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Mood-Congruent Attentional Bias in Dysphoria: Maintained Attention to and Impaired Disengagement From Negative Information

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Attentional bias to negative information has been proposed to be a cognitive vulnerability factor for the development of depression. In 2 experiments, the authors examined mood-congruent attentional bias in dysphoria. In both experiments, dysphoric and nondysphoric participants performed an attentional task with negative, positive, and neutral word cues preceding a target. Targets appeared either at the same or at the opposite location of the cue. Overall, results indicate that dysphoric participants show maintained attention for negative words at longer stimulus presentations, which is probably caused by impaired attentional disengagement from negative words. Furthermore, nondysphoric participants maintain their attention more strongly to positive words. These results are discussed in relation to recent developments in the pathogenesis and treatment of depression.

Keywords: dysphoria, depression, attention, disengagement, inhibition

A key interest in the study of depression is the interplay between negative mood state and information processing. In this domain, the mood-congruency hypothesis is of central importance. According to this hypothesis, positive moods should facilitate information processing of positive information, and negative moods should facilitate information processing of negative information (Bower, 1981). In line with the mood-congruency account, cognitive accounts of depression and depression risk have developed the idea that both depressed and dysphoric individuals have negative self-schemata that profoundly affect memory, reasoning, and attention (Beck, 1967; D. A. Clark, Beck, & Alford, 1999; Ingram, 1984). Indeed, considerable research supports the idea that depression and dysphoria are characterized by memory and reasoning biases (for a review, see Williams, Watts, MacLeod, & Mathews, 1997). However, it is yet unclear whether a mood-congruent attentional bias for negative information is present. The aim of the present article was, then, to further investigate and identify the attentional characteristics in dysphoric versus nondysphoric individuals by using the emotional modification of the exogenous cuing task (Posner, 1980).

Previous research investigating attentional biases toward negative information have not systematically been able to demonstrate that dysphoria and depression are characterized by attentional bias (e.g., Gotlib, McLachlan, & Katz, 1988; MacLeod, Mathews, & Tata, 1986; Mogg, Bradley, Williams, & Mathews, 1993). A reason may be the use of short stimulus presentations that are similar to those used in anxiety and phobia research. It is possible that the human fear system is tuned for rapid detection of and swift defensive response to threat, but this may not hold for depressive mood (Williams et al., 1997; Mogg & Bradley, 1998). Several authors have therefore suggested that a prolonged elaboration of negative information at later stages is more typical for dysphoria and depression (Hartlage, Alloy, Vázquez, & Dykman, 1993; Joormann, 2004; Williams et al., 1997). There is indeed some evidence for attentional biases to negative information at long stimulus presentations. Most of these studies have used the dot probe task (Bradley, Mogg, & Lee, 1997; Gotlib, Krasnoperova, Neubauer Yue, & Joormann, 2004; Mogg, Bradley, & Williams, 1995), in which participants are required to respond as fast as possible to a dot replacing one of two stimuli (a word or picture with an affective valence paired with a neutral stimulus) presented on a screen. By analyzing reaction times (RTs), one can infer whether individuals attend to the emotionally valenced stimulus. Other studies failed to find attentional biases with long stimulus presentations. For instance, using a dot probe task, Hill and Dutton (1989) did not find evidence for selective attention to self-esteem threatening words (presented for 750 ms) in depressed patients. Also, studies using the deployment-of-attention task (Gotlib, McLachlan, & Katz, 1988; McCabe & Toman, 2000) failed to observe specific attentional biases in depressed and dysphoric participants. This task shares many characteristics with the dot probe task: Two words, presented above each other, are replaced by two color bars that appear simultaneously. Participants are misinformed that one color bar will appear shortly before the other (the two color bars are actually presented at the same time), and they have to decide which color bar appears first. The rationale is that the bar at the attended location will be detected first. Using this task, McCabe and Toman (2000) presented words for long durations (750, 1,000, 1,250, and 1,500 ms) but failed to find evidence for an attentional bias for negative words in dysphoric individuals.

A limitation of both the dot probe task and the deployment-of-attention task is that they only provide a coarse measure of attentional bias (Fox, Russo, Bowles, & Dutton, 2001; Koster, Crombez, Verschuere, & De Houwer, 2004). In fact, attentional

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operations consist of a number of interrelated components (Posner, Inhoff, Friedrich, & Cohen, 1987): (a) initial shift of attention toward stimuli, (b) attentional engagement with stimuli, and (c) disengagement of attention from stimuli. It may be expected that depression and dysphoria affect the later attentional processes such as disengagement, especially during longer stimulus presentations (Bradley et al., 1997). This might explain the absence of early attentional biases in previous studies.

The main objective is, therefore, to further examine whether attentional bias toward negative words exists in dysphoric persons. In particular, we are interested whether the attentional bias toward negative information exists at long presentation times and whether maintained attention for negative material is related to difficulty in disengaging attention from these stimuli (Bradley et al., 1997; Joormann, 2004). We conducted two experiments using the emotional modification of the exogenous cuing task originally developed by Posner (1980). In this RT task, a target stimulus appears at one of two spatial locations on a screen. The target stimulus is cued by a stimulus at the spatial location of the target stimulus (*valid trial*) or at the opposite location of the target (*invalid trial*). At short intervals between cue onset and target onset (stimulus onset asynchrony < 300 ms), participants typically respond faster to the valid compared with the invalid trials. This is the *cue validity effect*. At longer stimulus onset asynchronies, the cue validity effect disappears and even reverses because attention to the location of a previously attended stimulus is inhibited in favor of new locations. This is the *inhibition of return effect* (IOR; Posner & Cohen, 1984).

