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ORIGINAL ARTICLE

# Negative Interpretation Bias in Individuals with Depressive Symptoms

**Alexandra H. Cowden Hindash · Nader Amir**



**Abstract** Negative interpretations are a central component of cognitive models of depression. Previous research on interpretation biases in depression has relied on self-report measures. Self-report measures have limited validity because they may measure a response bias rather than a cognitive bias. To overcome this limitation, recent investigations have used response latencies as a measure of interpretation bias with mixed results. We examined interpretation bias using a modified word sentence association paradigm (Beard and Amir in Cogn Therapy Res 33:406–415, 2009). In comparison with individuals without dysphoria, dysphoric individuals were significantly faster to endorse the association between negative words and ambiguous sentences. These results suggest that negative interpretations are primed in depression, suggesting that training towards benign interpretations may have therapeutic value.

**Keywords** Depression · Cognitive bias · Interpretation · Information processing

## Introduction

Cognitive theories of depression posit that underlying automatic cognitive biases affect the onset, maintenance, and recurrence of depressive symptoms (Beck 1976, 1987; Ingram and Ritter 2000; Teasdale 1983). For example, according to these theories, individuals with depression have a tendency to interpret ambiguous information negatively; although considering a lack of a positive interpretation bias is of interest as well (Berna et al. 2011).

Researchers examining interpretation biases in depression have used various self-report measures (e.g., Butler and Mathews 1983). These measures present participants with short scenarios (e.g., "You made an appointment with an acquaintance to go to the cinema. Shortly before the appointment this person leaves a message on your answering machine that the appointment has been cancelled."), followed by either a negative interpretation (e.g., "This acquaintance doesn't like me") or a benign interpretation (e.g., "This acquaintance feels sick"). Participants are asked to select the interpretation that best fits the scenario. Generally, individuals with depression choose the negative interpretations more often than individuals without depression (Butler and Mathews 1983; Nunn et al. 1997; Voncken et al. 2007). However, self report of interpretations may be affected by response bias (MacLeod 1993). For example, a dysphoric or depressed person may process the negative and neutral interpretation of ambiguous material, but report a negative interpretation more often than controls because of a reporting bias rather than an interpretation bias (Mogg et al. 2006). Further, self-report measures are subject to the respondent's experience which may be skewed due to anchoring and overestimation (Rude et al. 2002).

To overcome the response bias limitation of self-report measures, Wenzlaff et al. (Wenzlaff and Bates 1998; Rude et al. 2002) created the scrambled sentences task (SST). The SST is a set of a 20 sentences whose words have been rearranged out of order (e.g., "looks the future bright very dismal"). Each sentence can be unscrambled to form a

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A. H. C. Hindash · N. Amir
Department of Psychology, San Diego State University, San Diego, CA 92182, USA

N. Amir (✉)
6386 Alvarado Ct., Suite 301, San Diego, CA 92120, USA
e-mail: namir@sciences.sdsu.edu

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negative sentence (e.g., the future is very dismal) or benign sentence (e.g., the future is very bright). Participants unscramble the sentences by writing numbers on top of the words to put them into grammatical order (Wenzlaff and Bates 1998). Negative interpretation is revealed by the number of sentences a subject unscrambles using the negative word. Wenzlaff et al. hypothesized that negative thinking patterns remain active in formerly depressed and distressed individuals but cannot be assessed using self report measures because these individuals are suppressing the negative thoughts. Thus, increasing cognitive load in these individuals would make it more difficult for them to suppress their negative thoughts and make them more likely to unscramble the sentences using the negative word. In a series of studies, Wenzlaff et al. showed that dysphoric individuals were more likely than non-dysphoric individuals to unscramble a negative sentence, but only under cognitive load (Wenzlaff and Bates 1998). They also found that under cognitive load, the SST demonstrated negative interpretation patterns and predicted subsequent depressive symptoms in undergraduate students (Rude et al. 2002) and formally depressed individuals (Rude et al. 2001) while self-report measures of negative thinking did not.

There is also evidence that negative interpretations lead to greater reporting of negative life events (Safford et al. 2007). Moreover, depression may be associated with a lack of benign bias. For example, LeMoult et al. presented remitted patients with a history of recurrent major depression and never depressed individuals with facial stimuli that morphed from neutral facial expression to either sad, angry or happy expression. These authors found that the remitted patients performed similar to never-depressed individuals when asked to identify sad or angry facial expressions, but required greater expression intensity to identify happy facial expressions (LeMoult et al. 2009). In a similar study, Beevers et al. presented dysphoric college students with facial stimuli expressing happy, sad, angry, fearful, or a morphed mixture of two emotional expressions. The authors found that dysphoric and non-dysphoric individuals did not differ in their identification of unambigius expressions, but the dysphoric group was more likely than the non-dysphoric group to interpret ambiguous sad-happy mixed expressions as sad (Beevers et al. 2009).

