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Selective Attention in Dysphoric Individuals: The Role of Affective Interference and Inhibition

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The present study was designed to examine attentional functioning in dysphoric and nondysphoric individuals. A paradigm was used that permits an examination of processes involved in both affective interference and affective inhibition. While processing neutral stimuli, dysphoric participants exhibited both elevated interference and an inhibitory bias for negative, but not for positive, distractors. In contrast, nondysphoric participants did not demonstrate either interference for, or inhibition of, positive or negative distractors. Moreover, across all participants, level of interference was related to level of inhibition. Implications of these results for understanding the processing of emotional information in dysphoria and depression are discussed and directions for future research are advanced.

KEY WORDS: depression; dysphoria; attention; inhibition; interference; information processing.

Over the past two decades, there has been a steady increase in the number of investigations designed to examine the attentional functioning of depressed and dysphoric individuals (e.g., Gotlib & Cane, 1987; Mathews, Ridgeway, & Williamson, 1996; Mogg, Bradley, & Williams, 1995). Cognitive theories of depression postulate that depressed and dysphoric individuals are characterized by cognitive biases in attentional functioning that serve to facilitate the processing of negatively valenced information (Beck, 1976; Bower, 1981). Empirical support for this formulation comes primarily from attentional interference tasks, in which participants are asked to respond to a target stimulus in the presence of an emotional distractor. For example, in the dichotic listening task, participants are required to shadow, or repeat, neutral words presented to one ear while ignoring emotional words that are presented simultaneously to the other ear. Participants with a history of depressive episodes have been found to be characterized by biased processing of negative

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information on this task after a negative mood has been induced (Ingram, Bernet, & McLaughlin, 1994). In addition, depressed participants have been found to exhibit interference on a secondary task from negative but not positive distractors, indicating an inability to disattend from the negative stimuli (McCabe & Gotlib, 1993). Conceptually similar results have also been obtained on the emotion Stroop task, in which depressed participants have been found to be slower to name the ink colors of negative-content than of positive- or neutral-content words (e.g., Gotlib & Cane, 1987; Gotlib & McCann, 1984).

Based on the results of these studies, therefore, it appears that depressed and dysphoric individuals are characterized by interference and impaired performance on tasks in which they must try to ignore emotional aspects of the stimulus display in order to process neutral aspects of the stimuli. In contrast, depressed and dysphoric individuals do not demonstrate impaired performance on tasks in which participants are asked explicitly to attend to emotional aspects of the stimuli. For example, Siegle, Ingram, and Matt (2002) compared dysphoric participants' reaction times on an affective evaluation task with their response latencies on an affective lexical decision task. They found that dysphoric participants were relatively slow to identify both the emotional valence of positive words and the nonemotional aspects of negative information, but were quick to identify the emotional valence of negative words. Siegle et al. formulated an "affective interference" hypothesis to explain this pattern of findings. Essentially, they contend that dysphoric individuals attend to the emotional content of negative information at the expense of attending to other aspects of the stimuli. Thus, dysphoric participants should demonstrate negative affective interference effects on tasks in which they are required to attend to nonemotional aspects of the stimuli, whereas nondysphoric participants should show no interference at all. Moreover, dysphoric participants should also show facilitation on tasks that require them to attend to the emotional valence of a negative word.

Although the results of several studies are consistent with the affective interference hypothesis, investigators in this area often use tasks that do not permit unambiguous interpretation of their findings. This is particularly true of the emotion Stroop task. While there has certainly been empirical support for the prediction of increased interference from negative words among both depressed and dysphoric individuals (e.g., Gotlib & McCann, 1984; Williams & Nulty, 1986), several researchers have failed to replicate these findings (e.g., Mogg, Bradley, Williams, & Mathews, 1993; Pratto & John, 1991). It is important to recognize, however, that results obtained using the emotion Stroop task are open to both attentional and nonattentional explanations. For example, this task has been criticized as a measure of selective attention because its outcome measure of reaction time confounds stimulus actors with response factors (e.g., Gotlib, McLachlan, & Katz, 1988; MacLeod, Mathews, & Tata, 1986). That is, it is virtually impossible to determine whether group differences in interference are due to differences in input processes (i.e., encoding; Seymour, 1977), output processes (i.e., response production; Duncan-Johnson & Kopell, 1981), or both (e.g., Stirling, 1979). These are clearly critical distinctions. For example, if group differences in interference on the emotion Stroop task are actually due to biases in output rather than in input, this task would

not be providing clear information concerning group differences in attentional processing.