In the emotional modification of this task, the emotional valence of the cues is varied. There are two strategies to analyze RTs in this paradigm. First, one can examine the emotional modification of the IOR. It may be expected that in the case of emotionally relevant stimulus material, the IOR will not emerge as easily as with neutral information (see Fox, Russo, & Dutton, 2002). This would mean that the time course of the cue validity effect is extended with emotional stimuli (hereafter referred to as the *enhanced cue validity effect*). Second, the emotional modification of attentional engagement and disengagement can be analyzed by comparing the speed of responding on valid and invalid emotional versus neutral trials. The emotional valence may (a) facilitate attentional engagement to the emotional cue compared with a neutral cue, leading to response benefits on valid trials, and/or (b) delay the disengagement of attention from the emotional cue to the target on invalid trials, leading to delayed responding on these trials (see Derryberry & Reed, 1994; Fox et al., 2001; Koster, Crombez, Van Damme, Verschuere, & De Houwer, 2004; Yiend & Mathews, 2001). The two strategies result in different but interrelated aspects of attentional bias: The first analysis allows us to examine maintained attention to a cue, whereas the second analysis provides information about the precise attentional operations related to maintained attention. Therefore, both strategies will be applied in the present article.

In Experiment 1, we investigated attention for negative, positive, and neutral word cues in the exogenous cuing task. The negative words were self-referring adjectives related to failure and loss. The words were presented for 1,500 ms. This duration allows sufficient time for participants to read the words and for multiple shifts of attention. In Experiment 2, we tried to replicate the findings of Experiment 1. It was also designed to examine the time course of attention to emotional words: The presentation duration of the words was varied (250 ms, 500 ms, 1,500 ms). On the basis of the mood-congruency hypothesis and previous studies on attention and dysphoria, we predicted (a) that attention would be maintained for negative words at longer word presentations, resulting in enhanced cue validity effects, and (b) that maintained attention for negative information would be related to problematic disengagement of attention from negative word cues.

Experiment 1

Method

Participants. Fifty-seven undergraduate students volunteered to participate in this study. All participants were administered the Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961). We selected 15 dysphoric participants according to the cutoff scores (BDI score > 9) provided by Kendall, Hollon, Beck, Hammen, and Ingram (1987). A group of 15 nondepressed (BDI score < 5) individuals was selected that matched the dysphoric group as closely as possible on age and gender (see Table 1).

Materials. The exogenous cuing task was programmed with the Inquisit software package (Millisecond Software, 2001) and ran on a Windows 98 computer with a 72-Hz, 17-in. color monitor. Inquisit measures RTs with millisecond accuracy (De Clercq, Crombez, Buysse, & Roeyers, 2003).

Stimuli were presented against a black background. On every trial, a white fixation cross was presented in the middle of the screen, flanked by two white colored rectangles (4.0 cm high × 10.5 cm wide; visual angle = 3.8° × 10°). The middle of each of these rectangles was 7.9 cm (7.5°) from the fixation cross. Cues and targets were presented in the middle of the rectangles. Cues consisted of five negative, five positive, and five neutral words (see the Appendix) that were selected on the basis of negative, positive, and neutral affective valence and matched on familiarity (Hermans & De Houwer, 1994) and word length. All words were written in uppercase letters (35-point Times New Roman font). Targets were black squares (1.1 cm × 1.1 cm; 1° × 1°). Participants responded by pressing one of two keys on a standard keyboard.

The sequence of events on a test trial (depicted in Figure 1) consisted of a 500-ms presentation of the fixation cross and white rectangles. Next, a word cue appeared for 1,500 ms. The target was presented 50 ms after cue offset and remained on screen until a response was made. The following trial started immediately after the participant responded.

On the test trials, an equal amount of valid (left cue–left target and right cue–right target) and invalid (left cue–right target and right cue–left target) trials were presented. The words were presented at random at the left or right hemifield with an equal number of presentations for each word (eight times) and emotion category (40 trials each). For the participants to maintain gaze at the middle of the screen, on some trials the fixation cross was replaced by a digit presented for 100 ms after which no cue or target followed. Participants were instructed to report the digit aloud.

Table 1
Group Characteristics in Experiment 1

Variable	Group: Dysphoric	Group: Nondysphoric
Age	19.07	18.93
Gender ratio (male/female)	5/10	3/12
Beck Depression Inventory*	16.00	3.80
STAI-T*	46.33	34.67

Note. STAI-T = Trait version of the State–Trait Anxiety Inventory.
* $p < .001$.

