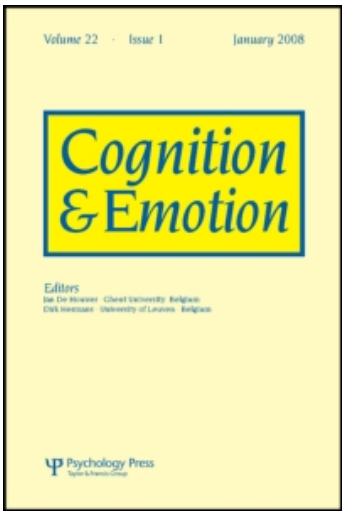

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Is dysphoria about being *red* and *blue*? Potentiation of anger and reduced distress tolerance among dysphoric individuals

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Emotion dysregulation has been implicated in a variety of psychopathologies including depression. However, few empirical studies with depressed samples have been completed, particularly involving negative emotions such as anger. The current study explored two aspects of emotion regulation by testing dysphoric individuals' emotional reactivity and ability to tolerate distress. Specifically, stably dysphoric ($n = 28$) and non-dysphoric ($n = 35$) individuals participated in two distressing laboratory tasks, the Paced Auditory Serial Addition Task (PASAT) and the Mirror Tracing Persistence Task (MTPT). The dysphoric group reported greater anger following each task and displayed less distress tolerance on the MTPT than the non-dysphoric group. Findings suggest that sad mood can potentiate anger and reduce distress tolerance. Results are consistent with the idea that difficulty regulating negative emotional states may contribute to the maintenance of dysphoria.

Keywords: Dysphoria; Depression; Emotion regulation; Distress tolerance; Anger.

Major Depressive Disorder, a mood disorder that typically involves prolonged episodes of sadness, has recently been conceptualised as a disorder of emotion regulation (e.g., Kring & Bachorowski, 1999). Although there is empirical support for the role of emotion dysregulation in many other psychopathologies such as substance abuse (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), anxiety (Mennin, Heimberg, Turk, & Fresco,

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2002), bipolar disorder (e.g., Green, Cahill, & Malhi, 2007), and borderline personality disorder (Linehan, 1993), its role in depression has received relatively less attention (Gross & Muñoz, 1995). Given that a persistent sad mood is a hallmark symptom of depression, it is very likely that emotion dysregulation has an important, if not central, role in the disorder.

Before reviewing the impact of depression on emotion regulation, the terms mood and emotions must first be defined. The term *emotion* describes responses that are adaptive, brief in duration, intense, and occur in response to a meaningful stimulus. *Moods* are slow moving, weakly linked to specific elicitors, and capable of lasting anywhere from hours to days. Rosenberg (1998) suggests that moods and emotions are mutually reinforcing. That is, if an emotion matches the current mood, this emotional state will be potentiated. In the case of negative moods (e.g., depression) and a negative emotion, this is referred to as negative potentiation. According to this theory, an underlying depressed mood would serve to amplify other negative emotions. Therefore, potentiation refers to the amplification of negative emotions due to an existing negative mood. Conversely, Rottenberg, Gross, and Gotlib (2005a) have posited a different view of this relationship. They suggest that a depressed mood serves to blunt all emotional reactions—both positive and negative (Emotion Context Insensitivity; ECI) (Rottenberg & Gotlib, 2004). An underlying depressed mood would therefore attenuate other negative emotions.

Although both these theories suggest difficulty regulating emotional reactions appropriately, a recent meta-analysis suggests there is more support for the ECI theory than negative potentiation (Bylsma, Morris, & Rottenburg, 2008). For example, depressed individuals report smaller changes in subjective sad emotion in response to a sad film (Rottenberg, Kasch, Gross, & Gotlib, 2002). These findings have also been observed in subjective response to participants' own sad thoughts (Rottenberg, Joormann, Brozovich, & Gotlib, 2005b).

However, Rottenberg (2005) identified several (untested) instances when negative mood potentiation may occur. For instance, he suggested that a tense mood can heighten an anxious reaction and an irritable mood can potentiate an angry outburst. Of these, the emotion of anger is of particular interest in depression, as it is often a prominent feature of the disorder (see Painuly, Sharan, & Mattoo, 2005, for a review). More than 40% of depressed out-patients diagnosed with major depression reported a significant level of irritability (Benazzi, 2005; Perlis et al., 2005), suggesting that sadness is not the only affective symptom that a depressed individual experiences. Additionally, Martin and Dahlen (2005) found that the cognitive coping strategies of rumination, catastrophising and low positive appraisal were significant predictors of both anger and depression, suggesting that these

two emotional states share common and ineffective cognitive emotion regulation strategies.