Negative interpretation biases in depression and dysphoria have also been examined using priming paradigms. In a priming task, participants see an ambiguous stimulus and then an unambiguous associated stimulus. Bias is assessed by measuring the response latency to read a negative or a neutral associated unambiguous stimulus. For example, Lawson and Macleod (1999) presented participants with ambiguous sentences (e.g., "The doctor examined little Emily's growth"), followed by either a negative word (e.g., tumor) or a neutral word (e.g., height). They instructed participants to read aloud the sentence and the word that followed as quickly and as accurately as possible. These authors measured response latencies to read the target word as an index of interpretation bias hypothesizing that faster response latencies when reading the associated negative words, compared to response latencies to read the benign words, indicated that the negative words were primed by the sentence. However, Lawson and MacLeod (1999) failed to find support for this hypothesis. That is, response latencies did not differ for reading negative and benign words.

Interpretation bias in this task may only be evident when participants are experiencing a dysphoric mood. To test this hypothesis, Bisson and Sears (2007) presented Lawson and MacLeod's (1999) priming task to individuals with and without dysphoria. Half of the participants completed the priming task before a musical negative mood induction while the other half completed the task after the mood induction. Again, there was no evidence of an interpretation bias in either group. Mogg et al. (2006) used a modification of this priming task to assess interpretation bias in depressed outpatients. These researchers modified the task in two ways. First they presented the negative (e.g., death) or benign (e.g., marriage) word before the ambiguous sentence (e.g., "Carol felt emotional throughout the service") and recorded how long it took for participants to read aloud a continuation sentence. The final sentence was either a negative (e.g., "Funerals always made her cry") or benign (e.g., "Weddings always made her cry") logical continuation of the ambiguous sentence. These authors hypothesized that faster reading latencies for negative continuation sentences than for benign continuation sentences would indicate a negative interpretation bias. Again, Mogg et al. (2006) failed to find evidence of a negative interpretation bias in depressed patients using this priming task.

In summary, at least three previous studies have failed to find evidence of a negative interpretation bias in both dysphoric and depressed populations using priming tasks. One reason for these null findings may be that these studies used ambiguous stimuli that were not self-referent for participants. Individuals with depression show stronger negative interpretation biases when presented with self-referent material than when presented with other-referent material (Dineen and Hadwin 2004; Hertel and El-Messidi 2006). For example, in one study Hertel and El-Messidi (2006) presented their subjects with homographs. Homographs are words that are spelled the same but have a negative or neutral meaning, for example "mean" could be interpreted as either nasty or average. Participants were dysphoric and non-dysphoric undergraduates who were asked to create a sentence that included the homograph. All participants completed the homograph task after completing a thought induction task. During the thought induction

task, participants were asked to think about themselves or a friend. Half of the participants in each group completed a self-focused thought induction while the remaining half completed an other-focused thought induction task. Negative interpretation bias was defined as using the negative meaning of the homograph in the generated sentence more often than using the benign meaning in creating a sentence. These authors found that dysphoric undergraduates demonstrated a negative interpretation bias only when primed to think about themselves, but not when primed to think about others, suggesting that stimuli need to be self-referent to activate depressive interpretation biases.

Applying Hertel and El-Messidi's (2006) findings to a priming paradigm, Dearing and Gotlib (2009) presented girls whose mothers had experienced at least one depressive episode during the child's lifetime (high risk) and girls whose mothers had never had a psychological disorder (low risk) with a task modeled after a priming paradigm used in the anxiety literature (Mathews & Machintosh, 2000). This priming task comprised self-referent, three sentence scenarios (e.g., "In PE, your teacher informs the class that she is starting a softball tournament. Your teacher picks four team captains and tells them to take turns picking teammates. You are certain that you will be picked _____") that remained ambiguous until the last word of the third sentence. The final word was either negative (e.g., last), benign (e.g., first) or grammatically impossible (e.g., front). Participants were instructed to indicate if the word fit the sentence grammatically. These authors defined bias as faster response latencies to make a decision about a negative word compared to response latencies to make a decision about a benign word. Dearing and Gotlib (2009) found that girls at high risk for developing depression interpreted ambiguous scenarios negatively more often than did low risk girls. Thus, a negative interpretation bias was present in individuals who were at risk for developing depression when researchers used self-referent ambiguous stimuli. However, to our knowledge, negative interpretation biases have yet to be assessed in individuals who are currently depressed using a priming task with self-referent stimuli.