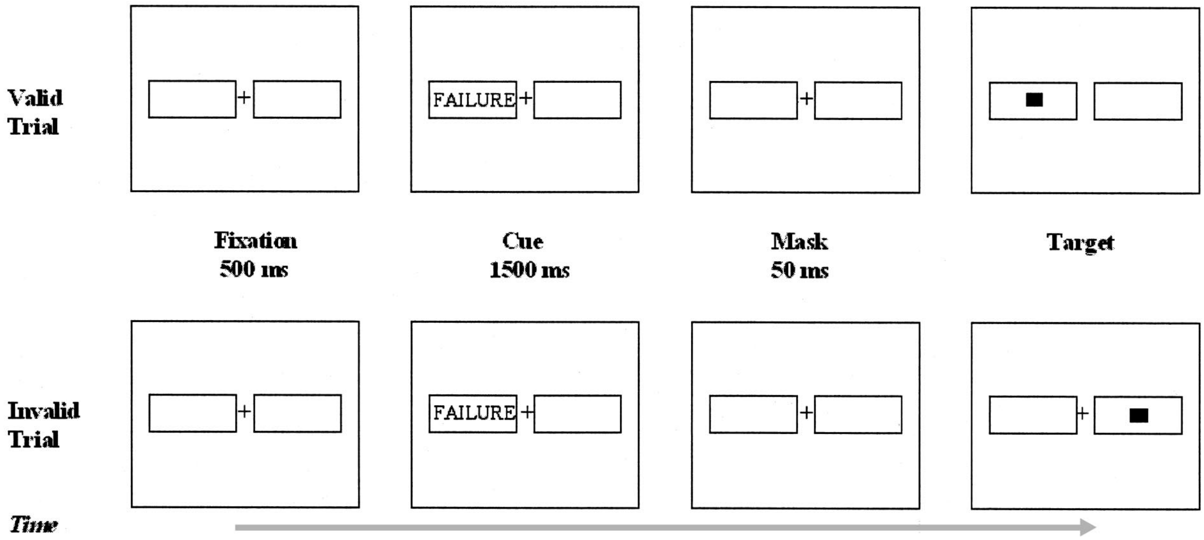

Figure 1. Stimulus presentation on validly and invalidly cued trials.

Procedure. Participants were tested individually. At the beginning of the experiment, participants completed the BDI and the Trait version of the State–Trait Anxiety Inventory (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). They were seated at 60-cm viewing distance from the computer screen to perform the cuing task. Instructions were presented on the computer screen. Participants were asked to respond as quickly as possible to the location of the target (target left: *q* key with the left index finger; target right: *5* key with the right index finger) without sacrificing accuracy. They were informed that a cue preceded the presentation of the target and that the cue correctly predicted the location of the target on some but not all trials. It was emphasized that the cue location was not predictive of the target location. Participants practiced the attentional task during 10 trials. The test phase consisted of one block with 140 trials, consisting of 120 test and 20 digit trials. Trials were presented in a new random order for each participant.

Design. RTs were subjected to a 3 (word valence: negative, positive, neutral) × 2 (cue validity: valid, invalid) × 2 (group: dysphoric, nondysphoric) mixed-design analysis of variance (ANOVA). Estimates of effect size are also reported (partial eta squared: η^2). If the relevant higher order effects were significant, the effects were further analyzed with the two strategies described above. First, the cue validity effects for emotionally relevant words were compared with the cue validity effects for neutral stimuli. Cue validity was determined by the following calculation:

$$\text{cue validity (CV)} = \text{RT invalid cue} - \text{RT valid cue}.$$

A positive value indicates the normal cue validity effect, whereas a negative value indicates an IOR. With longer stimulus presentations, a positive cue validity effect suggests that there is maintained attention to the cue instead of the usually observed IOR. To allow comparison of the cue validity effect between negative, positive, and neutral words, we made these calculations separately for each emotional valence.

Second, the emotional modulation of attentional engagement and disengagement was examined. Attentional engagement and disengagement were calculated using the following formulas:

$$\text{attentional engagement} = \text{RT valid/neutral cue} - \text{RT valid/emotional cue};$$

$$\text{difficulty in attentional disengagement} = \text{RT invalid/emotional cue} - \text{RT invalid/neutral cue}.$$

A positive attentional engagement score indicates that attention is directed at the location of the emotional cue compared with the neutral cue. A positive score on difficulties in attentional disengagement indicates that more time is required to shift attention away from emotional material compared with neutral material. Negative scores suggest an opposite attentional process, and a score of zero implies no differences in attentional engagement or disengagement for neutral versus emotional cues.

Results

Group characteristics. The high and low BDI groups are described in Table 1.

Data preparation. Trials with errors were discarded from analyses ($M = 0.83$). Dysphoric participants ($M = 0.54$) and nondysphoric participants ($M = 0.90$) did not differ with regard to the number of erroneous responses, $t(28) < 1.0$. After visual inspection of the data, RTs < 200 ms and RTs > 750 ms were considered outliers, indicating anticipatory responding and delayed responding, respectively. Also, RTs deviating more than 3 *SD*s from the individual mean RT were excluded. Statistical analyses were run on 97.2% of the data.

Overall effects. The 3 × 2 × 2 ANOVA revealed that the relevant three-way Word Valence × Cue Validity × Group interaction was significant, $F(2, 27) = 3.41$, $p < .05$, $\eta^2 = .20$. Mean RTs and standard deviations for this interaction are shown in Table 2. There was also a significant two-way interaction between word valence and cue validity, $F(2, 27) = 4.61$, $p < .05$, $\eta^2 = .25$. No other effects reached significance (all Fs < 1). The significant three-way interaction effect was further analyzed using the two strategies.

First, the cue validity effects for neutral, positive, and negative words for the dysphoric and the nondysphoric participants were investigated using simple two-tailed *t* tests. The cue validity effects are depicted in Figure 2. Analysis of the cue validity effect revealed that in the dysphoric group a significant enhanced cue validity effect was found for the negative cues (*M* CV = 16 ms) compared with the neutral cues (*M* CV = −6 ms), $t(14) = 2.26$, $p < .05$, $\eta^2 = .27$. In the nondysphoric participants, cue validity

Table 2
Mean Reaction Times, Standard Deviations, and Mean Cue Validity (CV; in Milliseconds) as a Function of Group, Cue Valence, and Trial Validity in Experiment 1

Cue valence and trial validity	Group					
	Dysphoric			Nondysphoric		
	M	*SD*	CV	*M*	*SD*	CV
Neutral			−6			−9
Valid	356	43		358	41	
Invalid	350	46		349	34	
Positive			−8			5
Valid	362	39		349	40	
Invalid	354	50		354	47	
Negative			16			4
Valid	346	37		343	37	
Invalid	362	53		347	42	

effects for negative words (*M* CV = 4 ms) and positive words (*M* CV = 5 ms) were larger compared with cue validity effects for neutral words (*M* CV = −9 ms), $t(14) = 2.05$, $p < .05$, $\eta^2 = .15$, and $t(14) = 2.21$, $p < .05$, $\eta^2 = .26$, respectively. Although the cue validity effect for negative words appeared to be more pronounced in the dysphoric individuals, the difference between the two groups was not significant ($t < 1.5$).