Anger expression has also been linked with increased risk for suicide attempts or ideation, as well as cardiovascular morbidity and mortality (Cautin, Overholser, & Goetz, 2001; Chang, Ford, Meoni, Wang, & Klag, 2002; Conner, Meldrum, Wieczorek, Duberstein, & Welte, 2004; Perlis et al., 2005; Shapiro et al., 2000; Williams, Nieto, Sanford, & Tyroler, 2001). In addition, anger may also contribute to poorer interpersonal relationships, employment maladjustment, and lowered self-esteem, which are often observed in depression (e.g., Painuly et al., 2005). There is also evidence to suggest that anger experience and expressed anger is correlated with severity of depression, although this relationship has not been supported by all studies (Painuly et al., 2005). Given these significant clinical implications and the shared cognitive vulnerabilities, the importance of exploring anger reactivity in depression is warranted. However, the majority of this work has been correlational; the current study builds upon this work by using an experimental approach to examine dysphoric individuals' anger responses to laboratory stressors.

Distress tolerance, or a lack thereof, is a second important component of emotion regulation that may be impaired in depression. Most studies of reactivity to stressful tasks in depressed samples have focused mainly on physiological outcomes (i.e., heart rate, skin conductance, blood pressure), but not distress tolerance per se. For example, Albus, Muller-Spahn, Ackenheil, and Engel (1987) found that in response to a stressful mental arithmetic task, depressed individuals displayed attenuated heart rate responses, as well as lower phasic electrodermal activity. Similarly, Carroll, Phillips, Hunt, and Der (2007), using the paced auditory serial addition task to cause acute psychological distress, found a negative association between symptoms of depression and heart rate and blood pressure. When psychiatric in-patients were exposed to a cold-pressor test, the depressed patients responded with increased rate of breathing and more fluctuations in their skin conductance compared to healthy controls (Zuckerman, Persky, & Curtis, 1968). None of these studies, however, examined ability to tolerate these distressing tasks.

Low distress tolerance has been implicated in a number of psychopathologies associated with negative affectivity such as borderline personality disorder, bipolar disorder, substance abuse, and suicide (e.g., Bornovalova, Gratz, Daughters, Nick, & Delany-Brumsey et al., 2008; Brown, Lejuez, & Kahler, 2002). Specifically, Nock and Mendes (2008) found that individuals who engage in non-suicidal self-injury displayed lower distress tolerance and a heightened physiological response to a distressing card-sorting task. In addition, Brown et al. (2002) found that individuals who immediately relapsed to smoking displayed lower distress tolerance to a carbon dioxide

challenge and a challenging mental arithmetic task. They also had higher depressive symptoms and reacted to stress with greater negative affect than did those who had longer time to smoking relapse. These studies suggest a link between negative mood and lower tolerance for distress. Consistent with this possibility, Ilgen and Hutchinson (2005) found that individuals who had experienced a previous episode of depression reported higher subjective tension scores and gave less effort in response to a stressful task. Further, Harrington (2006) found that frustration intolerance, specifically an intolerance to discomfort, significantly predicted depressed mood. Whether similar processes occur among people with elevated depressive symptoms remains untested.

Taken together, these studies point to the need for additional research with depressed individuals using stressful laboratory tasks and a broader assessment of emotional responding. Specifically, our study sought to elucidate how depressive symptoms affect emotional reactivity to a distressing task using experimental methodology. As described above, negative potentiation predicts that a depressed mood should amplify emotional reactivity to a stressful task. In contrast, ECI predicts emotional blunting. Given this theoretical conflict, we did not make any predictions regarding this aspect of the study. However, based on previous associations between negative affect and reduced distress tolerance, we predicted that dysphoric individuals would be less able to tolerate distress relative to healthy controls.