In the current study, we assessed interpretation bias in individuals with dysphoria by modifying a priming task used to assess interpretation biases in social anxiety. In the word sentence association paradigm (WSAP; Beard and Amir 2009) participants are presented with an unambiguous word that is either negative (e.g., clumsy) or benign (e.g., graceful), followed by a self-referent ambiguous sentence (e.g., "You carry a tray of food at a party"). The WSAP assesses interpretation bias using both self-report (endorsement rates) and response latency measures. Participants rate how related each word is to the sentence. Higher endorsement rate (as well as faster endorsements) of negative words as being related to the sentence compared to benign words reveals a bias for negative interpretations. We modified the WSAP to present ambiguous sentences before the unambiguous words to keep the task inline with previous paradigms used in the depression literature (Dearing and Gotlib 2009; Lawson and MacLeod 1999). We hypothesized that individuals with dysphoria, when compared to non-dysphoric controls, would endorse more negative interpretations. We further hypothesized that individuals with dysphoria would respond more quickly to endorse negative interpretations than non-dysphoric controls.

## Methods

### Participants

Participants were students from a large university who were assigned to high and low dysphoric groups based on their scores on the Beck Depression Inventory-Second Edition scores (BDI-II; Beck et al. 1996). Dysphoric individuals scored 15 or above on the BDI-II. The non-dysphoric individuals scored below 9. These cutoffs have been commonly used in previous studies of dysphoric individuals (Sprinkle et al. 2002). All participants received course credit for their participation.

### Materials

#### *Self-Report Measures*

The *Beck Depression Inventory -II* (BDI-II; Beck et al. 1996) was used to assess dysphoric symptoms and to determine group membership. The BDI-II has been shown to have excellent psychometric properties in college populations (Steer and Clark 1997). There was high internal consistency on this measure in the current sample ($\alpha = .92$).

To assess anxiety symptoms, participants completed the *Speilberger State Trait Anxiety Inventory* (STAI-S/T; Spielberger et al. 1983). The STAI-S/T has been shown to have good psychometric properties. There was high internal consistency on this measure in the current sample ($\alpha = .97$).

The *Automatic Thoughts Questionnaire-Revised* (ATQ-R; Kendall et al. 1989) was used to assess negativity in automatic thoughts. The ATQ-R presents sentences (e.g., "I'm no good.") and asks participants to rate how often they have had those thoughts during the past week on a 1 (not at all) to 5 (all the time) scale. The ATQ-R has been shown to have adequate psychometric properties

(Netemeyer et al. 2002). The ATQ-R had high internal consistency in the current sample ($\alpha = .97$).

### *Stimuli for the Word Sentence Association Paradigm for Depression*

We developed a set of 170 self-referent affectively ambiguous sentences (e.g. "People always tell you to smile."). Each sentence was paired with a negative and benign associative word (e.g. "defective" or "loved"). The non-negative (i.e., benign) words are a mixture of positive and neutral related words. Positive words such as "celebration" and "great" and neutral words such as "walk" and "adequate" are all included in the stimuli list. The sentence was always paired with one of the words matched to it.

We created the ambiguous sentences based on pilot sessions where a different group of participants rated how each sentence was related to each of two words (one negative and one benign). A sentence was considered ambiguous if the average rating was equal for both words. Ambiguous sentences were considered depression relevant if students with elevated depressive symptoms considered the negative word more related to the sentence than the benign word.

## Procedure

Participants were assessed individually. They completed written informed consent followed by the demographics questionnaire and the self-report measures. Participants then completed the word sentence association paradigm for depression (WSAP-D).