Second, the attentional engagement and disengagement indices for negative and positive words were calculated. As expected, dysphoric and nondysphoric participants showed differences on attentional disengagement from negative words. Mean RTs indicated that dysphoric individuals had difficulty disengaging attention from negative words (*M* = 12 ms), whereas nondysphoric participants did not (*M* = −2 ms). This difference was significant, $t(28) = 2.01$, $p = .05$, $\eta^2 = .13$. Note that the mean index score for difficulty disengaging attention from negative words in dysphoric participants also differed significantly from zero (recall that 0 = no attentional bias), $t(14) = 2.16$, $p < .05$, $\eta^2 = .25$. There were no significant differences in engaging attention with negative words in dysphoric (*M* CV = 10 ms) and nondysphoric individuals (*M* CV = 15 ms; $t < 1$). However, comparison to zero indicated that this attentional engagement score for negative words was significantly different from zero in the nondysphoric participants, $t(14) = 2.72$, $p < .05$, $\eta^2 = .34$, but not in the dysphoric participants, $t(14) = 1.44$, $p > .10$.

In addition, differences between dysphoric and nondysphoric participants were observed for attentional engagement with positive words, $t(28) = 2.34$, $p < .05$, $\eta^2 = .16$. Means indicate that nondysphoric participants engaged their attention with positive words (*M* = 9 ms), whereas dysphoric individuals showed a reversed effect (*M* = −6 ms). The attentional engagement score for positive words in nondysphoric participants differed significantly from zero, $t(14) = 2.11$, $p < .05$, $\eta^2 = .24$. The attentional engagement score for positive words in dysphoric participants did not differ significantly from zero ($t < 1.3$).

Discussion

In Experiment 1, we found that both dysphoric and nondysphoric individuals had an enhanced cue validity effect for negative words compared with neutral words. In the dysphoric participants, the enhanced cue validity effect was found only for negative words. The analysis of attentional engagement and disengagement components showed that dysphoric individuals had difficulty disengaging attention from the negative words, which was not the case for the nondysphoric individuals. Given the absence of significant attentional engagement effects for negative words in dysphoric participants, maintained attention in these individuals does not imply that visual attention was continuously directed at the location of the negative words. Rather, the combination of enhanced cue validity effects and impaired disengagement indicates an increased attentional dwell time at the location of the negative words (see Fox et al., 2001). In the nondysphoric individuals, an enhanced cue validity effect and an attentional engagement effect were found for both negative and positive words. This indicates that the nondysphoric individuals maintained attention to emotional material in general.

Thus, in line with our predictions, the results suggest that dysphoria is associated with maintained attention for negative words and an impaired attentional disengagement from negative material. However, the cue validity effect for negative words failed to differ significantly between the dysphoric group and the control group. A reason may be the lack of statistical power due to the small sample size. Furthermore, it is difficult to draw strong conclusions on the basis of Experiment 1 because of several methodological issues: First, cues were presented for 1,500 ms, which provides only a snapshot of attention at that particular word presentation. The presented data do not provide any information on the occurrence of attentional bias at shorter word presentations. Second, in Experiment 1 each word was presented eight times. It may be that repeated presentation of the words may have contributed to reduced attention for the word cues. Third, the components of attentional bias were assessed by comparing attentive processing of negative words with attentive processing of the neutral words. However, this comparison may be influenced by the IOR that influences response latencies on valid and invalid neutral trials. Therefore, an alternative baseline to examine facilitated and delayed responding might be warranted.

Experiment 2

This study was undertaken to further examine attentional bias in dysphoric versus nondysphoric participants. First, we wanted to replicate the findings of Experiment 1. Second, we wanted to investigate the time course of the cue validity effects and the

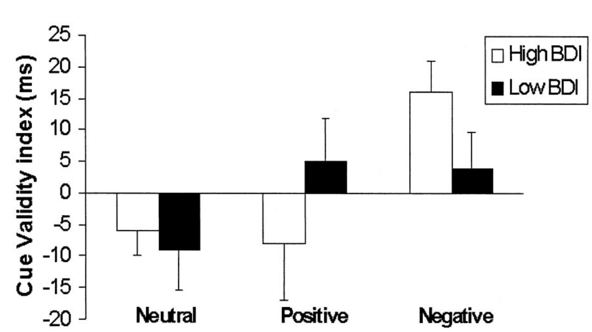

Figure 2. Mean cue validity indices (and standard errors) as a function of group and word valence in Experiment 1. BDI = Beck Depression Inventory score.

attentional components. Therefore, we used three different stimulus durations: 250, 500, and 1,500 ms. This allowed us to examine whether attentional biases for negative information occur at early versus later phases of information processing. Third, we adjusted the methodology to resolve the other methodological issues noted in the *Discussion* section of Experiment 1.

Method

Participants. Seventy-three students volunteered to participate. All participants were administered the BDI. Twenty participants had a BDI score higher than 9 and were classified as dysphoric. These individuals were matched on age and gender to 20 nondepressed (BDI score < 5) individuals. All participants were women (for further description of the participants, see Table 3).