METHOD

Participants

Sixty-three participants from a large south-western university and the surrounding area were recruited through their introduction to psychology course, flyers posted around campus, and online advertisements. Participants were recruited in a two-step fashion. First, those who scored above a 10 or below a 4 on the short-form of the Beck Depression Inventory (BDI-SF) prior to testing were invited to participate. Second, participants had to maintain their dysphoria status upon arrival to the laboratory, typically two to three weeks later. At that time, participants completed the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). Consistent with recent recommendations, participants who scored above a 20 on this inventory were classified as dysphoric ($n = 28$) and participants who scored 12 or below were classified as non-dysphoric ($n = 35$; Dozois, Dobson, & Ahnber, 1998). Individuals who did not meet these criteria (e.g., did not maintain their dysphoria status from pre-testing to the laboratory session) were excluded from analyses ($n = 11$). Descriptive statistics and demographic information for each group are presented in Table 1. Three participants in

TABLE 1
Demographic information of participants

	Dysphoric	*Non-dysphoric*	*Significance test*
n	28	35	
BDI-II (*SD*)	30.29 (6.74)	4.89 (3.55)	$F = 438.32$
Age (*SD*)	22.36 (5.69)	23.19 (8.04)	$t = 0.42$
Gender	73% Female	53% Female	$\chi^2 = 2.12$
Ethnicity			$\chi^2 = 1.83$
Asian	5%	3%	
African American		5%	3%
White	71%	74%	
Hispanic	14%	19%	

Note: No statistically significant differences between depression groups were observed for age, gender or ethnicity ($ps > .15$).

the dysphoric group did not provide complete data; however, these individuals did not differ from the group in age or BDI-II score ($ps > .50$).

Questionnaires

Beck Depression Inventory – II (BDI-II). The BDI-II consists of 21 items and measures the presence and severity of cognitive, motivational, affective, and somatic symptoms of depression. Internal reliability for the BDI-II is good ($\alpha = .92$) and its test–retest reliability is adequate (Beck, Steer, & Garbin, 1988). The BDI-II has been found to be valid measure of depression among undergraduate samples (Beck et al., 1996).

Beck Depression Inventory – Short Form (BDI-SF). This is a shortened version of the BDI with 13 questions and has been shown to have satisfactory reliability in a college sample ($\alpha = .78$; Gould, 1982). This assessment was used to screen individuals for depression symptom severity. At the request of our Institutional Review Board, we omitted the suicidality item of the BDI-SF for this screening assessment.

Profile of Mood States (POMS). The POMS-SF is a list of 21 adjectives, which participants use to indicate their current mood state on a 5-point Likert scale. Based on recent distress tolerance research utilising the same tasks as the current study (e.g., Bornovalova et al., 2008; Brown et al., 2002), we expected the distress tolerance tasks to elicit anger, frustration, irritability, and anxiety. However, for the current study, we examined all three of the subscales: Tension–Anxiety, Depression–Dejection and Anger–Hostility subscales of the POMS-SF (Curran, Andrykowski, & Studts,

1995). These subscales had adequate internal consistency in the current study (Anxiety: $\alpha = .88$; Depression: $\alpha = .94$; Anger: $\alpha = .81$).

Demographics. All participants completed a demographics form that included age, gender, and ethnicity (see Table 1). Participants were representative of a college student sample. Importantly, there were no statistical differences on any of the demographic characteristics between the dysphoric and non-dysphoric groups.

Distress tolerance tasks

Paced Auditory Serial Addition Task – Modified Computer Version (PASAT-C). The computerised version of the original PASAT task has been shown to increase self-reported and physiological distress (Lejuez, Kahler, & Brown, 2003). During this task, stimuli are presented via a computer and responses are obtained with a computer mouse click on a keypad presented in the upper right region of the computer screen. The task requires participants to respond with the sum of two sequentially presented single-digit numbers. They are then instructed to sum a third single-digit number to the second number presented in the previous trial. A total score based on number of correct responses is continuously presented throughout the task. To make the task more aversive, when participants provide an incorrect response, no points are awarded and unpleasant auditory feedback occurs (i.e., an explosion). Number of correct responses at each level was recorded and used to assess skill. To increase task difficulty, latency between presentations of digits to be summed is decreased. Latencies used in the current study were 3 seconds (Level 1), 1.5 seconds (Level 2), and 1 second (Level 3). Level 1 and 2 lasted for 3 and 5 minutes, respectively. Level 3, the most difficult (and consequently most aversive) level lasted up to 10 minutes. However, for Level 3, participants were able to push a "Quit" button to terminate the task. Participants were instructed to use their maximum effort to attain the highest score they could, and that discontinuing early would affect this overall score. Distress tolerance is operationalised as time to termination, with greater time to termination reflecting greater distress tolerance.

