

# Dispositional Influences on Priming for Emotional Words

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Isolating a vulnerability towards depression is important for understanding the origins of the disorder and to produce more effective treatment options. The negative affective priming (NAP) paradigm has been used to measure cognitive attentional biases characteristic of depression. Two accounts of NAP are deficient inhibition and facilitation of negative material. Both ignored repetition (IgnRep) and attended repetition (AttRep) trials were included to test facilitation and inhibition of negative words, respectively. To dissociate the effects of word valence, 93 female undergraduate students at SFU completed a modified NAP task that included neutral words. NEO-PI-R depression (N3) and positive emotions (E6) subscales were used to better isolate depressed trait from state influences. Results showed that all emotional words had a facilitation effect, regardless of valence. Importantly, an inability to ignore negative words did not characterize depressed trait, as previously reported. A differential effect of valence was found in the AttRep condition but was the reverse of previous findings, with facilitation for positive words. This may represent a subconscious compensatory effort to counteract the effects of a depressed trait, as well as a dominant threat detection system in the positive trait. These results are more consistent with an emotion regulation account of negative priming than the inhibitory account typically used in the NAP literature.

Keywords: negative affective priming, inhibition, positive priming, attention facilitation, emotional regulation

Depression is highly recurrent, suggesting there may be stable, dispositional differences that contribute to the maintenance of this disorder in certain individuals (Gotlib & Krasnoperova, 1998). Identifying potential vulnerability markers for depression is important for improving the understanding of etiology and treatment. Since the symptoms of depression include alterations in cognition such as impaired attentional control, difficulties concentrating, and ruminatory thought patterns, many theorists posit that the vulnerability for depression is cognitive in nature (Mathews & MacLeod, 1994; American Psychological Association, 2013).

A particularly influential theory is

Beck's (1967, 1976) content-specificity theory, which proposes that depression is characterized by negative schemas; cognitive structures that bias attention and information processing in favour of negative information. These negative schemas may underlie the negative ruminatory cycle; the constant "recycling" of negative thoughts that prevents the bad mood from receding (Gotlib & Joormann, 2010). Essentially, negative schemas increase the salience of negative items in the environment and lead to an overrepresentation of negative material in working memory (WM), ultimately causing depressed individuals to continually dwell on negative information (Gotlib & Joormann, 2010). Such

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rumination leads to deficits in concentration, memory, and attention, as well as the more general cognitive profile of depression (Joormann, 2006).

An inability to inhibit negative material may underlie the development of the negative schemas and thus, may represent a significant factor in the onset and maintenance of depression (Mathews & MacLeod, 2005). Recently, researchers have used the Negative Affective Priming (NAP) paradigm to examine inhibitory patterns in depression. During the task, two consecutive slides are presented, a prime followed by probe, each containing two words in the centre of the screen. Subjects are required to indicate the valence of the target word (e.g., "please indicate if the blue word is positive or negative"), while ignoring a distractor word of the opposite valence. The relationship between the prime and the probe slide is important at analysis. Ignored repetition (IgnRep) trials occur when the prime distractor and probe target are valence congruent. On the other hand, control trials occur when the prime distractor and probe target are valence incongruent. The priming effect (PE) is defined as the difference in reaction times (RT) between experimental and control trials. In this case, the PE is more accurately labeled a NAP effect and can be calculated by subtracting RTs on control trials, RTs on IgnRep trials, and is thought to measure the cost associated with previously ignoring a word of the same valence as the probe target. Because participants are typically slower to respond on IgnRep trials (Wentura, 1999; Joormann, 2004), this NAP effect is thought to indicate the strength of inhibition associated with each word valence (Joormann, 2004). Importantly, depressed individuals show a severely reduced NAP effect for negative material (Frings, Wentura & Holtz, 2007; Joormann & Gotlib, 2010; Joormann, 2004; Joormann, 2006;

Zetsche & Joormann, 2011; Dai, Feng & Koster, 2011; Leung, Lee, Yip, Li, & Wong, 2009) or even a facilitation effect, similar to that expected from a positive priming condition (Joormann, 2004). This has been interpreted as an inability to inhibit negative material (Joormann, 2004), which is consistent with other explanations of rumination (see Bradley, 1997). However, this explanation is subject to several criticisms.