Materials. The exogenous cuing task was similar to Experiment 1 except for the inclusion of variation of the durations of word presentation and the following minor adjustments. First, to resolve frequent repetition of the same words, we added 10 words to every category with each word presented only three times (see the Appendix). Second, for us to address the "baseline" problem in analyzing the components of attention, a "no-cue" baseline seems appropriate in determining whether responses to emotional information are speeded or delayed (cf. Yiend & Mathews, 2001); thus, we included no-cue trials in Experiment 2. For these trials, the duration between the beginning of the trial and target onset was varied to resemble the time course of the cued trials. Third, responses to the digit trials were not registered in Experiment 1. However, responding to the digit trials may reveal information about participant's attending the task and following the instructions to fixate on the middle of the screen. In Experiment 2, participants were asked to register the digit replacing the fixation cross.

Procedure. Participants were tested in groups of 15. At the beginning of the experiment, participants completed the BDI and the STAI-T. They sat 60 cm in front of a computer screen to perform the cuing task. Instructions were similar to Experiment 1. The cuing task started with 12 neutral practice trials, followed by 190 test trials consisting of 10 digit, 45 no-cue, 45 negative, 45 positive, and 45 neutral trials.

Design. RTs were subjected to a 3 (presentation duration: 250, 500, 1,500 ms) $\times$ 3 (word valence: negative, positive, neutral) $\times$ 2 (cue validity: valid, invalid) $\times$ 2 (group: dysphoric, nondysphoric) mixed-design ANOVA. Then, differential attentive responding between dysphoric and nondysphoric participants was examined for each presentation duration.

Results

Group characteristics. The high and low BDI groups are described in Table 3.

Data preparation. Overall, very few errors ($M = 0.48$) were made, and the number of errors did not differ significantly between dysphoric ($M = 0.30$) and nondysphoric ($M = 0.65$) participants, $t(38) = 1.54$, $p > .10$. Trials with errors were discarded from analyses. Outlying responses were removed (RTs < 200 ms, RTs > 750 ms, and RTs deviating more than 3 *SD*s from the individual mean RT). The number of errors on the digit trials did not differ between the dysphoric ($M = 0.50$) and nondysphoric participants ($M = 0.50$; $t < 1$). Statistical analyses were run on 98.5% of the data.

Table 3
Group Characteristics in Experiment 2

Variable	Group: Dysphoric	Group: Nondysphoric
Age	22.08	21.42
Beck Depression Inventory*	15.20	2.10
STAI-T*	52.60	32.00

Note. STAI-T = Trait version of the State–Trait Anxiety Inventory.
* $p < .001$.

Overall effects. The 3 $\times$ 3 $\times$ 2 $\times$ 2 ANOVA revealed that the relevant four-way Presentation Duration $\times$ Word Valence $\times$ Cue Validity $\times$ Group interaction was significant, $F(4, 34) = 2.72$, $p < .05$, $\eta^2 = .25$. Other significant interaction effects were Word Valence $\times$ Cue Validity $\times$ Group, $F(2, 36) = 4.66$, $p < .05$, $\eta^2 = .23$; Presentation Duration $\times$ Word Valence, $F(4, 34) = 4.92$, $p < .01$, $\eta^2 = .35$; and Presentation Duration $\times$ Validity, $F(2, 36) = 5.47$, $p < .01$, $\eta^2 = .26$. Note that the latter interaction effect relates directly to the IOR and indeed indicates the linear decrease in the cue validity effect at longer word presentations predicted by the IOR (250-ms presentation: *M* CV = 8 ms; 500-ms presentation: *M* CV = 0 ms; 1,500-ms presentation: *M* CV = −9 ms), $F(1, 37) = 11.09$, $p < .01$, $\eta^2 = .32$. The two- and three-way interactions could be subsumed under the four-way interaction effect. A main effect was found for presentation duration, $F(2, 36) = 33.59$, $p < .001$, $\eta^2 = .65$, with faster responding on longer word presentations (250-ms presentation: $M = 461$ ms; 500-ms presentation: $M = 435$ ms; 1,500-ms presentation: $M = 412$ ms). No other effects reached significance (*F*s < 1).

Response latencies as a function of presentation duration, word valence, cue validity, and group are presented in Table 4. To interpret the four-way interaction effect, we first examined for each presentation duration whether the Word Valence $\times$ Cue Validity $\times$ Group interaction reached significance. If significant, data were analyzed using the two strategies. Although we planned to use the RTs of the no-cue trials for baseline comparison, preliminary analyses showed that the mean RTs for the no-cue trials were significantly larger than for any other trial type (250-ms presentation: $M = 489$ ms; 500-ms presentation: $M = 437$ ms; 1,500-ms presentation: $M = 464$ ms; all *t*s > 1.75, all *p*s $< .09$). It appears that the absence of any temporal information regarding the onset of the target caused delayed responding on these trials. Because this causes difficulties in using the no-cue trials for baseline comparison, we decided not to use these data as baseline but to use the RTs to neutral trials for comparison.

250-ms condition. The 3 $\times$ 2 $\times$ 2 ANOVA revealed only a marginally significant effect of cue validity, $F(1, 37) = 3.20$, $p = .082$, $\eta^2 = .08$, with faster responses on valid trials ($M = 457$ ms) than on invalid trials ($M = 465$ ms). All other effects were nonsignificant (*F*s < 1.2), indicating no differences in the early attentive processing of affective material between dysphoric and nondysphoric individuals.

