjects would respond more quickly to centrally located imperative stimuli following words that triggered their body image concerns than following neutral words. As shown in Figure 3, neither group responded more quickly following the warning stimuli designed to trigger body image concerns: Eating-disordered subjects responded 25 ms slower than following neutral warning stimuli, whereas subjects with low BSQ scores responded 33 ms slower. This difference was not significant, $t(17) < 1.0$.

Planned comparisons were also conducted to test the hypothesis that, in comparison with subjects who had low BSQ scores, eating-disordered subjects would respond more slowly to peripheral imperative stimuli following words that triggered their body shape concerns than following neutral words. Results indicated that eating-disordered subjects responded 66 ms *slower* following triggers than following neutral stimuli, whereas those with low BSQ scores responded 21 ms *faster* following the triggers. This group difference was significant at the .05 level, $t(17) = 2.28$.

Planned comparisons were also conducted to examine responses to the affect words. For centrally presented imperative stimuli, eating-disordered subjects responded 8 ms faster following affect words than following neutral words, whereas subjects with low BSQ scores responded 24 ms slower, $t(17) < 1.0$. For peripherally presented imperative stimuli, clinic-referred subjects responded 45 ms slower following the general affect words than following the neutral words, whereas subjects with low BSQ scores responded 79 ms faster, $t(17) = 3.25$, $p < .01$.

Similar comparisons were also conducted contrasting the groups with high and low BSQ scores. First, we examined responses to the body-concern words. For centrally presented imperative stimuli, subjects with high BSQ scores responded 34 ms slower following the triggers than following neutral stimuli, whereas subjects with low BSQ scores responded 33 ms slower, $t(23) < 1.0$. For peripherally presented imperative stimuli, high-BSQ subjects responded 22 ms slower following the triggers than following neutral stimuli, whereas subjects with low BSQ scores responded 21 ms faster. This difference did not approach statistical significance, $t(23) = 1.27$.

For the affect words, subjects with high BSQ scores responded to centrally presented stimuli 18 ms slower than following neutral words, whereas subjects with low BSQ scores responded 24 ms slower, $t(23) < 1.0$. For peripherally presented imperative stimuli, subjects with high BSQ scores responded 2 ms slower following the general affect words than following the neutral words, whereas subjects with low BSQ scores responded 79 ms faster. This difference was significant at the .05 level, $t(23) = 2.39$.

As in Experiments 1 and 2, the results of Experiment 3 provided support for the hypothesis that subjects respond more slowly to peripheral stimuli on trials involving emotionally significant triggers. Moreover, Experiment 3 serves to extend this finding to subjects with clinically significant self-regulation problems. Although results for the groups with high and low BSQ scores were in the predicted direction, they were not statistically significant and, thus, failed to replicate results for clinic patients.

It is interesting that clinic-referred subjects and subjects with low BSQ scores also differed on trials involving the affect words. Inspection of the data suggests that the most likely explanation for this finding is that subjects with low BSQ scores, while unaffected by body concern triggers, reacted to the affect words with a readiness to respond to peripheral cues. That is, the significant group difference appears to reflect the faster response times of subjects with low BSQ scores following the affect words rather than any special sensitivity to affect words by eating-disordered or subjects with high BSQ scores. Given the likelihood that the body-concern words were regarded as neutral by subjects with low BSQ scores, it appears that the general affect words were relatively more salient for the control subjects.