### **Facilitation versus Inhibition**

The results from the NAP task can be explained by both facilitatory and inhibitory mechanisms of selective attention. While the deficient inhibition hypothesis claims that depressed individuals are unable to disengage from negative material, it is also possible that the processing of negative material is enhanced to the exclusion of positive material (Dai, Feng, & Koster, 2011). To tease these explanations apart, attended repetition (AttRep) trials should be used in addition to IgnRep trials, in order to measure facilitation and inhibition, respectively (see Figure 1). On AttRep trials, the prime target and probe target are valence congruent, and therefore subjects should be quicker to respond to the probe target. Very few studies add both types of PEs to the NAP task. In those that do, depressed individuals show a facilitation effect to negative stimuli on AttRep trials, which supports the facilitation account of NAP (Goeleven et al., 2006; Dai, Feng, & Koster, 2011; Leung et al., 2009). However, an inhibition effect on IgnRep trials to negative targets is only demonstrated in some studies (Goeleven et al., 2006; Dai, Feng, & Koster, 2011). In others, both dysphoric (mildly depressed) and non-dysphoric participants showed a reduced NAP effect to negative stimuli (Leung et al., 2009), which supports the deficient inhibition account of the NAP effect.

## Isolating Depressed Trait

While the Beck Depression Inventory (BDI) has been used to isolate a vulnerability towards depression (e.g., Fring, Wentura, & Holtz, 2007), the questionnaire likely measures a combination of current mood state and depressed trait. In accordance with DSM-IV criteria (American Psychological Association, 2013), the questionnaire measures severity of depressive symptoms over a two-week period. This includes a number of items (e.g., feelings of sadness and worthlessness) that reflect mood state rather than depressed trait. Consequently, BDI scores may vary along with mood state, making it impossible to confidently isolate the effects of depressive trait by grouping subjects according to BDI score.

Although no studies were found directly testing this logical inference, BDI scores have been shown to decrease with subsequent administration (Sharpe & Gilbert, 1998). Two possible explanations exist. First, it may be due to increased familiarity with the testing environment. Anxiety from the unfamiliar setting causes a more negative mood state during the first administration. This makes negative emotions more salient, leading to more negative responding (Choquette & Hesselbrock, 1987). However, in a subsequent session, subjects are less anxious due to increased familiarity with the testing environment. The result is less salient negative emotions and consequently, less negative responding. Second, it is possible that subjects deliberately used coping mechanisms between sessions to reduce the negative mood state. Because negative emotions are more salient during the first testing session, subjects are motivated to reduce the negative emotions by employ coping mechanisms, leading to a more positive mood in subsequent sessions and

thus, less negative responding (Sharpe & Gilbert, 1998). Either explanation reflects a sensitivity of the BDI to mood state. Although this is by no means conclusive evidence against the BDI as a measure of depressed trait, it does offer a cautionary note.

## Dissociating Priming Effects for Negative and Positive Words

Additionally, it remains uncertain whether only processing of negative stimuli is altered in depression. A substantial number of studies have emphasized the independence of valence, proposing that only processing of negative material is altered in depression (Gotlib & Meyer, 1986; Watson, Clark, & Carey, 1988). For example, negative stimuli become significantly less salient, while positive stimuli become only slightly more salient in previously depressed individuals (McCabe & Gotlib, 1993). However, numerous studies also demonstrate that emotional words have a processing (Kanske & Kotz, 2007; Kousta, Vinson, Vigliocco, 2009) and encoding (Zeelenberg, Wagenmakers, & Rotteveel, 2006) advantage, regardless of the polarity of the emotional valence. Given this processing advantage of emotional material more generally, it seems unlikely that only processing of negative material is altered. More importantly, the diagnostic criteria of depression equate absence of positive affect and the presence of negative affect (American Psychological Association, 2013). Thus, the effects of positive and negative material may not be as easily differentiated as previously thought.

This is particularly problematic in the NAP task. Previous versions of the NAP task directly contrast positive and negative material (Joormann & Gotlib, 2010; Joormann, 2004; Joormann, 2006). Thus, on control trials, participants ignored an item of the opposite valence.