Another difficulty with the emotion Stroop task concerns the validity of the model of attention that underlies its use. The interpretation of slowed reaction times on this task as interference is based on theories that conceptualize selective attention as a single, excitatory process (e.g., Kahneman & Treisman, 1984; van der Heijden, 1992). It is important to note, however, that interference is closely related to another process in selective attention that has long been ignored in depression research: inhibition. Cognitive theorists have recently began to conceptualize attention as involving two distinct processes: excitation and inhibition (e.g., Houghton & Tipper, 1994; Neumann & DeSchepper, 1992). According to this view, efficient selection is achieved not only by enhancing the availability of selected information, but also by suppressing, or inhibiting, irrelevant or to-be-ignored information. As would be expected, this dual process serves to facilitate responses to selected information and to slow responses to irrelevant information (e.g., Beech, Powell, McWilliam, & Claridge, 1989; Milliken, Tipper, & Weaver, 1994; Neill, Valdes, & Terry, 1995; Neumann, 1987; Tipper, 1985, 1991, 2001). These theorists suggest that the more interference a distractor causes, the more it has to be inhibited. Inhibition, therefore, is conceptualized as being responsive to interference, and one would expect a positive association between interference and inhibition. Indeed, research manipulating the level of activation of the distractor stimulus in a negative priming (i.e., inhibition) task supports this positive relation between the level of activation of the to-be-ignored stimulus and the magnitude of inhibition (Malley & Strayer, 1995), resulting in positive correlations between measures of interference and measures of inhibition.

Interestingly, inhibitory processes have rarely been studied in depression and dysphoria. As we noted earlier, most experimental tasks that have been used in research on selective attention in depression, such as the emotion Stroop task, do not permit a separation of the different processes involved in attention. Moreover, as suggested by Siegle et al. (2002) it is important to differentiate studies that require participants to focus on the emotional aspects of the stimuli and studies that require participants to focus on the nonemotional aspects while they ignore distracting emotional information. In one of the first studies to examine inhibitory processes in depression, Linville (1996) reported that depressed participants showed diminished inhibitory ability. Linville did not differentiate, however, between inhibition for negative stimuli and inhibition for positive stimuli. More recently, Joormann (2004) found that dysphoric individuals exhibited difficulty inhibiting negative but not positive distractor stimuli when the task required participants to attend to the emotional content of the target and distractor words (participants were required to make valence and self-reference judgments of the stimuli). In contrast, nondysphoric participants demonstrated inhibition for both positive and negative distractors. These results suggest that dysphoric participants exhibit deficits in their inhibitory functioning when they are asked to respond to emotional aspects of the stimuli. The affective interference hypothesis, however, posits that on a task that requires the semantic processing of a neutral target in the presence of affective distractors, depressed participants should exhibit both interference and inhibition

for negative distractors. To date, no study has examined interference and inhibition effects in a task that requires participants to focus on nonemotional aspects of the stimuli.

The present study was designed to examine the associations among dysphoria, attentional interference, and inhibitory processes using a task that required participants to attend to nonemotional aspects of stimuli in the presence of emotional distractors. Three main issues were examined in this study. The first issue concerned dysphoria-associated differences in interference caused by negative distractors and positive distractors when participants are processing neutral words. Based on cognitive theories of depression (Beck, 1976; Bower, 1981) and on the results obtained by Siegle et al. (2002), we predicted that, in contrast to nondysphoric participants, dysphoric participants would exhibit significantly more interference when processing neutral stimuli in the presence of negative, but not positive, distractors. Second, based on this hypothesized dysphoria-associated interference from the negative distractor words, we predicted further that the dysphoric participants would show significantly more inhibition of the negative distractors when required to respond to nonemotional aspects of the stimuli. Finally, we examined whether the interference caused by the presence of a negative distractor is related to the subsequent inhibition of the distractor. As we noted earlier, theorists have suggested that inhibition is responsive to interference. Therefore, we hypothesized that, across our sample, interference and inhibition would be positively correlated.