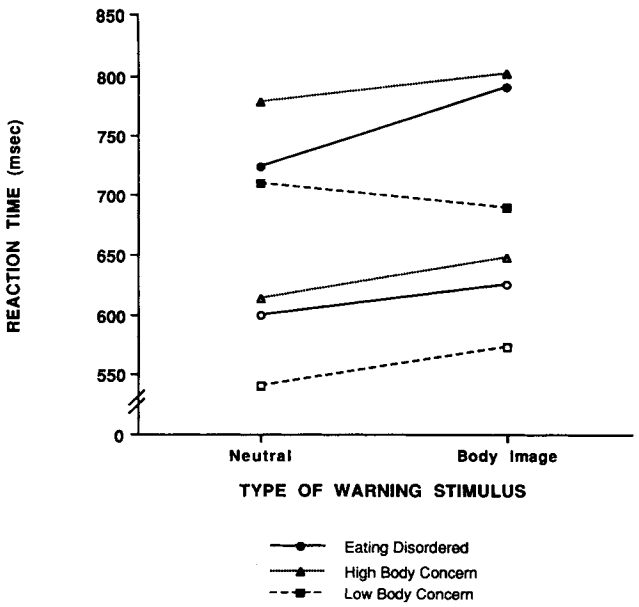

Figure 3. Mean reaction time as a function of group and type of warning stimulus. (Solid symbols represent data for peripheral imperative stimuli, and open symbols represent data for central imperative stimuli.)

Experiment 4

That the group differences in Experiment 3 related to affect as well as body concern triggers (i.e., lacked specificity) raises questions about the nature of the Person × Situation interactions observed in Experiments 1–3. To what extent do the interference effects obtained reflect the motivational significance of

specific triggers for high-anxious, high-AO-discrepant, and eating-disordered subjects as opposed to a more general propensity to display impaired performance following *any* unusual or distracting stimulus?

To explore this question, a fourth experiment was conducted that used high- and low-trait-anxious subjects and an unusual warning stimulus, which however, had no particular affective significance for anxious subjects. Specifically, the word *ready* initiated each trial, and a capital letter was used in place of the letters *e, a, d,* or *y* in a subset (33%) of trials (e.g., reaDy). On the one hand, if high-anxious subjects are simply more susceptible to distraction than low-anxious subjects, then the results of this study should parallel those for Experiments 1–3. On the other hand, the absence of group differences in this experiment would be consistent with our attributing the interference effects observed in Experiments 1–3 to subjects' specific stimulus sensitivities.

The purpose of this study was not to demonstrate that specific triggers are more disruptive than a general distractor. Indeed, the unusual warning stimulus used in this experiment was expected to impair performance overall. On the contrary, given a potent distractor stimulus, we wanted to assess the degree to which trait-anxious subjects were more susceptible than low-anxious subjects to the type of interference effects observed in Experiment 1.

Method

Subjects. Subjects were 57 female[5] undergraduate students, who were recruited as in Experiment 1. Using the same STAI cutoff scores used in Experiment 1, we identified 21 high-anxious, 18 moderate-anxious, and 18 low-anxious subjects. Four moderate-anxious subjects had to be eliminated because of missing data.

Procedure. With a few exceptions, the procedure was the same as that used in Experiment 1. Whereas the warning stimuli were displayed for either 250 or 1,000 ms in Experiment 1, the warning stimuli in Experiment 4 were displayed for 500 ms. On two thirds of the trials, the warning stimuli consisted of the word *ready.* On the remaining trials, the warning stimuli consisted of the word *ready* with one of its letters (*e, a, d,* or *y*) capitalized. MEL's randomization procedure was used to determine which trials contained the distracting warning stimulus and which letter was capitalized. During the practice block, all trials began with the standard warning stimulus (*ready*).

Results and Discussion

Data were analyzed using a $3 \times 2 \times 2 \times 3$ mixed-model ANOVA. The between-subjects variable was level of anxiety (high, moderate, or low). Within-subjects factors included location of the imperative stimulus (central or peripheral), type of warning stimulus (distractor or neutral), and trial block (three levels).

For centrally presented imperative stimuli, high-anxious subjects responded 57 ms slower following the distractor versus the neutral warning stimulus, whereas low-anxious subjects responded 31 ms slower. For peripherally presented stimuli, high-anxious subjects responded 55 ms slower following the distracting warning stimulus compared with the neutral warning stimulus, whereas low-anxious subjects responded 75 ms slower. Neither of these group differences approached statistical significance, $t(37) < 1.0$. Thus, in contrast to findings for the physical threat words in Experiment 1, there was virtually no evidence that the effect of a distracting warning stimulus on the processing of peripheral information was greater for high-anxious than for low-anxious subjects (Figure 4).