500-ms condition. There was a main effect of word valence, $F(2, 36) = 2.88$, $p < .01$, $\eta^2 = .25$, as participants responded faster to positive words ($M = 427$ ms) than to negative ($M = 440$ ms) or neutral words ($M = 437$ ms). Note that the Word Valence $\times$ Cue Validity $\times$ Group interaction was significant, $F(2, 36) = 4.41$, $p < .05$, $\eta^2 = .20$. Averaged across groups, the cue validity effects for neutral, positive, and negative words were not significantly different from zero (*t*s < 1.0), indicating no cue validity effects. Within groups, no significant differences were found in the cue validity effects for neutral versus emotional words (*t*s < 1.4). However, differential effects were found between dysphoric and nondysphoric participants. The cue validity effect

Table 4
Mean Reaction Times, Standard Deviations, and Mean Cue Validity (CV; in Milliseconds) as a Function of Presentation Duration, Group, Cue Valence, and Trial Validity in Experiment 2

Cue valence and trial validity	Dysphoric *M*	Dysphoric *SD*	Dysphoric CV	Nondysphoric *M*	Nondysphoric *SD*	Nondysphoric CV
250-ms presentation						
Neutral			9			8
Valid	471	78		455	70	
Invalid	480	96		463	77	
Positive			10			−9
Valid	453	71		462	75	
Invalid	463	84		453	77	
Negative			14			14
Valid	456	81		451	85	
Invalid	470	91		465	75	
500-ms presentation						
Neutral			−3			2
Valid	436	74		439	84	
Invalid	433	88		441	84	
Positive			−6			17
Valid	432	66		416	60	
Invalid	426	42		433	76	
Negative			9			−22
Valid	442	62		445	80	
Invalid	451	69		423	75	
1,500-ms presentation						
Neutral			−23			−15
Valid	422	55		412	73	
Invalid	399	62		397	59	
Positive			−17			8
Valid	429	48		413	62	
Invalid	412	47		421	55	
Negative			15			−26
Valid	406	52		420	49	
Invalid	421	47		394	70	

for negative words in dysphoric participants was significantly different from that of the nondysphoric participants, $t(38) = 1.99$, $p = .05$, $\eta^2 = .09$. Compared with the cue validity effect for neutral words (*M* CV = 2 ms), the nondysphoric participants showed a marginally significant smaller cue validity effect on trials with negative words (*M* CV = −22 ms), $t(19) = 1.78$, $p = .09$, $\eta^2 = .09$. This effect was not found in dysphoric participants (neutral words: *M* CV = −3; negative words: *M* CV = 9 ms; $t < 1$). Also, a marginally significant differential cue validity effect was found for the positive words, with nondysphoric participants showing a larger cue validity effect (*M* CV = 17 ms) than did dysphoric participants (*M* CV = −6 ms), $t(38) = 1.76$, $p = .08$, $\eta^2 = .08$ (see Figure 3).

Independent-samples *t* tests indicated that dysphoric participants showed difficulty disengaging attention from negative words (*M* = 18 ms) as compared with nondysphoric participants (*M* = −18 ms), $t(38) = 2.57$, $p < .05$, $\eta^2 = .15$. Comparison to zero showed a trend toward difficulty disengaging attention from negative material in dysphoric participants, $t(19) = 1.76$, $p = .10$, $\eta^2 = .14$, whereas the nondysphoric participants had the opposite trend, disengaging more rapidly from negative material, $t(19) = 1.89$, $p = .074$, $\eta^2 = .16$. No other significant differences were found between groups (*t*s < 1.4).

1,500-ms condition. The 3 × 2 × 2 ANOVA revealed a marginally significant effect of validity, $F(1, 37) = 3.50$, $p = .067$, $\eta^2 = .09$, as participants had overall faster responses to invalid trials (*M* = 407 ms) compared with valid trials (*M* = 417 ms). Of crucial importance was the significant Word Valence × Cue Validity × Group interaction, $F(1, 37) = 3.65$, $p < .05$, $\eta^2 = .19$. Important to note, across both groups, the cue validity effect for neutral words was negative and significantly different from zero (*M* CV = −19 ms), $t(38) = 2.61$, $p < .05$, $\eta^2 = .15$, providing further evidence for the IOR at 1,500-ms word presentation. In line with predictions, in the dysphoric group, the cue validity effect for negative words (*M* CV = 15 ms) was significantly more positive than that for neutral words (*M* CV = −23 ms), $t(18) = 2.38$, $p < .05$, $\eta^2 = .24$. This effect was not significant in the nondysphoric participants ($t < 1$). Instead, in the nondysphoric group a marginally significant enhanced cue validity effect was found for positive words (*M* CV = 8 ms) compared with neutral words (*M* CV = −15 ms), $t(19) = 1.90$, $p = .07$, $\eta^2 = .15$. Further analysis showed that the cue validity effect for trials containing negative words was larger in dysphoric participants (*M* CV = 15 ms) compared with nondysphoric participants (*M* CV = −26 ms), $t(38) = 2.41$, $p < .05$, $\eta^2 = .13$. Compared with zero, the dysphoric individuals had a positive cue validity effect, $t(14) = 2.11$, $p < .05$, $\eta^2 = .18$, whereas the nondysphoric individuals had a negative cue validity effect for negative words, $t(14) = 2.25$, $p < .05$, $\eta^2 = .27$.

Again, there was a significant difference in attentional disengagement from negative words between dysphoric and nondysphoric participants, $t(38) = 2.15$, $p < .05$, $\eta^2 = .11$. The dysphoric participants had more difficulty disengaging attention from negative words (*M* = 22 ms) compared with the nondysphoric participants (*M* = −3 ms). Of note, the difficulty disengaging attention in the dysphoric participants was also significant compared with zero, $t(19) = 2.37$, $p < .05$, $\eta^2 = .23$, whereas this was not the case in the nondysphoric group. No other differences emerged (*t*s < 1.5).