METHOD

Overview

Dysphoric and nondysphoric individuals participated in an information-processing task designed to examine attentional interference and inhibition with respect to emotionally valenced distractors. Briefly, participants were presented with a series of trials, each consisting of two consecutive displays. Each display contained a target word and a distractor word, one above the other, one in red ink and the other in green ink. For each display, participants were required to name the target (e.g., the word in red) and ignore the distractor (e.g., the word in green). On *interference* trials within this task, an emotionally valenced word is presented as a distractor in the first display, with unrelated neutral words being presented as the target in the first display, and as the target and the distractor in the second display. Thus, on the first display of interference trials, participants were required to name aloud a neutral word while ignoring an emotional word. In contrast, on *inhibition* trials, an emotionally valenced distractor stimulus in the first display also appeared as the target stimulus in the second display. Unrelated neutral stimuli were presented in the remaining positions of these two displays. Thus, on the second display of these inhibition trials, participants were required to name aloud a target stimulus that they had just attempted to ignore (i.e., inhibit) on the first display. Reaction times were recorded for all responses.

Participants

Participants were 36 undergraduate students recruited from the Introductory Psychology subject pool at a major university. In exchange for their participation, students received partial credit toward fulfillment of a course requirement. Participants' scores on the Inventory to Diagnose Depression (Zimmerman, Coryell, Corenthal, & Wilson, 1986) at an initial screening session provided selection information. This instrument was used to measure dysphoria, and to classify participants into dysphoric and nondysphoric groups. Finally, all participants had normal or corrected-to-normal vision, were not color blind, reported no learning or reading disabilities, and spoke English as their primary language. The final sample included 18 currently dysphoric and 18 nondysphoric participants.

Measures

Dysphoria

The Inventory to Diagnose Depression (IDD; Zimmerman et al., 1986) is a self-report scale composed of 22 groups of 5 statements each. We used both the IDD, which assesses the presence of depressive symptoms within the past week, and the IDD-L, which assesses the presence of depressive symptoms within the week that participants identify as the worst week of their lives in terms of feeling depressed. Each statement group corresponds to one depressive symptom (e.g., dysphoria, reduced energy, psychomotor acceleration or retardation, loss of interest in usually pleasurable activities, etc.). Within each statement group, respondents are asked to choose the statement that best describes how they have felt during the last week. The statements are numbered from 0 to 4, reflecting increasing severity of the specific symptom. If the respondent endorses a statement, then s/he is asked to answer a second, dichotomous, question about that item, indicating whether the duration of the symptom was more or less than 2 weeks. Only if participants endorse statements with an assigned number of 2 or more are they counted as a symptom. Symptom endorsement and duration of symptoms are combined according to DSM-criteria to give a self-reported diagnosis of depression (conservatively referred to as dysphoria in the present paper). The scoring procedure recommended by Zimmerman et al. conforms to a DSM-IV (American Psychiatric Association, 1994) diagnosis of Major Depressive Disorder (MDD). Participants were classified as dysphoric if they met DSM-criteria for MDD in their self-reported severity and duration ratings of the symptoms within the past week, and as nondysphoric if they did not meet criteria either in the past week or in the worst week in their life. This conservative approach to defining a nondysphoric group was chosen to compensate for the arbitrary time frame of the past week used in the IDD.

Apparatus and Stimulus Materials

Potential stimuli were selected from previous studies examining cognitive functioning and the relation between cognition and emotion (e.g., Ashcraft, 1978; Bradley & Mathews, 1983; Gibson & Watkins, 1988; Gotlib & McCann, 1984;

Guttentag, Haith, Goodman, & Hauch, 1984; Mathews, Mogg, May, & Eysenck, 1989; Mathews, Richards, & Eysenck, 1989; Richards & French, 1991; Teasdale & Russell, 1983). These stimuli were compiled into a single list and were selected for inclusion in this study on the basis of independent ratings provided by three graduate students in clinical psychology. These students rated on a 5-point scale how relevant each word was to negative and positive mood. Words were selected as negatively valenced if all three judges rated them as 3 or higher for relevance to negative mood and as less than 3 for relevance to positive mood. Words were selected as positively valenced if all three judges rated them as 3 or higher for relevance for positive mood and as less than 3 for relevance to negative mood. Words were selected as neutral if all three judges gave ratings of less than 2 for relevance to both positive and negative mood. Words were then eliminated if they: 1) had frequencies of usage less than 10, or greater than 50, per 1,000,000 words (Dahl, 1979); 2) had more than two syllables; or 3) had fewer than four, or more than seven, letters. From this elimination procedure, an average of six words remained for each experimental condition and 30 words remained for the control condition. To equalize the number of adjectives and nouns used in each condition, the final words were chosen based on their parts of speech. The final stimuli for the paradigm were 8 experimental and 24 control words. The experimental stimuli consisted of 4 negatively-valenced and 4 positively-valenced words. The control stimuli consisted of two sets of 12 uncategorized neutral words. The words used in each of the Word Type conditions (see below) are presented in Table I.