For example, on control trials for negative words, the previous distractor was a positive word. As a result, it is impossible to determine if alterations in the NAP effect are driven by altered processing of positive or negative words. To dissociate these effects, it is necessary to include neutral words.

### **The Current Study: Dissociating Depressed Trait from Positive Trait**

The present study addressed the above concerns by comparing both AttRep and IgnRep priming scores for positive, negative, and neutral words in participants with a propensity towards depression versus those with a propensity towards positive emotions. Additionally, instead of the BDI, the NEO Personality Inventory Revised (NEO-PI-R) depression (N3) and positive emotions (E6) subscales were used to isolate depressed and positive trait in a non-clinical population of female undergraduate students. The NEO-PI-R is a personality test that requires participants to indicate how they typically think and act. This encourages the participant to focus on more stable aspects of themselves, and is therefore a more reliable measure of dispositional factors. This led to three a priori hypotheses: First, we expected a facilitation effect (positive PE) for AttRep trials and an impeding effect (negative PE) for IgnRep trials. Second, the difference between the PE for AttRep trials and IgnRep trials would be greater for emotional words in both groups. Third, relative to the positive trait group, the depressed trait group would show a reduced PE for negative words on IgnRep trials and an increased PE for negative words on AttRep trials, while there would be no group differences on either priming trial for positive words. Thus, the depressed trait group would demonstrate both a facilitation and inhibition bias for negative words.

## **Method**

Data for the present manuscript is taken from a larger study on the interaction between mood and dispositional factors in a non-clinical population of female undergraduate students and their influence on priming for emotional material. This study collected scores on the BDI-II, NEO-PI-R N3 and E6 subscales, NEO-Five Factor Inventory (NEO-FFI), and State Trait Anxiety Inventory (STAI). Participants also completed a medical history questionnaire and a modified NAP task under positive, negative, and neutral mood states.

### **Participants**

Ninety-three female Simon Fraser University undergraduate students ( $M_{Age} = 19.74$ ,  $SD = 2.55$ ,  $Min = 17$ ,  $Max = 37$ ) with normal or corrected to normal vision were included in this study and received course credit for their participation. Students reporting any history of depression or anxiety on the medical history questionnaire were excluded from the study, since dispositional and mood state factors are inevitably conflated in such participants. To avoid logical and methodological concerns around median split grouping methods (see McClelland, Lynch, Irwin, Spiller & Fitzsimons, 2015; Rucker, McShane & Preacher, 2015), a quartile split method was used, based on the NEO-PI-R subscale scores. Those scoring above the third quartile on the NEO-PI-R N3 ( $> 17$ ) and below the first quartile on the NEO-PI-R E6 ( $< 21$ ) were included in the depressed trait (DT) group ( $N = 15$ ,  $M_{Age} = 19.47$ ,  $SD = 1.19$ ,  $Min = 18$ ,  $Max = 21$ ). Conversely, those scoring above the third quartile on the NEO-PI-R E6 ( $> 27$ ) and below the first quartile on the NEO-PI-R N3 ( $< 10$ ) were included in the positive trait (PT) group ( $N = 16$ ,  $M_{Age} = 20.31$ ,  $SD = 1.78$ ,  $Min = 18$ ,  $Max = 24$ ).

## Materials

Words were selected from the Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999). 64 positive, 64 negative, and 50 neutral words were selected based on valence rating and controlling for length and arousal rating. Words with a valence rating above 6 were considered for the positive list, between 4 and 6 for the neutral list, and below 4 for the negative list. Any words that may be associated with fear (e.g., snake, spider, etc.) were excluded from consideration. The final lists had an average valence of 7.54 ( $SD = .48$ ) for positive words, 5.19 ( $SD = .51$ ) for neutral words, and 2.55 ( $SD = .66$ ) for negative words. Average length was 6.55 characters (positive = 6.8, neutral = 6.44, negative = 6.3). Average arousal rating was 5.4 (positive = 5.6, neutral = 4.88, negative = 5.2). The word lists did not differ significantly with regards to word length (pos-neg:  $p = .68$ , neu-pos:  $p = .12$ , neu-neg:  $p = .14$ ). However, neutral words were significantly less arousing than both positive and negative words ( $p < .001$ ).