### *WSAP-D*

During the WSAP-D, each participant was presented with 30 sentences randomly selected from the pool of 170 sentences created in the pilot study. Each sentence was presented only once to each participant. Moreover each participant saw only one of the paired words with each sentence. We selected a different, random set of sentences for each participant in order to ensure the generalizability of the results to depression related material. The program randomly selected the sentence and one of the paired words. On average, each participant saw 15 negative sentence word pairs, and 15 benign sentence word pairs. Each trial comprised three phases. First, a fixation cross appeared on the screen for 500 ms to direct the participant's attention to the location on the screen where the sentence would appear. Next a self-referent ambiguous sentence (e.g. "You get a new job") was presented on the screen for 1,000 ms. The ambiguous sentence was then replaced with either a negative (e.g. "Unqualified") or benign (e.g. "Qualified") associated unambiguous word. The word remained on the screen until the participants indicated whether they thought the word and the sentence were related or not by pressing a corresponding mouse button. Participants were instructed to click on the left mouse button if they thought the word was related to the sentence and to click the right mouse button if they thought the word was not related to the sentence. Participants were further instructed to respond as quickly as possible. The next trial then began with a fixation cross (see Fig. 1).

The WSAP-D measured interpretation using both endorsement rates and response latencies. Negative endorsement rates were the percentage of trials where a negative word was presented and the participant indicated that the word and the sentence were related. Benign endorsement rates were the percentage of trials when a benign word was presented and the participant indicated that the word and the sentence were related. We measured response latencies for four trial types: (1) endorsement of negative interpretations, (2) rejection of negative interpretations, (3) endorsement of benign interpretations, and (4) rejection of benign interpretations. Similar to Beard and Amir (2009), faster response latencies to endorse than to reject negative interpretations indicate a negative bias.

# Results

## Demographics

The dysphoric and non-dysphoric groups did not differ in education [$t(48) = 1.58$, $P = .43$], age [$t(48) = .93$, $P = .36$], or gender, [$\chi^2(1, N = 50) = 2.71$, $P = .1$]. The dysphoric group scored significantly higher on the BDI-II [$t(48) = 13.86$, $P < .001$, $d = 3.77$], STAI-S [$t(48) = 8.8$, $P < .001$, $d = 2.46$], STAI-T [$t(48) = 11.93$, $P < .001$, $d = 3.41$], and the ATQ-R [$t(48) = 9.31$, $P < .001$, $d = 2.69$] than the non-dysphoric group.[1] These data are presented in Table 1.

[1] While the dysphoric group is somewhat heterogeneous, those within the group who scored below a 20 on the BDI-II are more similar to those who scored higher than 20 on the BDI-II than to non-dysphoric individuals, although as expected, all indications of negative thinking and depressive symptoms are attenuated in the lower dysphoric subgroup than in the higher subgroup.