Design

The design of this study was one between-subjects factor (Group: dysphoric, nondysphoric) and two within-subject factors (Trial Type: interference, interference control, inhibition, inhibition control; Word Type: negatively valenced, positively valenced). As noted above, each trial consisted of two consecutive presentations

Table I. Experimental Stimuli as a Function of Word Type Condition and Valence

Word-type condition			
Negative		Positive	
Valenced	Neutral	Valenced	Neutral
Hate	Brief	Calm	Cycle
Lonely	Central	Loved	Discuss
Upset	Daily	Merry	Fasten
Useless	Detail	Pleased	Gather
	Gravel		Inland
	Inner		Local
	Maple		Native
	Park		Pencil
	Shaped		Sandy
	Shelf		Settle
	Shift		Towards
	Steady		Trace

(i.e., displays) of pairs of words: a first, *prime*, display and a second, *probe*, display. Each display consisted of the simultaneous presentation of one target and one distractor word, one slightly above and one slightly below the central point of the computer screen. For roughly half of the participants the target word was presented in red and the distractor word in green, while for the remaining participants the target word was presented in green and the distractor word in red. Participants were instructed to name aloud the target words (i.e., either the red or the green words) and ignore the distractor words. Each participant was randomly assigned to one of the two color conditions.

Participants were presented with two blocks of 96 trials (a total of 384 displays). Each block represented one Word-Type condition (negatively valenced or positively valenced). Although participants received the same stimuli and the same order of stimuli within each block, two orders for the presentation of the blocks were randomly determined. Half of the participants received the negatively valenced block first and the other half received the positively valenced block first. The 96 trials within each block contained 24 instances of each of the following four Trial Types:

1. *Interference*. The prime display contained an emotionally valenced word in the distractor position and a neutral word in the target position. The probe display contained different neutral words in both the target and distractor positions.
2. *Interference Control*. Both the prime and probe displays contained different neutral words in both the distractor and target positions.
3. *Inhibition*. The prime display contained an emotionally valenced word in the distractor position and a neutral word in the target position. The probe display contained the same emotionally valenced word in the target position and a different neutral word in the distractor position.
4. *Inhibition Control*. The prime display consisted of neutral words in both the distractor and target positions. The probe display contained an emotionally valenced word in the target position and a different neutral word in the distractor position.

Examples of these Trial Types from each of the two Word-Type blocks are presented in Table II.

Each stimulus word appeared a total of 24 times in the experiment. Every experimental word appeared an equal number of times in each of the four possible functions and two possible positions. Every control word appeared an equal number of times in each of the 12 possible functions and two possible positions. Top-bottom positioning of the distractors and targets occurred equally and randomly across the Trial Type conditions and across the prime and probe displays. Within each block, the Trial Type conditions appeared pseudo-randomly, with the constraint that no Trial Type condition was presented more than three times consecutively. Finally, within each display, distractor and target word length did not differ by more than one letter, and the positioning of letters in the distractor word did not match the corresponding letters of the target word by more than one character.

Table II. Examples of Stimuli as a Function of Trial Type and Word-Type Conditions

	Word-type condition			
	Negative		Positive	
Trial type	Prime display	Probe display	Prime display	Probe display
Interference	MAPLE[a]	BRIEF	CALM	FASTEN[a]
	LONELY	PARK[a]	LOCAL[a]	TRACE
Interference control	CENTRAL[a]	STEADY[a]	SANDY	TOWARDS
	GRAVEL	SELECT	NATIVE[a]	PENCIL[a]
Inhibition	DETAIL[a]	SHAPED	INLAND[a]	LOVED[a]
	UPSET	UPSET[a]	LOVED	CYCLE
Inhibition control	DAILY	HATE[a]	GATHER[a]	DISCUSS
	INNER[a]	SHELF	SETTLE	PLEASED[a]

[a]Target stimulus.