Mirror Tracing Persistence Task – Computerised Version (MTPT-C). Developed by Strong et al. (2003), this computerised version of the Mirror Tracing Persistence task has been shown to be difficult and frustrating (Quinn, Brandon, & Copeland, 1996). Additionally, it has been used in previous research to increase participants' stress level, blood pressure and pulse rate (Matthews & Stoney, 1988; Tutoo, 1971). The task requires participants to move a red dot along the lines of different geometric shapes

presented on a computer monitor with a computer mouse. The mouse had been programmed to move the red dot in the opposite direction of physical movement of the mouse. Moving the computer mouse down and to the left resulted in the red dot moving up and to the right on the computer screen. In this way, the task simulated tracing an object that was viewed in a mirror.

Three levels, each with different geometric shapes (e.g., line, l-shape, star), were used and became increasingly more difficult. The first two levels had a 60 second time limit to trace the geometric shape. The final and most difficult level required the tracing of a star shape. Participants were given an unlimited amount of time and told that they could discontinue the task by pressing any key on the keyboard. They were instructed to use their maximum effort to attain the highest score they could, and that discontinuing early would affect this overall score. Each error—moving the red dot off the shape or a 2 second or more hesitation in movement—was accompanied by a loud buzzer sound and resulted in having to start the task over. The number of times the participant returned to the starting position of the task because of such an error was totalled and used to assess skill. Distress tolerance was measured as time to task termination on the third shape. The construct validity of the MTPT-C has been supported by strong correlations with the PASAT-C (Daughters et al., 2005b) and unwillingness to persist through the task has been found to predict treatment dropout for substance abusers (Daughters et al., 2005a).

Procedure

Individuals who met pre-screening criteria were invited to the lab to participate. Upon arrival, participants gave written informed consent and were asked to fill out demographic information and questionnaires. Participants who met study criteria were then placed in a testing room, asked to fill out the POMS-SF questionnaire, and were given the general instructions for the tasks. Task order was randomised for each participant to control for any carry-over effects. Following each of the stressful tasks, participants were asked to report their subjective mood and fill out the POMS-SF questionnaire. There were no additional tasks or breaks administered between the two stressful tasks.

Upon completion of the study, participants were thanked for their time and debriefed about the experiment. Those individuals enrolled in introduction to psychology were given credit towards their research requirement, and those individuals not currently enrolled in an introduction to psychology course were compensated with $20. Participants with elevated depressive symptoms not currently in treatment were offered referrals to local treatment providers. The Internal Review Board at the University of Texas at Austin approved all study procedures.

RESULTS

Preliminary analyses

Before conducting the main analyses, we first examined the randomisation of our tasks for carry-over effects. Forty-eight percent of participants completed the PASAT-C followed by the MTPT-C tracing task. The remaining 52% of participants completed the tasks in the reverse order. Task order was initially included as a factor in all analyses, but no significant main or interaction effects for task order were observed for any of the outcomes ($ps > .30$), so task order was consequently dropped as a factor from analyses. To examine baseline differences in negative emotions prior to completing the stressful tasks, a one-way ANOVA was conducted for sadness, anxiety and anger. For each of these, a significant effect of group status was revealed indicating higher levels of sadness, anxiety and anger in the dysphoric group: sadness: $F(1, 60) = 80.60$, $p = .00$; anxiety: $F(1, 61) = 20.66$, $p = .00$; anger: $F(1, 61) = 37.18$, $p = .00$. Means and standard errors are presented in Table 2.

To determine whether there were any dysphoria group differences in skill for the PASAT-C and MTPT-C, scores obtained during Level 2 of each task were examined. This score was selected because duration of Level 2 was standardised, whereas the participant could terminate Level 3 at any time. Further, examination of Level 2 performance allowed participants the opportunity to become comfortable with the task during Level 1 before skill was assessed. An ANOVA revealed a non-significant effect for dysphoria group status on skill performance (i.e., task scores) for the PASAT-C, $F(1, 53) = 0.04$, $p = .85$ and the MTPT-C, $F(1, 51) = 0.20$, $p = .66$. The dysphoria groups performed similarly on each task so any observed group

