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Unique association of approach motivation and mania vulnerability

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Abstract

Bipolar disorder involves experiences of both mania and depression over time, and measures of mania-risk and depression-risk therefore tend to be correlated, making it difficult to disentangle the shared versus unique aspects of mania and depression vulnerability. In theory, strong approach motivation is uniquely linked with mania risk, but this relation tends to be obscured unless co-occurring depression risk is statistically controlled. In this study, 461 college students completed the General Behaviour Inventory (GBI)—a validated questionnaire of bipolar disorder vulnerability—and they reported their degree of approach motivation in response to four vignettes that varied in relative incentive versus threat strength. After controlling for the effect of depression vulnerability, mania vulnerability was associated with approach motivation, particularly in response to more threatening scenarios, and this association remained significant even when controlling for dispositional threat and incentive responsiveness, current symptoms, mood, self-esteem, and optimism. The results are consistent with models that regard heightened approach motivation as a unique aspect of mania vulnerability.

Decades of research have documented that biological (e.g., genetic, neurochemical, neuroanatomical) and psychosocial factors (e.g., stressful life events, social support) influence the incidence and course of bipolar symptoms (e.g., Depue & Iacono, 1989; Depue & Zald, 1993; Johnson & Meyer, 2004; Johnson & Roberts, 1995; Johnson, Winett, Meyer, Greenhouse, & Miller, 1999; MacKinnon, Jamison, & DePaulo, 1997; Manji & Lennox, 2000; McGuffin et al., 2003; Miklowitz, Goldstein, Nuechterlein, & Snyder, 1998; Norris, Krishan, & Ahearn, 1997), but despite these advances, many questions remain about the variables that increase vulnerability to manic and depressive experiences.

One such question concerns the unique versus shared aspects of mania and depression vulnerability. Among people with lifetime episodes of mania, approximately 66–75% report lifetime episodes of depression, albeit typically at different times (Roy-Byrne, Post, Uhde, Porcu, & Davis, 1985; Winokur & Tsuang, 1996; see Johnson & Kizer, 2003, for a review of epidemiological studies). This co-occurrence of symptoms makes it difficult to disentangle

which aspects of depression and mania vulnerability are shared and which are unique (cf Johnson & Kizer, 2002). Indeed, even continuous measures of risk for mania tend to correlate highly with lifetime depressive symptoms.

Recent research suggests that mania and depression within bipolar disorder may be tied to separable genetic influences (McGuffin et al., 2003). Heritability for mania and depression appears to be correlated, but it is not the case that the aetiological variables overlap entirely. Figure 1 graphically illustrates that depression and mania vulnerability overlap, such that the variance of both vulnerabilities can be partitioned into shared and unique portions. This overlap is plausible because many people with mania also become depressed at some time, such that people scoring high on one index of vulnerability over time also tend to score high on the other. The overlap in vulnerability may also be explained by common aetiological processes that influence depression as well as mania. For example, a disturbance in the sensitivity or regulation of the approach motivational neurobehavioural system—the behavioural activation system (e.g., Depue & Zald, 1993)—may contribute to both mania and depression risk (e.g., Johnson, Winters, & Meyer, 2006). Similarly, cognitive and psychodynamic theorists have also written extensively about psychological processes that may tie together depression and mania vulnerability, including the idea that mania might be a compensatory or defensive process, triggered in response to an underlying vulnerability to depression (e.g., Lyon, Startup, & Bentall, 1999).

Intriguingly, whereas depression and mania may share some common risk variables, there is also evidence that certain variables may operate along a continuum, with high levels increasing risk for mania and low levels apparent during depressive episodes. For example, current depression has been found to be associated with decreases in self-reported reward sensitivity (Meyer, Johnson, & Carver, 1999), and with less behavioural responsiveness to rewards (Henriques & Davidson, 2000).

Beyond the conceptual plausibility of the mania and depression vulnerability overlap, this association is also reflected empirically in high correlations between measures of depression and mania risk. The General Behaviour Inventory—a well-validated bipolar disorder screening self-report (Depue et al., 1981; Depue, Krauss, Spont, & Arbisi, 1989)—for example, includes separate scales for depression and mania/hypomania vulnerability. These scales typically load on a single factor and correlate at about .60 to .70. Unless one controls for the shared depression vulnerability, then, it would be erroneous to conclude that a correlate of GBI mania vulnerability is a specific risk marker—such a correlate might instead be more closely tied with shared depression vulnerability, rendering its association with the mania risk scale spurious. By examining psychosocial correlates of mania vulnerability when controlling for concurrent depression vulnerability, though, it might be possible to identify specific markers of mania vulnerability, which would then be candidates for further investigation in studies with longitudinal and/or experimental designs.