**NEO-PI-R.** The N3 and E6 subscales from the NEO-PI-R were used to measure a subject's propensity towards depression and positive emotions. Although the two 8-item subscales were mixed into a single 16-item questionnaire to reduce reactivity, a separate score was calculated for each scale to provide both a measure of the subject's trait depression, as well as their trait positive emotions. Subjects indicated how well a statement describes them on a 5-point scale from 0 (strongly disagree) to 4 (strongly agree), with some items reverse coded to avoid malingering. Thus, scores on each scale can range from 0 to 32, with higher scores indicating a greater propensity to respond to situations in the corresponding manner. In a sample of 635 adults, these measures have good

internal consistency (N3 coefficient  $\alpha = .83$ , E6 coefficient  $\alpha = .79$ ) and inter-rater reliability (N3 cross-observer  $r = .51$ , E6 cross-observer  $r = .43$ ; McCrae, Martin & Costa, 2005). No individual validity measures are available for these scales. However, the larger personality index (NEO-PI-R) is partially based on Jungian theory, and thus important measures correspond to the Meyers-Briggs Trait Inventory (MBTI).

**BDI-II.** The BDI-II is a 21-item questionnaire designed to measure the severity of depressive symptoms during the preceding two weeks. Each item contains four statements and subjects indicate which best describes their experiences over the past two weeks. Responses corresponding to no symptoms are assigned a score of 0, while severe symptoms are scored 3. Thus, scores can range from 0 to 63, with higher scores indicating more severe depressed symptoms. The BDI-II is well established as a reliable and valid measure of depressed symptoms (outpatient coefficient  $\alpha = .92$ ,  $n = 500$ ; correlation with Hamilton Psychiatric Rating Scale for Depression  $r = .71$ ,  $n = 87$ ; Beck, Brown & Steer, 1989).

**STAI.** The STAI is a self-report scale that contains two independent anxiety measures, each consisting of 20 statements. The STAI A-Trait scale instructs subjects to describe how they generally feel, while the STAI A-State scale instructs participants to describe how they feel at a particular time. Each statement is rated on a 4-point scale and thus, scores can range from 20 to 80. On some statements, a high rating is assigned a score of 0, while on others, a high rating is assigned a score of 4. The STAI is well established as a reliable and valid measure of anxiety with high internal consistency (reliability scores range from .93 and .96; Chronbach's  $\alpha$  reliability scores range between .87 and .92; Goeleven et al., 2006).

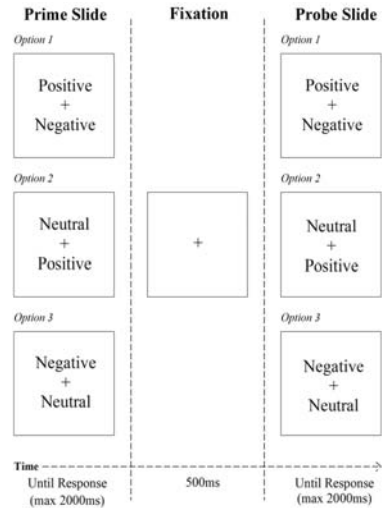
## Design

During the modified NAP task (see Figure 1), participants saw a fixation cross appearing for 500 ms, alternating with response slides containing two words. Response slides remained on the screen until subjects responded. Subjects were seated approximately 60 cm from the screen. Letter dimensions were approximately 1 cm x 1 cm and words were presented 1 cm apart in the centre of the screen. Each slide contained both a red and a blue word, indicating which word was to be ignored (i.e., distractor) and which was to be attended (i.e., target). The attended colour was counter-balanced, such that half of the participants attended to the blue word and half attended to the red word. A slide could contain a positive and a negative word, a neutral and a positive word, or a negative and a neutral word, with target or distractor randomly assigned. Each trial was analyzed relative to the valence of the previous target, since each slide primed the subsequent slide. Thus, for positive and negative targets, four trial types were possible; AttRep (the previous target shared a valence with current target), IgnRep (the previous distractor shared a valence with current target), AttRepCont (the previous target was neutral and previous distractor did not share a valence with the current target), and IgnRepCont (the previous distractor was neutral and previous target did not share a valence with the current target). For neutral targets, only three trial types were possible; AttRep, IgnRep, and Control. Control trials occurred when the previous slide contained both a positive and a negative word, regardless of target/distractor designation. Within each block, participants responded to each word type (positive, neutral, and negative) 50 times and the order of the four conditions was randomized. Thus, each block contained 150 trials, for a total of

450 experimental trials and 15 practice trials. RT and accuracy of responses to the target word were recorded and analyzed.