TABLE 2
Estimated means (standard errors) of subjective emotions pre- and post-distressing task for dysphoric and non-dysphoric individuals

	PASAT-C		*MTPT-C*	
	Non-dysphoric	*Dysphoric*	*Non-dysphoric*	*Dysphoric*
Anxiety				
Pre	8.51 (0.62)	14.22 (0.70)	8.44 (0.63)	14.15 (0.73)
Post	9.94 (0.75)	16.48 (0.86)	8.71 (0.61)	14.85 (0.70)
Sad				
Pre	8.63 (0.68)	17.88 (0.81)	8.59 (0.69)	17.88 (0.81)
Post	9.77 (0.85)	18.52 (1.00)	9.00 (0.79)	17.32 (0.93)
Anger				
Pre	7.8 (0.42)	10.89 (0.49)	7.8 (0.44)	10.73 (0.50)
Post	11.43 (0.95)	17.16 (1.10)	10.09 (0.85)	16.54 (0.97)

differences for emotional response or task persistence are unlikely due to differences in skill level.

Emotional response

PASAT-C. We examined whether change in anger, anxiety, and sadness differed between the dysphoria groups during this distressing task. Each emotion was tested with a 2 (Time: pre, post) × 2 (Dysphoria Group: dysphoric, non-dysphoric) mixed-plot ANOVA.

For anger, analyses revealed a main effect for Time, $F(1, 59) = 55.02$, $p = .00$, $\eta^2 = .48$, Dysphoria Group status, $F(1, 59) = 23.68$, $p = .00$, $\eta^2 = .29$, and a significant two-way interaction for Time × Dysphoria Group status, $F(1, 60) = 3.92$, $p = .05$, $\eta^2 = .06$. Follow-up analyses of this interaction indicated that the dysphoric individuals reported significantly greater change in anger following completion of the PASAT-C than the non-dysphoric group, dysphoric: $F(1, 25) = 41.26$, $p = .00$, $\eta^2 = .62$; non-dysphoric: $F(1, 34) = 16.53$, $p = .00$, $\eta^2 = .33$. Based on effect size, the dysphoric group responded with nearly twice the change in anger than the non-dysphoric group. Further, after controlling for anger prior to the PASAT-C, the dysphoric group reported more anger than the non-dysphoric group, although this difference was marginally significant, $F(1, 58) = 3.51$, $p = .07$, $\eta^2 = .06$.

For anxiety, the mixed-plot ANOVA revealed a significant effect for Time, $F(1, 60) = 10.69$, $p = .00$, $\eta^2 = .15$, and a significant effect for Dysphoria Group status, $F(1, 60) = 48.63$, $p = .00$, $\eta^2 = .45$. However, the Time × Dysphoria Group interaction was non-significant, $F(1, 60) = 0.54$, $p = .46$, $\eta^2 = .01$, indicating no statistically significant dysphoria group differences for change in anxiety.

For sadness, the mixed-plot ANOVA revealed a non-significant effect for Time, $F(1, 58) = 2.84$, $p = .10$, $\eta^2 = .05$, and a significant effect for Dysphoria Group status, $F(1, 58) = 70.55$, $p = .00$, $\eta^2 = .55$. However, the Time × Dysphoria Group interaction was non-significant, $F(1, 58) = 0.23$, $p = .64$, $\eta^2 = .00$, indicating no statistically significant dysphoria group differences for change in sadness.

MTPT-C. To see if this task differentially affected the dysphoria groups' negative emotional response, a 2 (Time: pre, post) × 2 (Dysphoria Group: dysphoric, non-dysphoric) mixed-plot ANOVA for each negative emotion was used.

For anger, a significant effect of Time, $F(1, 58) = 42.24$, $p = .00$, $\eta^2 = .42$, Dysphoria Group status, $F(1, 58) = 33.54$, $p = .00$, $\eta^2 = .37$, and Time × Dysphoria Group interaction, $F(1, 58) = 7.76$, $p = .01$, $\eta^2 = .12$, was observed. Follow-up analyses of this interaction revealed significant effects

of Time for both the dysphoric and non-dysphoric groups, dysphoric: $F(1, 25) = 19.72$, $p = .00$, $\eta^2 = .44$; non-dysphoric: $F(1, 34) = 26.87$, $p = .00$, $\eta^2 = .45$. The significant interaction indicates that the dysphoric and non-dysphoric groups displayed differential increases in their anger response to the MTPT-C. Further, when controlling for anger prior to the MTPT-C, the dysphoric group reported significantly higher post-task anger than did the non-dysphoric individuals, $F(1, 57) = 10.64$, $p = .00$, $\eta^2 = .16$.