Although there were no a priori hypotheses concerning moderate-anxious subjects, similar analyses are reported for comparison purposes. For both centrally located (49 ms) and peripherally located (118 ms) stimuli, the moderate-anxious subjects responded more slowly following the distracting stimuli than following the standard warning stimulus. Neither of these differences was significantly greater than the differences observed in low-anxious subjects, $t(30) < 1.0$ for centrally located stimuli and $t(30) = 1.36$ for peripherally located stimuli.

Because the groups did not differ in response to the distracting warning stimulus, it is important to examine whether this stimulus was, in fact, distracting. The highly significant main effect for type of warning stimulus, $F(1, 50) = 23.06$, $p < .0001$, provides unambiguous evidence that the distracting warning stimulus did impair performance. In addition, even though we did not specify a priori hypotheses concerning within-subjects data, any within-group comparison of 39 ms or greater would be statistically significant in this study. Thus, the interference effects observed for both centrally and peripherally presented stimuli in all three groups would be considered statistically reliable, with the exception of the 32-ms difference found in low-anxious subjects responding to the centrally located imperative stimuli.

General Discussion

Taken together, the results of these studies provide consistent evidence that motivationally significant stimuli interfere with a subject's ability to process information presented in the peripheral, nondominant location. The results are equally consistent in their lack of support for the prediction that such stimuli facilitate processing of information presented in the central, dominant location.

The purpose of this investigation was to address the potential association between the situation-specific breakdowns in self-regulation displayed by particular personality and psychopathological groups (e.g., Newman, 1987; Wallace et al., 1991) and the information-processing consequences engendered by motivationally significant stimuli. Prior research demonstrates that cues corresponding to a person's stimulus sensitivities can interfere with the regulation of dominant motor responses (see Wallace et al., 1991). The current study extends this research in two ways: First, significant effects were found using three different Group (anxious, AO discrepant, or eating disordered) × Cue Type (threat, discrepancy prime, or body image) interactions to operationalize "stimulus sensitivity." Second, the results demonstrate that motivationally significant cues can affect a subject's ability to alter dominant attentional as well as dominant motor responses.

These findings are important because they suggest a process that may help to explain the perseveration of maladaptive be-

[5] As in Experiment 1, we elected to hold sex of subject and sex of experimenter constant. Because the experimenter (Katherine A. Elder) was female, we tested only female subjects.

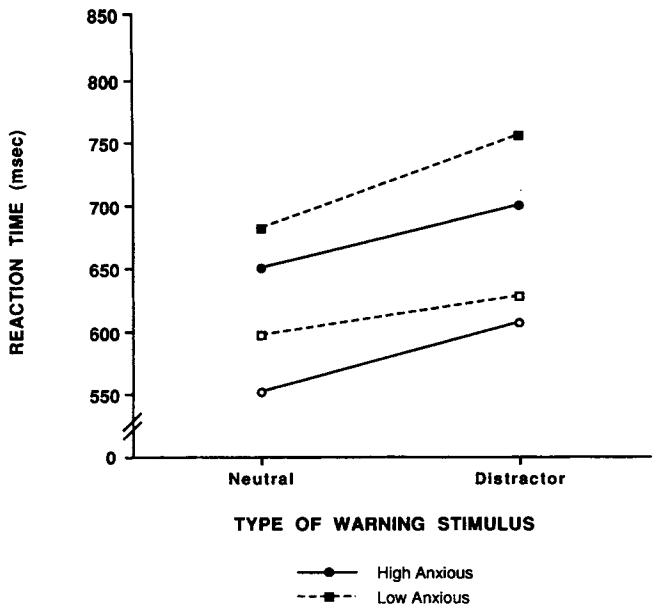

Figure 4. Mean reaction time as a function of group and type of warning stimulus. (Solid symbols represent data for peripheral imperative stimuli, and open symbols represent data for central imperative stimuli.)

havior. However, definitive statements regarding the mechanism by which motivationally significant stimuli disrupt regulation of dominant responses cannot yet be made. As noted in the introduction, our hypotheses were based on the assumption that motivationally significant cues would increase arousal and cause subjects to focus attention differentially on the dominant, central elements of our task at the expense of nondominant, peripheral elements. Easterbrook (1959) has proposed that when emotional arousal is high as a result of threatening or frustrating cues, the presence of other human beings, biological deprivation, incentives, or even a person's level of neuroticism, individuals tend to process a narrower range of informational cues. With regard to such motivational factors, Easterbrook noted that as they increased, "the range of cue utilization was reduced to central, to the exclusion of the peripheral, cues" (p. 184).