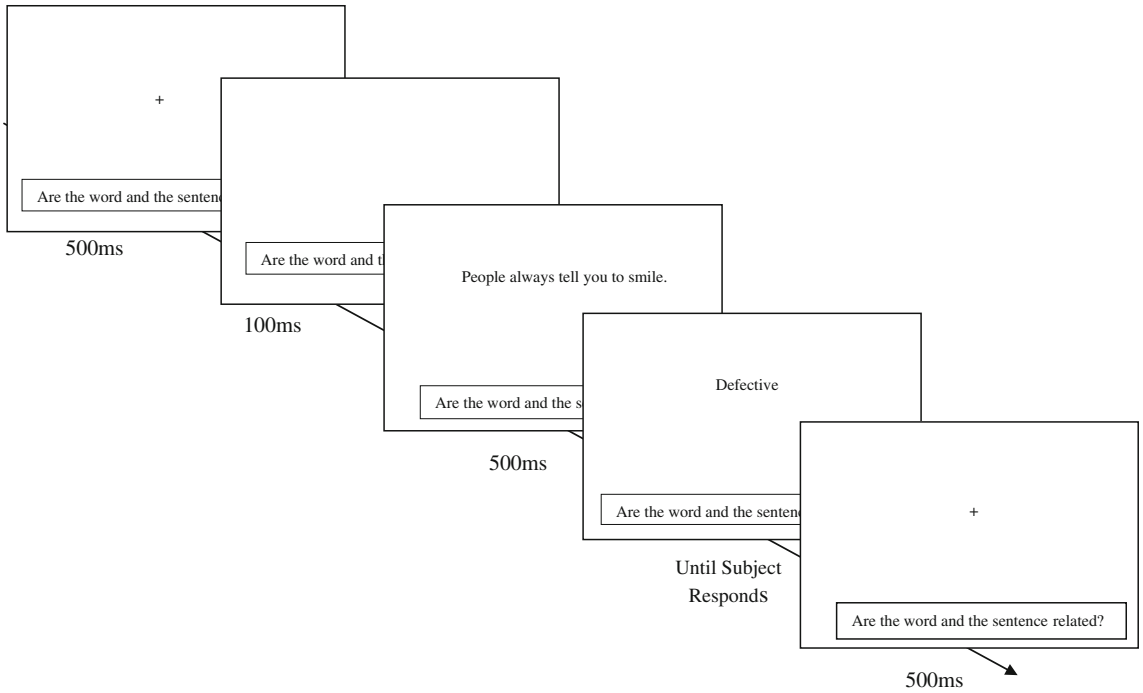


**Fig. 1** Example word sentence association paradigm for depression (WSAP-D) trial with negative word pairing

**Table 1** Demographic information among groups

| | Dysphoric ($n = 22$) | Non-dysphoric ($n = 28$) |
|---|---|---|
| Age | 18.50 (.67) | 18.86 (1.69) |
| Education | 12.71 (.85) | 13.14 (1.00) |
| Sex (% female) | 59.09 | 35.71 |
| BDI-II | 22.09 (5.76) | 5.36 (2.47) |
| STAI-S | 48.95 (8.80) | 29.86 (6.55) |
| STAI-T | 53.73 (6.44) | 31.07 (6.84) |
| ATQ-R total | 106.77 (22.16) | 60.14 (12.93) |
| ATQ-R negative | 69.00 (20.68) | 38.68 (7.56) |
| ATQ-R positive | 22.91 (5.45) | 37.89 (8.13) |

Education refers to years of schooling completed. *BDI-II* beck depression inventory-second edition, *STAI-S* speilberger state trait anxiety inventory-state, *STAI-T* speilberger state trait anxiety inventory-trait, *ATQ-R* automatic thoughts questionnaire-revised with negative and positive subscale and total scores

## Interpretation Assessment

### *Endorsement Data*

To examine endorsement rate data, we conducted a 2 (Group: dysphoric, non-dysphoric) × 2 (Endorsement type: negative, benign) ANOVA with repeated measurement on the second factor. This analysis revealed a significant main effect of Endorsement type [$F(1, 48) = 40.75$, $P < .001$, $\eta^2 = .46$], that was modified by a significant Group × Endorsement type interaction, [$F(1, 48) = 9.38$, $P = .004$, $\eta^2 = .16$]. Follow up independent samples $t$ tests revealed that the dysphoric group endorsed negative words as related to the ambiguous sentence significantly more often than the non-dysphoric group, [$t(48) = 2.74$, $P = .009$, $d = .78$] (see Table 2 for means and standard deviations). However the groups did not differ in how often they endorsed the benign words as related to the ambiguous sentences [$t(48) = 1.56$, $P = .124$, $d = .45$]. Follow up paired $t$ tests revealed that the non-dysphoric group endorsed benign interpretations significantly more than negative interpretations [$t(27) = 8.17$, $P < .001$, $d = -10.61$], while the dysphoric group endorsed benign interpretations only marginally significantly more often than negative interpretations [$t(21) = 2.02$, $P = .06$, $d = -3.12$.

### *Response Latency Data*

We calculated the median response latencies for each participant and each trial type. We then calculated group means and standard deviations based on the individual median response latencies for each trial type (Table 2). To examine the response latency data in the WSAP-D, we conducted a 2 (Group: dysphoric, non-dysphoric) × 2 (Valence: negative, benign) × 2 (Endorsement type: endorse, reject) ANOVA with repeated measurement on the last two factors. This analysis revealed a significant main effect of Endorsement type [$F(1, 48) = 7.1$, $P = .01$,

**Table 2** WSAP-D indices

| | Dysphoric ($n = 22$) $M$ (SD) | Non-dysphoric ($n = 28$) $M$ (SD) |
|---|---|---|
| Self-report indices (%) | | |
| Negative endorsement | 49.52 (1.78) | 35.73 (1.76) |
| Benign endorsement | 61.51 (1.82) | 69.83 (1.90) |
| Response latency indices (ms) | | |
| Endorsement of negative | 951 (523) | 1313 (627) |
| Rejection of negative | 1119 (526) | 1188 (719) |
| Endorsement of benign | 936 (492) | 971 (550) |
| Rejection of benign | 1190 (627) | 1342 (904) |

$\eta^2 = .13$], that was modified by an interaction of Valence × Endorsement type [$F(1, 48) = 9.9$, $P = .003$, $\eta^2 = .17$], and a Group × Valence × Endorsement type interaction [$F(1, 48) = 4.93$, $P = .031$, $\eta^2 = .09$]. No other effects were significant ($P$s > .3).