For anxiety, analyses revealed a non-significant effect for Time, $F(1, 58) = 1.42$, $p = .24$, $\eta^2 = .02$, a significant effect for Dysphoria Group status, $F(1, 58) = 47.75$, $p = .00$, $\eta = .45$, and a non-significant interaction of Time and Dysphoria Group status, $F(1, 58) = 0.28$, $p = .60$, $\eta^2 = .01$. The MTPT-C did not appear to influence anxiety. Similarly, for sadness, the analyses revealed a non-significant effect for Time, $F(1, 57) = 0.03$, $p = .87$, $\eta^2 = .00$, a significant effect for Dysphoria Group status, $F(1, 57) = 69.29$, $p = .00$, $\eta = .55$, and a non-significant interaction of Time and Dysphoria Group status, $F(1, 57) = 1.17$, $p = .29$, $\eta^2 = .02$. Thus, the task also did not elicit sadness.

Distress tolerance

PASAT-C and MTPT-C. To assess differences in latency to task termination between the dysphoric and non-dysphoric individuals, a one-way ANOVA was conducted for each of the distress tolerance tasks. For the PASAT-C, this analysis revealed a non-significant effect of group status on time to termination, $F(1, 53) = 0.00$, $p = .99$, $\eta^2 = .00$. For the MTPT-C, the one-way ANOVA revealed a significant effect for dysphoria group status, $F(1, 53) = 4.14$, $p = .05$, $\eta^2 = .07$; the dysphoric group terminated the MTPT-C task significantly sooner than the non-dysphoric group. Means for these results are presented in Figure 1.

Given the different distress tolerance outcomes across tasks, we examined whether time to termination differed across tasks with a 2 (Time to Termination: PASAT-C, MTPT-C) $\times$ 2 (Dysphoria Group: dysphoric, non-dysphoric) repeated-measures ANOVA. This analysis revealed a non-significant main effect for Time to Termination, $F(1, 52) = 1.49$, $p = .23$, $\eta^2 = .03$; however, the interaction of Time to Termination $\times$ Dysphoria Group status was marginally significant, $F(1, 52) = 3.60$, $p = .06$, $\eta^2 = .07$, indicating that the groups may differ in time to termination across the two tasks. Although this interaction was marginally significant, we conducted follow-up analyses to examine it. Separately paired t-tests were conducted to examine the effects of dysphoria group on time to termination. These analyses indicated that the dysphoric group displayed similar times to termination between the two distressing tasks $t(21) = 0.45$, $p = .66$, whereas

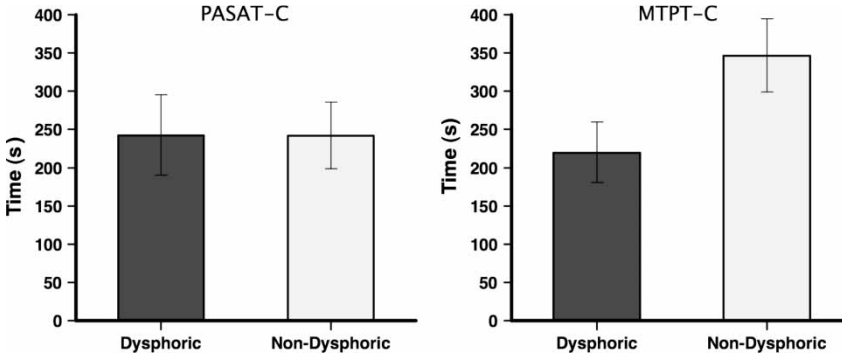

Figure 1. Average time (in seconds) to task termination for each of the groups on the PASAT-C and MTPT-C. Error bars represent standard error.

the non-dysphoric group displayed a significantly shorter time to termination on the PASAT-C task than the MTPT-C, $t(31) = 2.41$, $p = .02$.