Discussion

In Experiment 2, further evidence was found for an attentional bias to negative information in dysphoric persons. They had an

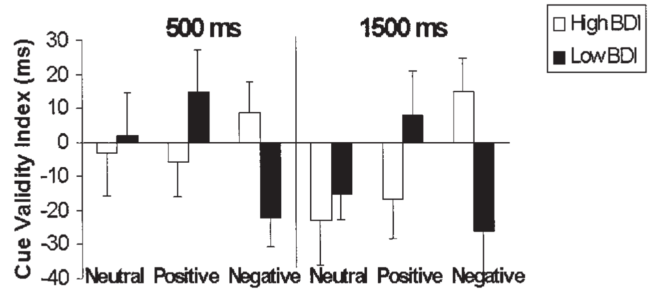

Figure 3. Mean cue validity indices (and standard errors) as a function of presentation duration, group, and word valence in Experiment 2. BDI = Beck Depression Inventory score.

enhanced cue validity effect for negative words and showed impaired attentional disengagement from negative words. These effects were significant at 1,500 ms, whereas only a trend toward impaired disengagement was observed at 500 ms. No such effects were significant at the 250-ms word presentation. These results partially replicate the results of Experiment 1, in which we also found maintained attention for and impaired attentional disengagement from negative words in dysphoric participants. In line with the mood-congruency hypothesis, Experiment 2 replicated that nondysphoric individuals attended to positive words whereas dysphoric individuals did not.

Of importance, in Experiment 2 we found that the enhanced cue validity effect for negative words was specific for the dysphoric participants. In contrast, in Experiment 1, nondysphoric participants also showed an enhanced cue validity effect for negative words, whereas in Experiment 2, nondysphoric participants showed a strong IOR for negative words. This difference between experiments may be attributed to sample size and methodological improvements. However, it is yet unclear which methodological adjustment caused the divergence in findings on attention for negative words between Experiments 1 and 2 in the nondysphoric participants.

General Discussion

The results of two experiments provide evidence that dysphoric mood is associated with maintained attention for negative words, which might be caused by a more pronounced difficulty disengaging attention from negative words. In Experiment 1, an enhanced cue validity effect was found for trials containing negative words in all individuals, but analysis of the components of attention showed that only the dysphoric participants had difficulty disengaging attention from negative words. In Experiment 2, the latter finding was replicated and enhanced, as dysphoric participants showed difficulty disengaging attention from negative, self-referring words and an enhanced cue validity effect for this information at the 1,500-ms word presentation. Of interest, no differences were found between dysphoric and nondysphoric individuals in attending negative words that were presented for 250 ms. The latter finding indicates that dysphoric mood is characterized by a mood-congruent bias in later but not early stages of attentive processing. Furthermore, in both experiments interesting effects were found regarding attention for positive words: Compared with the dysphoric participants, nondysphoric individuals showed an enhanced cue validity effect for positive words, indicating maintained attention to these stimuli.

Our results support the idea that mood-congruent attentional biases exist in dysphoria and are in line with previous studies indicating an attentional bias to negative information in dysphoria and depression (Bradley et al., 1997; Gotlib et al., 2004; Mogg et al., 1995). However, the current study is also informative on the nature of attentional bias. There are strong indications that attentional dwell time is increased at the location of negative words, and specific difficulties emerge when attention has to be shifted away from that location. These findings suggest that dysphoria and depression are not characterized by an early, purely stimulus-driven attentional bias. Rather, it seems that only with longer exposure to negative information an attentional bias is elicited that causes maintained attention to negative material related to difficulties in shifting attention from this information.

The present findings may be of relevance in explaining some of the problems found in depressed individuals. First, the attentional bias may contribute to the continuous processing of negative information observed in depressed individuals, such as rumination and self-focused attention. Of importance, some definitions of rumination do already imply a link between attentional processes. For instance, ruminative responses have been defined as “behaviors or thoughts that focus an individual’s attention on his or her depressed mood, and [on] the possible causes and consequences of that mood” (Nolen-Hoeksema, Morrow, & Fredrickson, 1994, p. 92). Regarding self-focused attention, it may very well be that the attentional problems observed in dysphoric individuals do not apply only to externally presented stimuli but are also important in maintaining self-focused attention. Second, attentional biases to negative information in favor of positive information may be an important factor in determining the perception and interpretation of events (Ellenbogen, Schwartzman, Stewart, & Walker, 2002). Finally, the lack of attentional regulation can be negative in itself as it may lead to feelings of uncontrollability and trigger maladaptive control strategies such as thought suppression (for a review, see Beevers, Wenzlaff, Hayes, & Scott, 1999).

The observed pattern of findings can be understood within the theoretical position that attentional biases are of importance to the maintenance and relapse of depression. Recent studies confirm that cognitive processing biases and specifically the inability to regulate attention away from distressing information may be an important cognitive vulnerability factor in the maintenance and development of clinical mood disorders (Compton, 2000; Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002). For instance, participants trained to attend to aversive information responded more emotionally to a stress-inducing task, compared with individuals trained to ignore aversive information (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2001). In addition, Beevers and Carver (2003) found that an attentional bias toward negative information following a mood-induction procedure predicted increased dysphoria 7 weeks later. It is important to note that attentional control is nowadays targeted in clinical treatments to prevent relapses of depression (Teasdale, Segal, & Williams, 1995). Results from the present study may be helpful in guiding such clinical interventions by providing a localization of the attentional problems in depression-prone individuals.

The behavioral data obtained in the present study fit well with neuropsychological data found in depressed individuals. Problematic inhibition of attention to negative information at the cost of task-related information may point to differential activation at brain structures responsible for emotional processing (e.g., the amygdala) and cognitive control (prefrontal lobes) and specifically the structures determining the coordination between the emotion and attention networks (e.g., anterior cingulate cortex and dorsolateral prefrontal cortex). These structures have indeed been related to depression (see Davidson et al., 2002; Drevets, 2000). Of interest, recent studies on, for instance, sustained amygdala activity provide promising insights in the causation of elaborate cognitive processing of negative information in depression (Siegle, Steinhauer, Thase, Stenger, & Carter, 2002).