To examine further the three way interaction, we conducted separate analyses for each valence. For benign words, a 2 (Group: dysphoric, non-dysphoric) × 2 (Endorsement type: endorse, reject) ANOVA revealed a significant main effect of endorsement type [$F(1, 48) = 11.07$, $P = .002$, $\eta^2 = .19$]. All participants were faster to endorse than to reject the relatedness of the benign words to the sentences. None of the other effects were significant ($P$s > .6).

For the negative words, the 2 (Group: dysphoric, non-dysphoric) × 2 (Endorsement type: endorse, reject) ANOVA revealed a significant Group × Endorsement type interaction [$F(1, 48) = 6.51$, $P = .014$, $\eta^2 = .12$]. The main effects were not significant ($P$s > .3). To further examine this interaction, we first conducted independent samples $t$ tests. The dysphoric group was significantly faster to endorse negative interpretations than the non-dysphoric group [$t(48) = 2.08$, $P = .043$, $d = .58$], but groups did not differ in their response latencies to reject negative interpretations [$t(48) = .374$, $P = .71$, $d = .11$]. Paired $t$ tests revealed that the dysphoric group was marginally faster to endorse than to reject negative interpretations [$t(21) = 1.74$, $P = .09$], while the non-dysphoric group was faster to reject than to endorse negative interpretations [$t(27) = -2.12$, $P = .04$].

### *Interpretation Bias*

In line with previous research (Beard and Amir 2009), we calculated a negative bias score by subtracting the response latency to endorse a negative interpretation from the response latency to reject a negative interpretation. We calculated a benign interpretation bias score by subtracting the response latency to reject a benign interpretation from the response latency to endorse a benign interpretation. Positive bias scores indicate more bias towards negative interpretation and away from benign interpretations. Independent samples $t$ tests revealed that the dysphoric group had a significantly larger negative bias score than the non-dysphoric group [$t(48) = 2.55$, $P = .01$, $d = .74$], but the groups did not differ in benign bias scores [$t(48) = .624$, $P = .56$, $d = .18$] (see Fig. 2).

### *Correlate Analyses*

To examine the relationship between the different interpretation indices of the WSAP-D as well as the association of the response latency and endorsement rate indices, we calculated bivariate correlations between the negative and benign response latency biases, endorsement rates, the ATQ-R, BDI-II, STAI-T, and STAI-S. These analyses revealed significant correlations between the negative response latency bias and the negative endorsement rate and between the benign response latency bias and the benign endorsement rate. The negative response latency bias was significantly correlated with the BDI-II, but was not correlated with any other self-report measures. The negative endorsement rate was significantly correlated with all the self-report measures. The benign endorsement rate was negatively correlated with the ATQ-R but was not correlated with any other self-report measures. The negative and benign endorsement rates were not associated with each other. These analyses are detailed in Table 3.

To examine the predictive validity of the negative interpretation bias indices, we conducted a linear regression to predict BDI-II scores using the negative response latency bias, negative endorsement rate, and STAI-T as predictive variables. This analysis revealed that these predictors accounted for a significant proportion of the

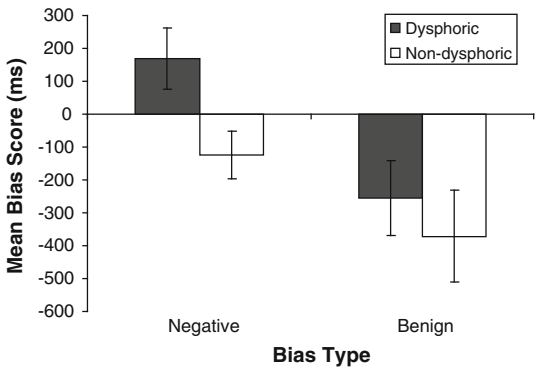


**Fig. 2** Interpretation bias scores between groups. Negative Bias = response latency (reject—endorse). Benign Bias = response latency (endorse—reject). Positive bias scores indicate faster response latencies toward negative and away from benign information

**Table 3** Correlations among modified WSAP and ATQ-R

| Measure | Reaction time bias | | Endorsement rates | |
|---|---|---|---|---|
| | Negative | Benign | Negative | Benign |
| ATQ-R | | | | |
| Total | .2 | .18 | .51** | −.3* |
| Positive | −.19 | −.21 | −.28* | .2 |
| Negative | .18 | .14 | .56** | −.3* |
| BDI-II | .34* | .15 | .46** | −.24 |
| STAI-S | .13 | .15 | .36* | −.21 |
| STAI-T | .21 | .15 | .45** | −.26 |
| Endorsement rates | | | | |
| Negative | .28* | −.2 | – | −.06 |
| Benign | .18 | −.31* | −.06 | – |
| Response time bias | | | | |
| Negative | – | −.28* | .28* | .18 |
| Benign | −.28 | – | −.2 | −.31* |