The potential specific marker of mania vulnerability we focus on in this study is approach motivation. Several authors have noted that mania tends to relate to hyper-confidence (Johnson, Ruggero, & Carver, 2005), or that mania-prone individuals may cognitively appraise the future and personal resources in unrealistically optimistic ways (e.g., Beck & Weishaar, 1995; Leahy, 1999). Others have suggested that mania risk is associated with tendencies towards unrestrained pursuit of incentives (e.g., Fowles, 2001; Gray, 1994). Such approach motivational tendencies are thought to increase mania risk by facilitating the likelihood that the person easily or frequently spirals into frantic, unrestrained activity and, ultimately, into mania. Beck and Weishaar (1995) wrote in this regard that “the continued stimulation from inflated self-evaluations and overly optimistic expectations provide vast sources of energy and drive the manic individual into continuous goal-directed activity” (p. 240).

Preliminary evidence supports the idea that heightened approach motivation is implicated in mania risk. Among college students, hypomanic features were associated with positive, confident appraisals of personal goals, although lifetime mania vulnerability was not (Meyer, Beevers, & Johnson, 2004). However, that null finding is difficult to interpret because lifetime depression vulnerability was not statistically controlled. Mania-prone college students have also been found to set more ambitious goals, but only after experiencing an initial success that might trigger approach motivation and achievement strivings (Johnson et al., 2005).

Earlier studies have also found that achievement striving and ambitious goal setting appear to be common among mania-prone individuals. For example, persons with remitted bipolar disorder endorsed valuing achievement more than healthy controls did on a brief self-report measure (Spielberger, Parker, & Becker, 1963). In that study, 93% of individuals with a history of mania endorsed the item, "I nearly always strive hard for personal achievement". Goal-relevant traits have also been found to predict the course of manic symptoms: self-report items capturing high investment in goals and newly formed goals predicted increases in manic (but not depressive) symptoms over six months (Lozano & Johnson, 2001). Similarly, we found in a previous study that a measure of incentive responsiveness predicted manic symptom intensification in a clinical sample over time, but a self-report of threat responsiveness did not (Meyer, Johnson, & Winters, 2001). That study extended previous analyses in which threat and incentive responsiveness had been linked with the GBI mania and depression scales, although we did not systematically examine shared and unique correlates of the GBI scales in those earlier analyses (Meyer et al., 1999).

In the present study, we examined unique aspects of mania and depression vulnerability, with a particular focus on their associations with approach motivation. Four hundred and sixty-one college students completed questionnaires of mania and depression vulnerability and responded to vignettes in which incentive versus threat strength were experimentally manipulated. The strength of approach motivation in response to the scenarios was measured, and students completed questionnaires of various alternative predictors of approach motivation, including measures of dispositional approach motivation and threat sensitivity (i.e., BIS/BAS), dispositional optimism, current mood, and depression and hypomania symptom severity.

METHOD

Participants and procedure

Participants were 461 college students (80% women; median age = 20; range = 18–48) at a large university in the Southern United States. Of these participants, 82% endorsed Caucasian and 12% African American as their ethnic background/affiliation. Given the clinical relevance of this research, we also queried participants' history of mental or emotional problems with a questionnaire developed for this study. Fifty-nine (12.7%) endorsed previously being diagnosed with a mental disorder (e.g., depression, bipolar disorder, ADHD, OCD, PTSD). In terms of mood-disorder diagnoses, 28 (6%) reported a previous diagnosis in the depression spectrum (either alone or comorbid with another disorder), and 4 (0.9%) reported specifically having been diagnosed with bipolar disorder. Nineteen (4.1%) reported at least one previous hospitalisation for mental, emotional, or behavioural problems (e.g., depression, suicide attempts). Seventy-nine (17%) reported previously taking psychotropic medication, and 50 (10.8%) reported currently taking psychotropic medication (most commonly antidepressant and anxiolytic medication). One hundred and eighty-six (40.1%) reported a family history of mental illness (e.g., depression, bipolar disorder, schizophrenia).