## Procedure

After obtaining informed consent, subjects completed a medical history questionnaire, NEO-FFI, and the NEO-PI-R subscales, before moving on to the NAP task. Following the task, subjects completed the BDI-II and the STAI before being debriefed. Only the NEO-PI-R subscales were used for identifying the DT and PT groups. The BDI and STAI were used to compare the groups on other potentially influential factors.



**Figure 1:** Modified NAP task used in the present study. Two priming conditions with corresponding control were used for each word type. The PEs (AttRep and IgnRep) were calculated by subtracting RTs to the control trials from RTs to priming trials.

## Statistical Analysis

Independent samples t-tests were conducted to compare the groups on

the depression and positive emotion measures, as well as other relevant demographics. Six independent samples t-tests were conducted comparing the groups on age, BDI-II, depression, positive emotions, state anxiety, and trait anxiety scores. Family-wise error was capped at  $\alpha = .30$ , setting the per test probability level for significant effects at  $\alpha' = .05$ .

The PE was calculated by subtracting RTs on control trials from the corresponding priming trials (e.g., AttRep-AttRepCont) and was calculated for each word valence. This provides a measure of the cost/benefit associated with previously attending to or ignoring a word of the same valence as the current target. The PE was entered as the dependent variable in the RT analyses.

A 2 (Priming Type: AttRep, IgnRep)  $\times$  3 (Word Valence: positive, neutral, negative) within-subjects Analysis of Variance (ANOVA) was conducted on the NAP scores. This was followed by six paired sample t-tests comparing specific conditions. Family-wise error was capped at  $\alpha = .30$ . Thus, the probability level for significant effects was set at  $\alpha' = .043$  for all seven tests. To better isolate the effect of group membership

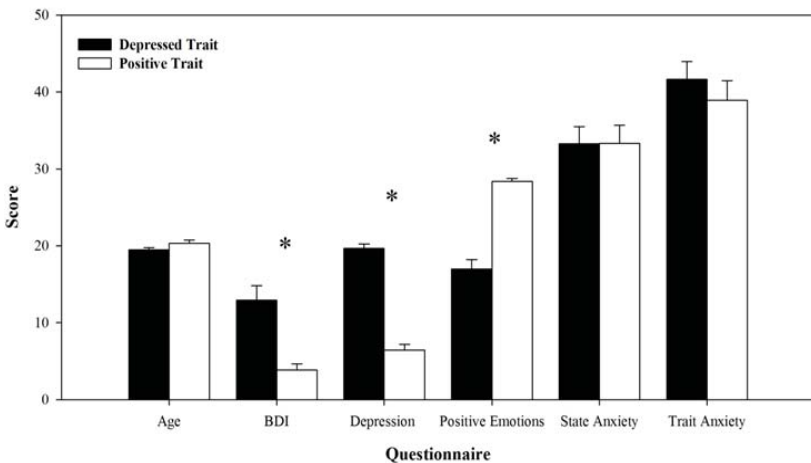
on processing of emotional words, this analysis was performed separately in the DT and PT groups.

To compare the groups directly, six independent samples t-tests were conducted on the priming effects for each trial type on all three word valences. Family-wise error was capped at  $\alpha = .30$ , setting the per test probability level for significant effects at  $\alpha' = .05$ .