Procedure

Participants completed the experiment individually in a well-lit room in a single session. At the beginning of the experiment, the experimenter informed the participants that the study would include a simple reading task designed to measure how well they could name words while distracted, and a few brief questionnaires that measure mood and thought processes. The experimenter then explained to the participants that there would not be any deception involved in the task and obtained their consent for participation.

The experimenter informed the participants of their color condition and explained to them that they should attend to, and read aloud, the words printed only in that color. Participants were told that the words printed in a different color were there to distract them and to make the task more difficult. The experimenter assured the participants that there would not be a memory test following the task. The experimenter informed the participants that their reading ability would be determined by measuring how quickly and accurately they could name each word. The experimenter explained that the microphone attached to their shirts would enable the computer to measure their speed, and that the experimenter would sit at the back of the room and monitor their accuracy. Participants were told that they would receive feedback from the computer about their response times after every two responses, and accuracy feedback at the end of the experiment. The experimenter instructed the participants to use the response-time feedback to maximize the speed and consistency of their responses, and to try to be as accurate as possible in their responses. The experimenter then told the participants that because the task was fairly long and could be tiring, they would receive one break during the experiment. The experimenter emphasized the importance of performing well throughout the task and encouraged participants to take time to refresh themselves during the respite.

Participants placed their chairs comfortably between 40 and 80 cm from the computer monitor. The visual angle subtended by the distance from the upper edge of the top word to the lower edge of the bottom word was between .46 and .84°; the horizontal visual angle was between .2 and .3°. Thus, both words were always

presented to the fovea visual area for all participants. The experimenter sat in a chair located approximately 6 feet behind the participant. Detailed instructions for completing the task were then presented on the computer, and four practice trials were administered that contained neutral unrelated words that were not used in the experimental task. After completion of these trials, instructions were presented on the computer directing the participants to ask the experimenter any questions before beginning the experimental task.

Experimental Task

At the start of each trial a "Ready?" signal appeared in the center of the computer screen. The signal remained on the screen until participants pressed the space bar on the keyboard. The computer paused for 1 s and then presented two white fixation crosses that appeared slightly above and below the center of the screen. After 250 ms, a red and a green word (the *prime* display) replaced the crosses. The words remained onscreen for 100 ms and then were each replaced by a mask. Each mask consisted of a string of white asterisks that remained on the screen for 100 ms. The masks were followed by a blank screen for 1500 ms while participants named the target word. The computer measured response latency, defined as the time from the onset of the words to the naming of the target. Response accuracy was assessed by the experimenter. One second after participants named the target word, a centered "Ready?" signal replaced the blank screen. The signal again remained on the screen until participants pressed the space bar. The computer then paused for 1 s and presented the two white fixation crosses that remained onscreen for 250 ms. A red and green word (the *probe* display) replaced the fixation crosses and remained onscreen for 100 ms. Two masks then replaced the word stimuli and remained onscreen for 100 ms. The masks were followed by a blank screen for 1500 ms while participants named the target word. The computer then presented response time feedback for both the prime and probe displays. This information remained onscreen for 3000 ms and represented the end of one trial. Participants repeated this sequence 96 times before receiving one self-timed break, and then completed another 96 trials. Following the computer task, participants completed the IDD. The entire experiment took approximately 35 min to complete.

RESULTS

Participant Characteristics

The dysphoric (4 males, 14 females), and nondysphoric (8 males, 10 females) groups did not differ significantly with respect to the proportion of females, $\chi^2(1, 36) = 2.57, p > .05$.

Errors

Three types of errors were recorded during the experiment: misses, participant failures, and computer failures. Misses included incorrect naming, partial naming, and failure to name the target. Participant failures included responses made while

stuttering, coughing, or moving loudly enough to trigger the voice key. Computer failures included instances in which participants' responses did not activate the voice key. All trials that contained an error in either the prime or the probe display were eliminated from further analysis. Overall, fewer than 6% of all trials were discarded because of errors. Moreover, error rates were not significantly different for the two groups, $t(34) = 1.01; p > .05$.