DISCUSSION

The current study sought to compare dysphoric and non-dysphoric individuals' emotional reactivity to a stressful task and ability to tolerate emotional distress. Much of the previous work in this area has focused on the hallmark emotion seen in depression, sadness, or have used a broad category such as negative emotion. Accordingly, these studies have used stimuli designed to specifically manipulate these particular states (see Bylsma et al., 2007). The current study expanded this work by inducing frustration and measuring the less frequently studied emotional state—anger. We also sought to examine how dysphoric individuals tolerated a stressful task. We examined willingness to experience distress by comparing latency times of the groups to task termination during two aversive tasks.

Intensity of emotions

For our first aim, results indicate that the dysphoric and non-dysphoric groups responded to both the PASAT-C and MTPT-C with an increase in anger. Because these tasks were specifically chosen to cause frustration and distress, these results were expected. However, for the PASAT-C and MTPT-C, dysphoric individuals experienced significantly greater increases in anger than non-dysphoric individuals. Dysphoria effects were specific to the emotion of anger, as no potentiation was observed for anxiety and sadness. These results suggest that depressive symptoms may serve to potentiate an anger response when presented with a frustrating or stressful event.

These results suggest that a central hypothesis of the ECI model, that a depressed mood serves to attenuate emotional responses, may not be applicable to all negative emotions. Interestingly, the ECI view has been most robustly supported for negative emotions using sadness as the main outcome. If the current findings are replicated in the future, ECI theory may need to be modified to account for this divergence. One possibility is that when mood and emotion are of similar valence and arousal, such as depression and sadness, emotion attenuation will be observed. Depression and anger, although both negative emotions, differ in their arousal. It may be that greater arousal associated with anger is responsible for increased anger reactivity. Consistent with this possibility, several studies have reported that depression is associated with greater physiological arousal in response to stressful tasks (e.g., Kibler & Ma, 2004; Zuckerman et al., 1968). Future work using procedures that elicit a variety of emotions that vary in arousal and that measure subjective emotional responding, distress tolerance, and physiological responses could be helpful for examining the role of emotional arousal in emotion responding.

Another possibility for the difference between our results and earlier work supporting the ECI hypothesis is that the current tasks were quite different from the tasks used in much of the ECI literature (e.g., passive viewing of films and images). The tasks in the current study required active participation and personal involvement during the emotionally evocative situation. Future work using tasks that require active participation and personal involvement to elicit other mood states (e.g., sadness) is also needed to further test, and potentially broaden, the ECI model.

Additional work that identifies the mechanisms by which anger is potentiated in dysphoria is another important direction for future research. Rumination has been considered a common emotion regulation strategy used by depressed individuals (e.g., Nolen-Hoeksema, Morrow, & Fredrickson, 1993). In a non-depressed population, Feldner, Leen-Feldner, Zvolensky, and Lejuez (2006) found that high levels of rumination in combination with high levels of a propensity to experience negative affect predicted a stronger negative emotional response to the PASAT. They concluded that rumination may inhibit a person's ability to effectively regulate emotions and may increase the risk of experiencing additional negative emotions such as anger, irritability and frustration (Feldner et al., 2006). Given that depression and rumination are so closely linked, this may be one possible mechanism that potentiates anger in depression. Indeed, other research has found positive associations between rumination and anger responses (Martin & Dahlen, 2005; Rusting & Nolen-Hoeksema, 1998).

Additionally, future work should explore the function of anger in response to frustrating experiences. Emotion regulation research generally focuses on the alleviation of negative emotions in depression through the use

of therapeutic techniques and coping skills. However, Tamir and Diener (2008) recently found in a healthy male population that angry responses may be adaptive and beneficial in some contexts (e.g., goal pursuits). It may be that depressed individuals report more anger in part because they experience greater difficultly attaining their goals. As a number of failure experiences accumulate, anger may become more easily activated. Interestingly, an inability to achieve important goals has also been linked to rumination (Martin & Tesser, 1989). Individuals who achieve their goals are less likely to ruminate about the goal than those whose goal pursuits are thwarted. Depressed individuals could interpret poor performance on difficult tasks, such as the ones used in the current study, as yet another failed goal. This failure may trigger rumination about the task and their failure and further potentiate anger. Future work that tests this formulation of anger potentiation in depression would be particularly interesting.