Significant correlations are denoted as follows: $*P < .05$, $**P < .001$. *ATQ-R* automatic thoughts questionnaire-revised (Kendall et al. 1989); Total, positive, and negative indicate scale scores for the ATQ-R. *BDI-II* beck depression inventory-second edition (Beck et al. 1996). *STAI-S* speilberger state trait anxiety inventory-state (Spielberger et al. 1983). *STAI-T* speilberger state trait anxiety inventory-trait (Spielberger et al. 1983)

variance in the model, [$F(3, 49) = 64.15$, $P < .001$, $R^2 = .81$]. Standardized coefficients revealed that the negative response latency bias ($b* = .14$, $t = 2.08$, $P = .04$) significantly predicted BDI-II scores in addition to the STAI-T ($b* = .83$, $t = 10.87$, $P < .001$), while the negative endorsement rate bias did not ($b* = .05$, $t = .63$, $P = .53$).

## Discussion

The purpose of the current study was to assess negative interpretation bias in currently dysphoric individuals. We examined interpretation bias using the word sentence association paradigm for depression (WSAP-D). The endorsement rate data confirmed the hypothesis that individuals with dysphoria endorse more negative interpretations than non-dysphoric individuals. However the groups did not differ in endorsement rates for benign interpretations. These results corroborate self report measures from past research (e.g., Butler and Mathews 1983), indicating that dysphoric individuals differ from non-dysphoric individuals by endorsing more negative interpretations but do not differ in benign interpretation rates.

The response latency data also supported our hypothesis that dysphoria is characterized by a negative interpretation bias. Specifically, individuals with dysphoria were faster to endorse negative words as being related to an ambiguous sentence than were individuals without dysphoria. This finding indicates that ambiguity primes negative interpretations in individuals with dysphoria. However, the groups did not differ in how quickly they rejected a relationship between a negative word and an ambiguous sentence, indicating that endorsement of negative interpretation may be a more sensitive indicator of interpretation bias in depression.

One alternative interpretation of the results presented in the current study is that the dysphoric group is more even handed in their judgments than the non-dysphoric group and therefore do not have a negative bias but rather lack a benign bias present in the non-dysphoric group. Distinguishing a negative interpretation bias from a lack of a benign bias is difficult. However, we believe in most cognitive studies this simply requires a clear definition of how bias is defined. Generally, if one defines bias within a group, and compares negative and benign interpretations, depressed individuals may lack a benign bias present in non-depressed individuals. On the other hand, if we measure negative and benign biases separately in depressed and non-depressed individuals, and define bias as a difference between the two groups, dysphoric individuals differ from non-dysphoric participants in their negative interpretations but not their benign interpretations. Of course finding that groups differ does not allow us to conclude that one group had a bias unless we assume that responses from non-dysphoric individuals are the norm and hence any responses differing from this normative response represents a bias.

The correlational analyses between the different indices of the WSAP-D and the ATQ-R, BDI-II, and STAI-S/T indicate that the negative endorsement rate overlaps with self-report measures of depressive thinking. While the negative response latency bias may reflect a more specific indicator of interpretation bias as it only correlated with the BDI-II. Further evidence that the response latency bias may be specific to depression was found with a regression analysis where both the STAI-T and response latency bias were found to predict BDI-II scores, while the negative endorsement rate bias did not contribute significantly to this prediction.

Individuals with depression show a negative interpretation bias when using self-report measures (Butler and Mathews 1983; Norman et al. 1983; Nunn et al. 1997). However, negative interpretation biases have not been found in individuals with dysphoria using priming. To our knowledge, this is the first study to examine a negative interpretation bias using priming and self-referent ambiguous stimuli. Previous investigations using semantic priming paradigms did not find a negative interpretation bias in individuals with dysphoria (Bisson and Sears 2007; Lawson and MacLeod 1999) or clinical depression (Mogg

et al. 2006). Automatic interpretation biases had been assessed in never disordered girls at risk for developing depression (Dearing and Gotlib 2009) but not in currently dysphoric participants. One difference between the current study and previous studies is the use of self-referential stimuli.