Interference Effects

Because the influence of outliers is best reduced by analyzing the reciprocals of response-time data (Ratcliff, 1993), the reciprocal of each response latency was used to compile participants' mean response times to each display of the four Trial-Type conditions. To facilitate presentation of the data, the means of the reciprocals were multiplied by 100,000 and divided by −1 (Revelle, personal communication). Thus, large values indicate a slow response time and small values indicate a fast response time.

Interference effects were calculated by subtracting response times for the prime displays in the Control condition from response times for the prime displays in the Interference condition. This computation provides a measure of participants' ability to ignore emotionally valenced stimuli relative to their ability to ignore neutral stimuli of comparable length and frequency. Positive values reflect relatively greater difficulty in ignoring emotionally valenced stimuli and, thus, indicate an interference effect for emotionally valenced words. Interference scores as a function of group and word type are presented in Fig. 1.

A two-way analysis of variance (ANOVA; Group repeated over Word Type) was conducted on the computed interference response time latencies. The main effect for group was not significant, $F(1, 34) < 1$, indicating that response latency did

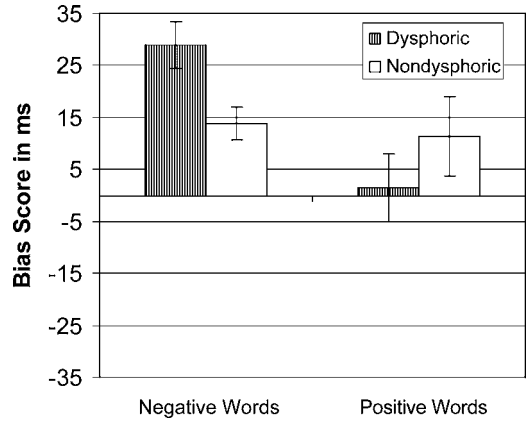

Fig. 1. Mean bias scores (in ms) for positive and negative words on the interference task for dysphoric and nondysphoric participants. Error bars represent one standard error.

not differ as a function of dysphoria. There was a significant main effect for word type, $F(1, 34) = 10.60$, $p < .01$, which was qualified by a significant interaction of group and word type, $F(1, 34) = 4.13$, $p < .05$. To examine this interaction, *t*-tests were conducted comparing dysphoric and nondysphoric participants on interference for positive and negative words. These analyses indicated that although dysphoric and nondysphoric participants did not differ in their interference for positive words, $t(34) < 1$, dysphoric individuals demonstrated significantly greater interference for negative words than did the nondysphoric participants, $t(34) = 3.18$, $p < .01$. This pattern of results supports the prediction that, compared with nondysphoric controls, dysphoric participants would exhibit greater interference when confronted with negative, but not positive, distractors.

Inhibition Effects

Inhibition effects were similarly calculated by subtracting response times for the probe displays in the Inhibition Control condition from response times to the probe displays in the Inhibition condition. This calculation provides a measure of individuals' ability to respond to emotionally valenced stimuli that were previously inhibited, relative to their ability to respond to emotionally valenced stimuli that were not inhibited. Positive values indicate increased difficulty in responding to previously inhibited words and, therefore, indicate an inhibition effect. Computed measures of inhibition as a function of dysphoria and word type are presented in Fig. 2.

A repeated measures ANOVA (Group repeated over Word Type) was conducted on the inhibition scores. Again, the main effect for group was not significant, $F(1, 34) = 1.51$, $p > .05$, indicating that inhibition did not differ between

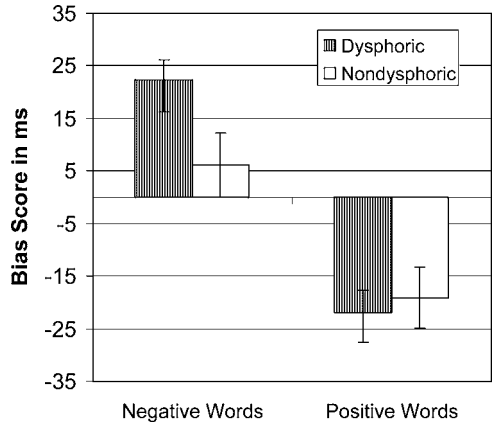

Fig. 2. Mean bias scores (in ms) for positive and negative words on the inhibition task for dysphoric and nondysphoric participants. Error bars represent one standard error.

the groups. There was a significant main effect for word type, $F(1, 34) = 58.87$, $p < .001$, which was qualified by a significant interaction of group and word type, $F(1, 34) = 4.44$, $p < .05$, indicating that the two groups responded differentially across the negative and positive inhibition conditions.