An alternative interpretation may be derived from Matthews and MacLeod's (1986; see also Matthews, 1990) findings that individuals with generalized anxiety disorder orient attention automatically to threatening stimuli. In an analogous manner, the motivationally significant cues used as warning stimuli in this study may have interfered with processing peripheral stimuli by attracting attention to the center of the visual display.

A third perspective involves the distinction between automatic and control processing. "Automatic processing is a fast, parallel, fairly effortless process that is not limited by short-term memory (STM) capacity, is not under direct subject control, and is responsible for the performance of well-developed skilled behaviors" (Schneider, Dumais, & Shiffrin, 1984, p. 1). On the other hand, "control processing is characterized as a slow, generally serial, effortful, capacity-limited, subject-regulated processing mode that must be used to deal with novel or inconsistent information" (Schneider et al., 1984, p. 2). Wallace and Newman (1992) have proposed that motivationally significant cues elicit brief, automatic shifts of attention, akin to orienting responses, that are proportional in strength to the significance of the eliciting stimulus. When such cues attract attention, they interfere with control processing because controlled processes are "limited-capacity processes *requiring* [italics added] attention" (Shiffrin & Schneider, 1977). Thus, motivationally significant cues effect a momentary reduction in a person's capacity for control processing which, in turn, necessitates enhanced reliance on automatic processing and causes habitual responses and cognitions to proceed without the benefit of critical evaluation.

It is generally accepted that people allocate attention to specific locations on the basis of the frequency with which significant events occur (e.g., Hockey, 1970). Thus, allocation of attention to the center of the video display in this investigation should have been relatively automatic because all of the warning stimuli and 75% of the imperative stimuli occurred at this location. By contrast, control processing would be expected to facilitate reallocation of attention from the central to the peripheral location. To the extent that motivationally significant cues compete with control processing for limited attentional resources, they would, therefore, interfere with processing of peripheral cues but have a negligible impact on the processing of centrally located stimuli.

These three interpretations of our findings are not mutually exclusive. Rather, they highlight different aspects of the association between motivation and information processing. It should be noted that this investigation was not designed to test hypotheses regarding the mechanism by which motivationally significant cues alter information processing. Our goal was to determine whether motivationally significant cues interfere with the regulation of dominant attentional responses so that we could establish their potential relevance for problems in self-regulation. Our findings are encouraging in this regard.

Although further research is needed to clarify the mechanism responsible for the information-processing consequences associated with motivationally significant cues, we wish to highlight two factors that commend the interpretation involving the breakdown of control processing: First, it provides a satisfying explanation for the combination of (a) impaired performance on the nondominant component of the task and (b) absence of significant effects for the dominant component of the task. Second, this framework has direct links to the literature on self-regulation. According to Kanfer and Gaelick (1986), self-regulation involves "a qualitatively different mode of cognitive functioning, called controlled processing" (p. 287). In light of the fact that self-regulation is required whenever "new behavior chains need to be learned, when choices among alternate responses need to be made, or when habitual response sequences are interrupted or ineffective" (p. 287), anything that reduces control processing is likely to impair a person's ability to evaluate and modify "overlearned" (i.e., automatic) responses.[6]

[6] For the purposes of this article, we have ignored the possibility that different types of motivationally significant cues could exert different effects on the regulation of attention. Our working assumption is that

To this point, our discussion has focused on Experiments 1–3, but Experiment 4 also warrants consideration. Experiment 4 provides important information regarding the specificity of the findings obtained in Experiments 1–3. In contrast to the physical threat words used in Experiment 1, the distractor stimuli used in Experiment 4 failed to differentiate the performance of high- and low-anxious subjects even though the distractors resulted in significantly poorer performance overall (i.e., across groups). This finding indicates that high-anxious subjects are not more distractible in general and supports our view that the significant Group × Stimulus Type interaction contrasts observed in Experiments 1–3 reflect the disruptive effects of priming individuals' particular stimulus sensitivities. In this regard, our results closely resemble those reported by Eysenck and Byrne (1992).