Ability to tolerate distress

For our second aim, results indicate that in the MTPT-C, the dysphoric group terminated the task sooner than the non-dysphoric group. This suggests that dysphoric individuals may be less tolerant of distress than non-dysphoric individuals. However, this result was not observed in the PASAT-C. The lack of consistency between the two tasks is a surprise, as they are expected to generate similar levels of distress. To understand this difference across tasks, we compared time to termination across the distress tolerance tasks. Interestingly, although the results were only marginally significant and thus tentative, non-dysphoric individuals persisted longer on the MTPT-C than the PASAT-C, whereas the dysphoric group displayed similar task persistence across the tasks. Thus, the PASAT-C may have been more aversive overall than the MTPT-C. Future work is needed to determine whether this dysphoria group difference in task persistence between the PASAT-C and MTPT-C effect is replicated, or whether this finding is unique to the current sample.

These results highlight the difficulties that dysphoric individuals experience with distress tolerance. According to Muraven and Baumeister (2000), a person experiencing a sad mood may be depleting self-regulatory resources necessary for other types of self-control such as alleviating an angry emotion or tolerating a distressing task. This reduction in resources may explain both the increase in anger and the limited tolerance of distress observed in our study. Baumeister, Bratslavsky, Muraven, and Tice (1998) found that individuals who experienced a depletion of resources persisted less on a difficult and frustrating task involving tracing a difficult geometric shape. Additionally, DeWall, Baumeister, Stillman, and Gailliot (2007) showed through a number of converging studies that this depletion in self-regulation

resources is linked to aggression. Future work should more specifically test the hypothesis of resource depletion in depressed populations.

Clinical implications

The current study was able to elucidate how emotional reactions may be impaired in depression. Targeting depressed individuals' ability to regulate emotions and the mechanisms hampering this ability (e.g., resource depletion) is an important direction, as these findings suggest that individuals may be suffering from not only sadness, but may also be susceptible to irritability and hostility.

In Gratz and Roemer's (2004) conceptualisation of emotion regulation, they posited that increased emotional reactivity may result from utilising inappropriate emotion regulation strategies. Given this, these results highlight the importance of exploring the specific strategies that depressed individuals are using and examining which emotion-regulation strategies are most effective for this population. Our results may be taken to support the incorporation of additional treatment methodologies such as mindfulness-based and acceptance-based therapies into practice. These treatments emphasise being mindful of emotions and learning to tolerate difficult emotions (e.g., Teasdale et al., 2000). Many of these treatments incorporate distress tolerance skills, which highlight the ability to observe and experience emotions without evaluating them or trying to change or control them (e.g., Linehan, Bohus, & Lynch, 2007). Although there is evidence that acceptance-based treatments can prevent the onset of depression among people with three or more previous episodes of depression (Teasdale et al., 2000), relatively few studies have examined whether such treatments are effective for people who are currently depressed. Results from this study suggest that using acceptance-based approaches with dysphoric or depressed individuals to improve distress tolerance and emotion regulation may be promising.

Limitations

The current study had several limitations. Notably, the sample was obtained from a convenient college student population and may not be generalisable to non-student populations. Additionally, our groups were classified as dysphoric or non-dysphoric based on self-report scores. Although the dysphoric group on average had BDI-II scores that would place them in the moderate to severe range, they were not diagnosed with clinical depression. Another limitation of the current study is the high level of baseline anger in the dysphoric individuals. Although the dysphoria groups also differed in sadness and anxiety, we cannot be certain that the existing levels of baseline anger, and not dysphoria, predicted anger potentiation.

Finally, although the participants were told to use maximum effort on the two tasks, previous work has used a monetary incentive. The use of a monetary incentive may have encouraged greater task persistence, although mean duration time for our control group was comparable or longer than previous work with the PASAT and MTPT-C (e.g., Bornovalova et al., 2008).

In addition to these limitations, the study also has several strengths. Primarily, this work provides evidence for the negative potentiation theory of emotion in dysphoria using anger as the targeted emotion. No previous work has experimentally examined the potentiation of anger in dysphoria. The study also provides preliminary evidence of reduced distress tolerance in dysphoria, which has not previously been assessed behaviourally.

Summary

The current study suggests that when dysphoric individuals are exposed to a distressing or stressful task, they are likely to respond with a potentiation of anger. In addition, the results provide preliminary support that dysphoric individuals may be less able to tolerate the distress caused by these tasks. Future work in this area should continue to explore anger as an important emotion in dysphoria. In addition, given that the current study found two major aspects of emotion regulation are impaired in dysphoria, future work should examine the role emotion regulation plays in the maintenance and aetiology of depression.

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