To examine this interaction, *t*-tests were conducted to test the hypothesis that inhibition for negative versus positive stimuli will differ as a function of dysphoria status. The results of these analyses indicated that although the dysphoric and nondysphoric participants did not differ significantly in their inhibition for positive words, $t(34) < 1$, the dysphoric participants demonstrated greater inhibition for negative words, $t(34) = 2.23$, $p < .05$, than did the nondysphoric controls. Moreover, the bias scores of the dysphoric participants for both positive, $t(17) = 4.33$, $p < .01$, and negative, $t(17) = 6.18$, $p < .01$, words were significantly different from zero. In contrast, the nondysphoric participants showed a significant bias score only for the positive words (positive words: $t[17] = 3.51$, $p < .01$; negative words: $t[17] = 1.16$, $p > .05$).

Relation Between Inhibition and Interference

Finally, to examine the association between interference from a concurrently presented negative distractor and inhibition of negative distractors, the correlation between interference and inhibition scores was calculated across all participants. The resultant correlation ($r = .34$, $p < .05$) indicates that inhibition and interference are significantly intercorrelated. Thus, the more interference the participants exhibited when responding to a neutral target in the presence of a negative distractor, the more difficult it was for them to respond to a negative target that had been presented as a distractor on the previous display.

DISCUSSION

There were three primary goals of this study. First, we investigated whether, compared to nondysphoric controls, dysphoric individuals are characterized by relatively greater interference from negatively valenced distractors. The results of this study indicate that, as predicted, dysphoric individuals experience and demonstrate greater interference from negative than from positive words while they are naming a neutral word, a pattern of functioning not exhibited by the nondysphoric participants. Second, we examined the hypothesis that dysphoric individuals would demonstrate greater inhibition for previously presented negative distractors than would nondysphoric individuals. Consistent with this formulation, dysphoric participants demonstrated greater inhibition for previously presented negative distractors than did nondysphoric participants, who did not exhibit inhibition for negative distractors at all. Unexpectedly, both groups showed a priming effect in response to previously presented positive distractors. Finally, we examined whether the degree of interference is related to the level of inhibition. Our results indicated that levels of interference and inhibition are significantly intercorrelated across all participants.

The present results support the findings of previous studies that have documented the operation of a negative attentional bias in depressed and dysphoric persons (e.g., Gotlib & Cane, 1987; Gotlib, Krasnoperova, Neubauer, & Joormann, 2004; Mathews et al., 1996; Mogg et al., 1995). As we noted earlier, in many of these investigations the emotion Stroop task was used to examine attentional functioning. The emotion Stroop task assesses the interference caused by the content of stimuli when participants are required to name the ink color in which the stimuli are presented. In contrast to the Stroop task, the task used in the present study assessed the interference caused by the simultaneous presentation of negative-content stimuli on participants' ability to process neutral stimuli. Using this task, the results of the present study indicated that the performance of dysphoric participants is impaired by the simultaneous presentation of a negative, but not a positive, distractor. This paradigm is conceptually similar to a dichotic listening task, in which participants are required to shadow (i.e., repeat) neutral stimuli presented in one ear while ignoring valenced stimuli that are presented simultaneously to the other ear. Interestingly, on this task, too, depressed individuals have been found to exhibit interference effects for negative-content distractor stimuli (cf. McCabe & Gotlib, 1993), suggesting that depressed individuals are particularly affected by negative information when they have to attend to several aspects of the environment simultaneously. Collectively, therefore, these findings indicate that on multistimulus tasks depressed and dysphoric individuals are characterized by greater interference for negative than for positive stimuli.