Vignette task and questionnaires

Vignette task—Four brief vignettes (105–171 words) were devised for this study to manipulate the degree of relative incentive versus threat (see Appendix). Administration of vignettes was counterbalanced such that all participants received two incentive and two threat vignettes. For 97 (21%) participants, the first two vignettes were relatively more appealing (incentive) and the latter two were relatively more threatening. One hundred and twenty-two (26.5%) first read two threatening scenarios and then two appealing ones; 113 (24.5%) first read a threatening vignette, followed by two appealing ones, followed by another threatening vignette; and 129 (28%) first read an appealing vignette, followed by two threatening versions, followed by another appealing one. Although the content of the vignettes was presented in the same order across participants (business, investments, grade, party), the order of relative incentive versus threat strength was counterbalanced.

Participants answered six approach motivation questions after reading each vignette; each question was answered on 9-point response scales. The first item inquired about participants' positive appraisal of the situation: "Does this sound like it could be a good opportunity?" (1 = *not an interesting or promising opportunity*; 9 = *sounds like a fantastic, very promising opportunity*). The second and third question inquired about positive expectancies: "What will most likely happen?" (1 = *something negative, awful*; 9 = *something positive, great*) and "How confident are you that this would turn out positively for you?" (1 = *not at all confident*; 9 = *very confident*). The fourth question inquired directly about participants' approach motivation; the phrasing was slightly altered depending on the content of the vignette: "How eager would you be to [go into the office; invest the money; give the presentation; accept the invitation and join the party]?" (1 = *not at all eager*; 9 = *very eager*). The fifth question also asked about motivation but was phrased to emphasise avoidance rather than approach: "Would you prefer to avoid the situation and [not go in; not invest the money; not give the presentation; not accept the invitation]?" (1 = *would prefer to avoid the situation*; 9 = *would prefer to go ahead*). The final question inquired about energised/positive affect in response to the ambiguous scenario: "Would you feel excited, energised, or happy in response to this situation?" (1 = *not at all*; 9 = *very much*).

Four principal components analyses (one for each vignette) suggested that the six approach motivation items formed unitary scales. In each case, a single factor solution emerged (using the Eigenvalue > 1 criterion and Screeplot inspection). For the first vignette, the single component accounted for 64% of the variance; for the second vignette, for 78%; for the third vignette, for 69%; and for the last vignette, for 88%. Internal consistency coefficients (Cronbach's alpha) of these scales ranged from .84 (vignette 1) to .97 (vignette 4).

To simplify our analyses and reduce the number of variables, we constructed two approach motivation indexes. The first was the *incentive approach motivation* scale, which was computed as the mean of the six approach motivation items across the two incentive vignettes for each participant. As described above, the content of the two incentive conditions was counterbalanced across participants, such that content and incentive would not be confounded. The second approach motivation index was the *threat approach motivation* scale, computed as the mean of the six approach motivation items across the two threat vignettes for each participant. Again, the content of these two threat conditions was counterbalanced across participants, such that threat and content were not confounded. *Threat approach motivation* and *incentive approach motivation* were only weakly correlated ($r = .21, p < .001$).

Vulnerability to hypomania and depression—The General Behaviour Inventory (GBI; Depue et al., 1989) was used to identify individuals who had experienced symptoms of depression or mania in the past; it is considered to be a measure of lifetime vulnerability but not necessarily current symptom severity. The GBI has demonstrated excellent validity in a

series of studies. For example, Depue et al. (1981) reported five early validation studies in which it was shown that the GBI was efficient and specific at identifying clinically diagnosable cases, that it related to external ratings of bipolar risk, that it predicted the severity of future symptoms, that it related to family markers of vulnerability, and that it predicted behavioural variability over time. Additional studies since then have further supported the GBI's validity, both in nonclinical (e.g., Depue, Kleiman, Davis, Hutchison, & Krauss, 1985; Klein & Depue, 1984) and clinical samples (e.g., Depue & Klein, 1988).