The current studies have several limitations that require discussion. First, the information processing consequences of motivationally significant cues were, for the most part, limited to the first block of trials. In line with our interpretation of the interference effects, we assume that the automatic attention response elicited by motivationally significant stimuli habituated with repeated exposure just as orienting responses are found to habituate with repeated exposure. We would expect the effect of these cues on performance to be less ephemeral in more natural settings where they are encountered less regularly, where the cues reflect actual events as opposed to words, and where they may convey potentially relevant information.

In addition, it is important to note specific limitations that characterized each of the studies reported. The results of Experiment 1 provided evidence of impaired information processing following physical threat cues but not following social threat words. As noted earlier, this difficulty highlights the importance of conducting specific assessments to ensure that the triggers used are, in fact, motivationally significant. In general, research using this design should include manipulation checks so that the significance of the priming stimuli may be assessed independently of their effects on performance. A minor difficulty with the design of Experiment 2 involved the selection of the neutral warning stimuli. Whereas the relevant warning stimuli were all adjectives, the neutral stimuli were nouns. This aspect of the design probably explains the general tendency for subjects to react differently to relevant and neutral stimuli (see Figure 2).

Although Experiment 3 is especially worthwhile because it extends our findings to a clinical population, the strength of our conclusions are tempered by several limitations. First, the number of subjects per group is relatively small, especially for the eating-disordered group ($n = 9$). Second, although the experimental and control subjects were matched approximately for age and sex, the eating-disordered subjects were recruited from a clinic, whereas the control subjects were recruited from undergraduate psychology courses. Two additional factors accentuate this limitation: First, our experimenter could not be blind regarding subjects' group status. Although the experimenter was not in the room during behavioral testing, it is possible that her knowledge of group status had some effect on performance. Second, the high- and low-body-concern subjects, who were recruited from the same undergraduate population and who were compensated in the same manner, did not display the predicted differences in performance. Thus, even though the results for Experiment 3 closely parallel those for Experiments 1 and 2, this experiment must be regarded as preliminary and in need of replication.

Although small differences in procedure preclude a definitive statement, comparison of the results for Experiments 1–3 suggests that an idiographic approach to the study of motivationally significant stimuli provides a more powerful methodology for priming concerns than generic–nomothetic methods. Moreover, such manipulations would seem to have more in common with the type of Person × Situation interactions that disrupt self-regulation and engender behavior problems. Finally, beyond providing a method for studying such interactions, some variation of the procedures used in this investigation may prove useful for determining an individual's particular triggers. Such procedures might, in turn, facilitate the process of assessing and modifying a person's maladaptive response to motivationally significant triggers in clinical settings.

In summary, the results of this study provide evidence that motivationally significant cues do, indeed, interfere with the flexible allocation of attention to nondominant stimuli. Moreover, we have speculated that one effect of motivationally significant cues is to increase a person's reliance on automatic as opposed to control processing resources. As a result, there is a decrease in self-regulation and an increased tendency to emit dominant responses that may be prepotent by virtue of prior learning, the dictates of particular situations, or biologically based individual differences. Clearly, the results of this investigation alone are not sufficient to support such speculation and we recognize that the applied significance of our proposal rests heavily on the generality of the phenomenon. Toward this end, we believe that it is essential to investigate the effects of motivationally significant cues on a variety of behaviors, especially those in which subjects are required to inhibit a dominant (i.e., prepotent or overlearned) response.

the attention-demanding component of a stimulus is dependent on its level of significance, regardless of how that significance has been acquired. Although particular stimuli (e.g., those associated with negative affect) may seem to be more disruptive than others, we presume that such effects reflect degree of stimulus significance or, alternatively, the type of automatic (i.e., unregulated) response elicited by the stimuli as opposed to qualitative differences in the attentional processes producing the dysregulation.

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