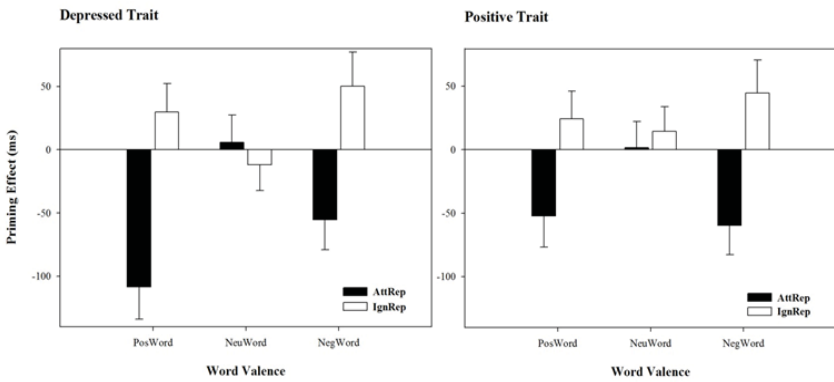
Although a family-wise error rate of  $\alpha = .30$  is quite high, this was not deemed to be problematic for the present study. The study was designed to maximize the distinction between various levels of the independent variables. As a result, only medium to large effect sizes were of interest. Type 1 errors are less likely to occur under these conditions and therefore, a higher family-wise error rate can be accommodated.

## Results

Independent samples t-tests (see Figure 2) confirmed that the groups were significantly different on both the NEO-PI-R N3 ( $t_{27,47} = 14.33, p < .001$ ) and E6 scores ( $t_{16,74} = -8.82, p < .001$ ). This indicates that the quartile split grouping



**Figure 2:** Differences between the DT and PT groups on several relevant demographics. Error bars reflect standard error. Significant effects are indicated by asterisk,  $*p < .001$ .



**Figure 3:** PEs for each word valence for both groups. Error bars reflect standard error.

method was effective. Not surprisingly, BDI scores were also significantly different between the two groups ( $t_{29} = 4.52, p < .001$ ). Importantly, the groups did not differ in terms of age ( $t_{29} = -1.55, p = .13$ ), state anxiety ( $t_{29} = -.01, p = .99$ ), or trait anxiety ( $t_{29} = .80, p = .43$ ).

### Depressed Trait Group

A 2 (Priming Type: AttRep, IgnRep)  $\times$  3 (Word Valence: positive, neutral, negative) within-subjects ANOVA was conducted on the DT group (see Figure 3). The main effect for Word Valence was not significant ( $F_{1,97,27.60} = 1.26, p = .30, \eta_p^2 = .08$ ). Additionally, the main effect for Priming Type ( $F_{1,14} = 20.61, p < .001, \eta_p^2 = .60$ ) and the two-way interaction ( $F_{1,83,25.67} = 7.54, p = .003, \eta_p^2 = .35$ ) was significant. Follow-up t-tests indicated that the PE on AttRep trials to positive words differed significantly from neutral words ( $t_{14} = -2.59, p = .02$ ). No other significant differences were found.

### Positive Trait Group

A second 2 (Priming Type: AttRep, IgnRep)  $\times$  3 (Word Valence: positive, neutral, negative) within-subjects ANOVA was conducted on the PT group (see Figure 3). Again, the main effect for Word Valence was not significant ( $F_{1,57,23.51} =$

$.65, p = .50, \eta_p^2 = .04$ ), while the main effect for Priming Type was significant ( $F_{1,15} = 24.47, p < .001, \eta_p^2 = .62$ ). However, the two-way interaction was not significant ( $F_{1,67,25.07} = 3.33, p = .06, \eta_p^2 = .18$ ). Follow-up t-tests indicated that the PE on AttRep trials to negative words differed significantly from neutral words ( $t_{15} = 2.28, p = .04$ ). No other significant differences were found.

Importantly, as expected, only large effects sizes ( $\eta_p^2 > .35$ ) were observed for significant effects, supporting previous speculations that type 1 errors would be unlikely under this design.

### Direct Group Comparison

Although a different pattern of results was observed within each group, t-test comparisons showed that the groups did not differ significantly in any of the six conditions.

### Discussion

The main aim of this study was to distinguish priming effects for positive and negative words in participants with a propensity towards depression (DT group), relative to those with a propensity towards positive emotions (PT group). Our study broadened the scope of existing NAP literature by using the NEO-PI-R to isolate the depressed trait more



effectively and by including AttRep trials, in addition to IgnRep trials. As expected, a facilitation effect on AttRep trials and an impeding effect on IgnRep trials was observed, suggesting that the modified NAP task measured both AttRep and IgnRep effects accurately.