Although these previous findings support Beck's and Bower's models of cognition and emotion, it is important to note that the measure of interference used in these studies provides information about only one aspect of attentional processing: excitation. Several theorists have noted the potential importance to depression and dysphoria of another aspect of attentional processing: inhibition (Hertel, 1997; Joormann, in press; Linville, 1996). To examine this construct more explicitly, we utilized a task that, in addition to allowing an examination of interference, also permitted an assessment of inhibitory processes. Siegle et al.'s. (2002) hypothesis of affective interference in depression and dysphoria would predict that dysphoric participants would exhibit impaired inhibitory processes when they are required to respond to affective aspect of information, for example, in an affective evaluation task. Indeed, consistent with this position, Joormann (2004) recently found that dysphoric participants demonstrated inhibitory deficits for negative words in an affective evaluation task. In contrast, however, on tasks that require participants to attend to neutral aspects of stimuli and ignore affective aspects of the material, dysphoric subjects should experience interference from negative distractors and, therefore, should inhibit the negative stimuli.

Consistent with this latter position, and paralleling the results of the interference analyses, the present findings indicated that dysphoric participants exhibited inhibition for negative stimuli. That is, when negative words were presented, dysphoric individuals demonstrated longer response latencies on the inhibition trials than they did on the control trials. Nondysphoric individuals, in contrast, exhibited equivalent response latencies for negative words on inhibition and control trials. Interestingly, participants in both groups exhibited positive priming to the positive

words, indicating that positive words do not lead to interference and, therefore, do not have to be inhibited. Indeed, their presentation seems to lead to an activation that primes the reaction times on the subsequent trial. A possible explanation for these results is that in the positive condition (in which there was no interference), the mere repetition of the positive word in the prime and probe display of the inhibition trials led to priming effects, i.e., facilitation of response to a previously presented word. Thus, this effect might be independent of the valence of the words. In future research, the inclusion of a condition in which neutral words are used as distractors in the prime display and as targets in the probe display would be helpful to investigate this possibility. Finally, as we predicted, interference and inhibition scores were significantly intercorrelated, suggesting that inhibition is responsive to interference.

Overall, our results are consistent with Siegle et al.'s (2002) affective interference hypothesis. As we described earlier, Siegle et al. found that although dysphoric individuals were slow in attending to the semantic aspects of negative words, they were not slow in identifying the emotional valence of the words. Thus, while studies have demonstrated that dysphoric participants have difficulties inhibiting negative words on affective evaluation tasks, in the present study dysphoric individuals were found to inhibit negative distractors on a task that required participants to focus on nonemotional aspects of the information. In general, these findings are consistent with the notion of affective interference, in that dysphoric participants attend to the emotional aspects of stimuli at the expense of attending to the nonemotional aspects of stimuli. Dysphoric individuals may become easily distracted by negative aspects of stimuli, which may hinder them in responding to any other aspects of the stimuli. In this context, the present results might provide an explanation for the seemingly contradictory findings that depressed and dysphoric persons are skilled in attending to and remembering negative stimuli, but at the same time report concentration difficulties and impairments in the processing of neutral information (Hertel, 1997).

We should note several limitations to this study. Most noteworthy, perhaps, we assessed depressive symptomatology using a self-report measure, the IDD. Although the IDD is closer to matching diagnostic criteria than are other self-report measures of depressive symptomatology, it cannot take the place of a comprehensive diagnostic interview. In particular, the IDD does not permit the assessment of possible comorbid conditions such as anxiety and drug and alcohol use, which might be relevant to a college student sample, or the contribution of these potential disorders to symptom scores on the IDD. Clearly, therefore the present results should be replicated using diagnosed samples of depressed participants. Two other limitations of the current study involved the stimuli and stimulus presentation. Only eight unique valenced words were used, and these words were repeated throughout the experiment. It is important to note, however, that including block order as a covariate did not change the results, suggesting that habituation is not a viable explanation for the present findings. Finally, the ISI was not predetermined, but rather, varied depending on the timing of the participants' responses. Although it is difficult to see how this variable might have influenced the results of the present study, it may be important in future research to make this a fixed parameter.

In closing, we believe that the promising findings of the present study support the continued use of interference and inhibition paradigms in studies of attention and psychopathology. Unlike more traditional measures of attention, which have been criticized because they confound attentional and nonattentional processes, our task permits a more direct examination of the processing of emotional stimuli by dysphoric individuals. The present results suggest that dysphoric individuals are characterized by increased interference from negative stimuli, and that they then inhibit negative information. It remains for future research to examine the parameters of these processes, and to delineate their possible role in contributing to vulnerability to depression.

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