The current results may have clinical implications. For example, cognitive restructuring, which involves reevaluating negative interpretations, may be assessed using the WSAP-D. Specifically, clinicians may be able to assess negative and benign interpretation biases with the WSAP-D, which could inform restructuring sessions to focus on both areas if a client demonstrates negative biases as well as deficiencies in benign biases. Further, the WSAP-D could easily become a cognitive bias modification paradigm by introducing a feedback component to the paradigm, which could act as a restructuring tool with minimal clinician interaction (Beard and Amir 2008). For example, if the participant sees the sentence "You get a new job" followed by the negative word "Unqualified" and endorses a relationship, the participant would be given feedback indicating that the interpretation or judgment is incorrect. If the participant rejected the negative interpretation, then he would be given feedback indicating that their interpretation is correct.

Our study indicates that dysphoric individuals respond more quickly to endorse negative information than non-dysphoric individuals. Future studies should determine if slowing these responses is a viable path to symptom reduction rather than altering a negative interpretation bias.

This study has several limitations. First, we did not assess diagnosis. Although the mean BDI-II score for the dysphoric group is within the moderate depression range (Beck et al. 1996; Sprinkle et al. 2002), it is not clear whether these results can be generalized to a clinical population. Further, there is some debate as to whether subclinical depressive groups, especially undergraduate students, can be representative of clinically depressed groups. For example, Haaga and Solomon (1993) suggest that it may be inappropriate to use a dysphoric group in place of a clinically depressed group. However, Lewinsohn et al. (2000) have presented evidence supporting the continuity between self report measures of distress and depressive symptoms and diagnosed depressive episodes. Also, Vredenburg et al. (1993) reviewed the literature showing that in general, studies using dysphoric college students and patients with depression yielded comparable results. Thus findings from a high dysphoria group will not always generalize to depressed patients; however it seems reasonable to examine new measures of depressive thinking in dysphoric groups as a preliminary step towards understanding depressive thinking. Second, our dysphoric group ranged in BDI-II scores from 15 to 36. Those individuals with higher BDI-II scores were more likely to be clinically depressed than those with lower scores. However, subgroup analyses revealed that dysphoric individuals with lower scores on the BDI-II (15–19) had similar albeit less negative response patterns as those with higher BDI-II scores (20–36). Third, the WSAP-D does not distinguish between neutral and positive in the benign stimuli. It may be informative for future studies to include a neutral group of stimuli and a positive group of stimuli to assess a positive bias rather than simply a benign bias. Fourth, it is possible that rather than interpreting the ambiguous sentence negatively, dysphoric individuals were simply faster to respond to the negative word. Although the presence of ambiguity was not manipulated in the current study, dysphoric individuals did not differ from non-dysphoric individuals when rejecting a negative word's relationship to the sentence. The groups only differed in response latencies to endorse negative interpretations, suggesting that the dysphoric group had already determined that the ambiguous sentence was negative while the non-dysphoric group had to consider if the negative word was related to the ambiguous sentence. Moreover, the standard deviations for the response latency data indicate that there was a high degree of variability in response time in both the dysphoric and non-dysphoric groups. There is greater variability in the dysphoric group, however this is to be expected as dysphoric individuals tend have more variable response times (Lawson et al. 2002; Wells and Beevers 2010). This variability may be due to the relatively small number of trials for each trial type or to order effects as we changed the sentence/word presentation order from the previous study using this paradigm (Beard and Amir 2009). Another possibility is that this paradigm differs from other reaction time tasks in that participants are asked to make a judgment about meaning rather than a basic decision.

Finally, although the results of the regression analyses suggest that the negative response latency bias is related to depressive symptoms when controlling for level of anxiety, we did not include an anxious control group. Future investigations would benefit by including an anxious control group to examine the specificity of interpretation biases.

In summary, although negative interpretation biases have been clinically recorded and accepted as part of depressotypic thinking for decades (Beck 1967, 1976, 1987, 2008; Bower 1981, 1987; Teasdale 1983), online biases have been difficult to assess in interpretation (for reviews see Gotlib and Joorman 2010; Wisco 2009). In the current study we assessed negative interpretation biases in dysphoric individuals using response latencies. Thus the WSAP-D may be a useful tool in the assessment of depressotypic thinking. Further, with minimal modification,

the WSAP-D could become an interpretation modification paradigm, that could simultaneously modify and assess interpretation biases. Future research should address the relationship between negative beliefs and the interpretation of ambiguity in depression both for specificity and symptom relationships.

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