As predicted, the facilitation effect was most evident for emotional words. This is consistent with a series of studies reporting a processing advantage of emotional material, regardless of valence (Kanske & Kotz, 2007; Kousta, Vinson, Vigliocco, 2009; Zeelenberg, Wagenmakers, & Rotteveel, 2006; Murray, 2007; Anderson, 2001). According to Lang and Bradley (2013), attention can be involuntarily drawn towards a stimulus by two different motivational systems; an approach/appetitive system and a withdrawal/aversive system, neither of which is dominant. Our results are consistent with this motivational hypothesis, suggesting that individuals are equipped with an evolutionary mechanism that facilitates the processing of emotional stimuli due to their motivational value. This may be explained by recent findings that show a greater degree of similarity in the representation of positive and negative affect in neural circuits (Murray, 2007).

However, despite the general processing advantage that emotional words have over neutral words, an asymmetry of valence still exists between the groups. In particular, while a significant processing advantage for positive words was observed in the DT group, a similar significant facilitation effect for negative words was observed in the PT group. These results suggest that valences are independent, as previously suggested (Gotlib & Meyer, 1986; Watson, Clark, & Carey, 1988; McCabe & Gotlib, 1993) and that neither motivational system is universally dominant, since more immediate environmental factors determine motivation.

Contrary to expectations, no significant group differences were observed in the priming effects for negative words. This is not in line with previous studies using the NAP paradigm that show a greater inhibition of negative material in DT groups (Frings, Wentura & Holtz, 2007; Joormann & Gotlib, 2010; Joormann, 2004; Joormann, 2006; Zetsche & Joormann, 2011; Dai, Feng, & Koster, 2011; Leung et al., 2009). The current results suggest that deficient inhibition of negative material does not constitute a vulnerability towards depression, as previously reported. The complete lack of group differences potentially supports previous research that indicates that there is no automatic attention bias in depressed individuals (Gotlib et al., 1988; Williams, 1988; Mogg et al., 1993). Thus, previous results showing altered processing of negative words likely depended on the severity of depressed symptoms, which includes more transient mood state effects.

Interestingly, relative to neutral words on AttRep trials, the DT group showed greater facilitation for positive words, while the PT group showed greater facilitation for negative words. This is inconsistent with previous studies, which reported that in the positive condition, depressed individuals show facilitation, or a processing bias for negative stimuli (Leung et al., 2009; Dai, Feng, & Koster, 2011), and no significant differences for positive words (Dai, Feng, & Koster, 2011). This counterintuitive finding is also incongruent with the results of previous literature on mood-congruent attentional biases, which generally demonstrate that depressed individuals allocate their attention towards negative stimuli (Mineka, Watson, & Clark, 1998). However, this result is consistent with two studies that failed to find negative interference in depressed individuals on supraliminal (unmasked) conditions (Mogg et al., 1993; Bradley, 1994). To ex-

plain their findings, it was proposed that interference of negative words in AttRep conditions is not a consistent feature of depression, and that this uncertainty stems from the influence of strategic and controlled processes that may operate in this condition. Thus, perhaps in an attempt to compensate for a pervasive negative mood, the DT group subconsciously emphasized positive material as an emotion-regulation strategy (Gotlib & Joormann, 2010).

Therefore, the facilitation for positive words in the DT group can be explained as a compensatory mechanism. This group reported significantly greater BDI scores than the PT group, suggesting they were experiencing more negative emotions. Biasing responses towards positive material may be a subconscious attempt to counteract the effects of this negative mood state. The reduced inhibition for positive words sometimes observed in remitted patients (Joormann & Gotlib, 2010; Joormann 2004) has been interpreted as a subconscious effort to counteract a negative mood by over attending to positive words. Because the current study used a subclinical sample, the effects may not be as severe as in remitted patients, and therefore not be observable in IgnRep trials. Instead, it may be that the initial predisposition towards negative words may be observed in AttRep trials. As this cognitive pattern is strengthened, the compensatory effects would then also be seen in IgnRep trials. It is possible that a similar process is at work in subclinical populations, and that these individuals may be subconsciously overcompensating in an attempt to avoid a negative mood state. Thus, it is only as the negative bias is strengthened that compensation becomes observable in IgnRep trials.