An important restriction of the present experiment is that there were significantly high correlations between BDI scores and trait anxiety scores (Experiment 1: $r = .70$, $p < .001$; Experiment 2: $r = .85$, $p < .001$). This high correlation is not surprising given the high comorbidity between anxiety and depression (for a review, see Mineka, Watson, & Clark, 1998). This implies that our results cannot unambiguously be attributed to the effects of dysphoria alone. Actually, there is some evidence to suggest that similar attentional effects may arise in high trait anxiety (Derryberry & Reed, 2002; Fox et al., 2002). However, Yiend and Mathews (2001, Experiment 3) did not observe any effects of trait anxiety on IOR, which might suggest that some of our findings are uniquely related to dysphoria. In this context, it is interesting to note that although theoretical models predict differential patterns of attentional bias for depression versus anxiety (e.g., Williams et al., 1997), isolating depression from anxiety in empirical research seems virtually impossible (Mineka et al., 1998). Provided that contemporary models of anxiety and depression have proposed detailed overlapping (i.e., high negative affect) and distinguishing features of anxiety (high physiological arousal) and depression (low positive affect or anhedonia; Barlow, Chorpita, & Turovsky, 1996; L. A. Clark & Watson, 1991), future research should apply these models to examine general versus specific cognitive processing characteristics.

A second limitation of the present study is the potentially confounded nature of IORs and the componential analysis of attentional bias. Both strategies have been used in previous research (e.g., Fox et al., 2001; Yiend & Mathews, 2001) and provided important information about the mechanisms underlying attentional bias. In the present studies, we found an enhanced cue validity effect, impaired attentional disengagement, but no facilitated engagement in the dysphoric participants. This pattern of results might imply that there is an increased attentional dwell time on negative information, with problematic disengagement causing the increased attentional dwell time. Indeed, correlations between the enhanced cue validity and the disengagement effect are positive, especially in the 1,500-ms condition (Experiment 1: $r = .63$, $p < .05$; Experiment 2: 500-ms condition, $r = .02$, *ns*, and 1,500-ms condition, $r = .47$, $p < .05$). However, at this point this conclusion is premature as the IOR influences responding to the neutral trials in that responding to valid trials is slower and responding to invalid trials is faster. One might argue that this could inflate the chances of finding facilitated responding on valid trials and retarded responding on invalid trials containing emotional material, if the cue validity is enhanced for those trials. Similarly, specific effects on valid and invalid emotional trials, like difficulties in disengaging attention, may result in an enhanced cue validity effect on emotional trials. Although we cannot exclude the possibility of mutual influences between IOR and components of attention, there are several reasons to suggest that the conclusions of our studies are reliable. First, both strategies of analyzing attentional bias are in the same direction, indicating that dysphoric participants' attention is held by negative information. Second, additional support for the present conclusions has been found in a recent eye-tracking study. In that experiment, depressed individuals fixated more on negative pictures (presented for 10.5 s) and had difficulty disengaging attention from this information (Eizenman et al., 2003).

Another interpretational problem arises with the interpretation of the absence of valence-specific attentional effects at the 250-ms condition in Experiment 2. It has been argued that the exogenous cuing task does not provide an ideal measure of initial orienting effects to emotional versus neutral cues. That is, because only one cue is presented, this cue automatically captures attention, which poses problems in finding valence-specific effects (Fox et al., 2001). Although research with the exogenous cuing task has demonstrated valence-specific attentional engagement effects (e.g., Koster, Crombez, Van Damme, et al., 2004), there still may be an underestimation of valence-specific engagement effects. The measurement of attentional engagement with longer cue presentations is not affected by this problem. However, research on attention to negative information in dysphoria may use other tasks that present more than one stimulus at a time to verify the idea that dysphoria is not characterized by early attentional biases.

Finally, it is important to note that the effect of the experimental conditions (i.e., task demands, mood state, stimulus material) needs to be further incorporated in future work in this area. For instance, Ellenbogen et al. (2002) found that after a mood-induction procedure, dysphoric participants showed impaired disengagement from negative, positive, and neutral words (presented for 290 ms) in a spatial cuing task. A tentative explanation for this finding may be that mood induction leads to a general reduction of attentional control. Clearly, further research should examine the reliability of mood-congruent attentional biases. Given the relevance of attentional biases, future studies should examine the precise conditions related to attentional problems in dysphoria and depression.

In summary, this article has shown that dysphoric individuals show an attentional bias for negative words at longer presentation durations. This is the first behavioral study relating the attentional model of Posner et al. (1987) to attentional bias in depression. Dysphoric individuals increasingly dwell on negative words and have difficulty in disengaging attention from these words. The present methodology provides a promising tool for the in-depth study of the effects of attention bias on negative mood and depression.

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Appendix

Word Cues Used in Experiment 1 and the Additional Word Cues Used in Experiment 2 (English Translation)

Negative words	Positive words	Neutral words
	Experiment 1	
Worthless	Beloved	Crane
Loser	Skillful	Screen
Failure	Successful	Paper
Weak	Competent	Office
Inferior	Powerful	Petrol
	Experiment 2	
Rejected	Strong	Paperclip
Lonely	Friendly	Pencil
Desperate	Sociable	Frame
Useless	Independent	Dictionary
Vulnerable	Enjoyable	Hallstand
Incompetent	Optimistic	Space bar
Unwanted	Well-liked	Wallpaper
Dependant	Winner	Light switch
Hopeless	Popular	Sunglasses
Lost	Kind	Toothbrush

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