Such subconscious compensatory mechanisms in remitted and sub-clinical populations are more indicative of an emotion regulation account of depres-

sion. Given the general avoidance of negative emotions shown by most individuals, people must naturally employ compensatory mechanisms to prevent descending into a negative, or sad mood state (Koster, Lissnyden, Derashan, & De Readt, 2011). Likely, the sad mood and corresponding negative thoughts conflict with a person's tendency towards positive emotions (Drace, Desrichard, Shepperd & Hoorens, 2009; Deldin, Kim, Casas & Best, 2001). The resulting conflict signal initiates some compensatory mechanism that breaks the negative ruminatory cycle. The fact that this does not happen in depressed individuals could be due to poor emotion regulation, where frequent and excessive negative emotions become part of a person's self-concept and thus, no conflict occurs. Consequently, the reduced inhibition for negative words so frequently reported in high DT groups might represent an already broken system, rather than the origins of the problem. If the emotion regulation hypothesis is correct, then these subjects are already past appropriate compensatory behaviours. They will have incorporated negative emotions into their self-concept, so no conflict signal was engaged and rumination on negative material is possible. Thus, it is likely that the traditional NAP design examines the consequences rather than the causes of depression.

The facilitation to negative words in the PT group suggests that this group may be more greatly influenced by their innate threat detection system, and thus place greater emphasis on environmental factors (Kousta, 2009). According to the automatic vigilance model, this system is an evolutionary mechanism that equips humans with the ability to allocate attentional resources to negative stimuli at an early stage, rather than positive stimuli, since this is more critical for survival (Pratto, 1991). In the presence of negative stimuli, the processing

of other stimuli may also be impeded as a mechanism of defence, while processing of negative words is facilitated (Algolm, Chajut, & Lev, 2004).

Four issues need to be addressed in order to clarify the results. Firstly, care should always be taken when generalizing from subclinical to clinical populations. This study used non-clinically depressed students to avoid various confounds, and to fully differentiate mood state and depressed trait. However, the populations are by no means comparable, and similar studies should be conducted using clinical samples. Secondly, the data is drawn from a study that included positive, negative, and neutral mood inductions, and is thus an aggregate across these mood states. However, the effects of a positive and negative induced mood are likely to cancel each other out, so confounding effects are not likely to be observable. Thirdly, comorbid anxiety may affect some of the results. In the present study, anxiety scores (as measured by the STAI) were only used to rule out possible influences of anxiety. According to Mathews & MacLeod (1994), many of the studies that found an automatic negative bias did not control for anxiety levels. The effects may be explained by the frequent comorbidity of these disorders, as well as their high correlation on self-report scales (Gotlib, 1984; Watson, Clark, & Carey, 1988; Mineka, Watson, & Clark, 1998; Lonigan, Phillips, Hooe, 2003). Thus, anxiety, which studies have found to be associated with an automatic negative disinhibition deficit (Mathews & MacLeod, 2005), may be driving these effects. Future studies should examine the effect of anxiety on NAP scores to further illuminate the differences between anxiety and depression, and to allow for more targeted interventions in the case of comorbidity. Fourthly, the use of both positive and negative priming trials (AttRep and IgnRep, respectively) resulted

in fewer trials per condition. It is possible that differences were observed in AttRep trials simply because positive priming is a stronger effect. With reduced trials in the IgnRep conditions and a smaller effect size, it is possible that power was not sufficient to detect the differences. This may account for the lower levels of arousal that caused a positive bias in the DT group. Future studies should separate these trial types to increase power for both.

## Conclusion

The results from this study suggests that the mechanisms underlying mood-congruent biases depend largely on dispositional factors but that depressed individuals may not be characterized by a negative bias as previously thought. More importantly, biases are first obvious in stronger priming conditions, such as on AttRep trials. On these trials, individuals vulnerable to depression may initially engage in compensatory mechanisms to improve their mood, while individuals with positive affect may be more affected by their innate threat detection system.

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