The GBI's items are typically grouped into three subscales: depression (46 items), hypomania (21 items), and biphasic (7 items). Our focus in this study was only on the first two of these scales, given our aim to distinguish correlates of depression and hypomania vulnerability. GBI items are specific and often relatively lengthy, complex, and "clinical" in their wording. A sample item for the hypomania scale is: "Have you experienced periods of several days or more when, although you were feeling unusually happy and intensely energetic (clearly more than your usual self), you also were physically restless, unable to sit still and had to keep moving or jumping from one activity to another?" A sample item for the depression scale is: "Have there been times of several days or more when you were so down that nothing (not even friends or good news) could cheer you up?"

The GBI depression and hypomania scales correlated .62 ($p < .001$) in our sample, consistent with expectations and with previous research. Because of this overlap, these scales are referred to here as the *confounded vulnerability scales*. In addition to these scales, two additional indexes of depression and hypomania risk were computed. The first was the *unique mania vulnerability* scale, computed as the unstandardised residual from a regression with the GBI hypomania scale as the dependent and the GBI depression scale as the independent variable. Thus, *unique mania vulnerability* reflects variability in GBI hypomania scores that is unrelated with (i.e., $r = .00$) raw GBI depression scores. Similarly, the second index was the *unique depression vulnerability* scale, computed as the unstandardised residual from a regression with GBI depression as the dependent variable and GBI hypomania as the independent variable. *Unique depression vulnerability* thus reflects variability in depression risk that is unrelated ($r = .00$) to hypomania risk.

Current depression symptoms—The Beck Depression Inventory–II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item questionnaire measuring the severity of cognitive, motivational, affective, and somatic symptoms of depression. The time frame "within the past week" was used here (rather than the standard "two weeks") to focus on current symptom elevations (not necessarily chronic symptoms) and to be consistent with the assessment of current hypomania symptoms (see below). The BDI-II is frequently used among college student samples and has demonstrated adequate reliability and validity (Beck et al., 1996; Dozois, Dobson, & Ahnberg, 1998). The BDI-II correlates .93 with the original BDI, and scores on this newer version are typically slightly higher than those on the older BDI (Dozois et al., 1998).

Current hypomania/mania symptoms—The Altman Self-Rating Mania Scale (ASRM; Altman, Hedeker, Peterson, & Davis, 1997) is a 5-item questionnaire that measures current ("within the past week") symptoms of hypomania/mania. The ASRM items measure increased cheerfulness, inflated self-confidence, talkativeness, reduced need for sleep, and excessive behavioural activity. For each item, five response options are provided with increasingly severe descriptions of the target dimension (e.g., for behavioural activity: 0 = "I have not been more active [either socially, sexually, at work, home, or school] than usual"; 5 = "I am constantly active or on the go all the time"). The ASRM is reported to be sensitive to changes in clinical state, to differentiate mania from other clinical conditions, and to be low in participant burden (Altman et al., 1997).

Optimism–pessimism—The Life Orientation Test, Revised (LOT-R; Scheier, Carver, & Bridges, 1994) was used to measure generalised outcome expectancies or dispositional optimism. The LOT-R contains six brief items; responses are made on 5-point scales ranging from 1 (*I disagree a lot*) to 5 (*I agree a lot*). Scheier et al. (1994) reported a unifactorial structure and adequate internal consistency and test–retest reliability for the LOT-R. This questionnaire has also been shown to be related to, but distinguishable from, measures of neuroticism, self-mastery, self-esteem, and trait anxiety (Scheier et al., 1994).

Self-esteem—We used the Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965, 1979) to measure global self-esteem. The RSE contains ten items that are rated on scales from 1 (*I disagree very much*) to 5 (*I agree very much*). In the current sample, internal consistency was high (Cronbach’s $\alpha = .88$). The mean of 3.81 ($SD = 0.70$) indicates that participants “*slightly agree*”, on average, with items such as: “I take a positive attitude toward myself”.

Responsiveness to threat and incentive—The BIS/BAS scales (Carver & White, 1994) contain 20 items designed to measure affective and behavioural response tendencies to incentive (desired events) and threat (undesired events). Conceptually, the BIS/BAS scales aim to assess individual differences in the sensitivity of the behavioural inhibition and approach systems, respectively (cf. Gray, 1982, 1990). One 7-item subscale measures BIS sensitivity, reflected in items such as: “If I think something unpleasant is going to happen I usually get pretty ‘worked up’”. BAS sensitivity is measured by three separate subscales that are moderately correlated and load on a single higher-order factor (Carver & White, 1994). Sample items include: “If I see a chance to get something I want I move on it right away” (drive); “When good things happen to me, it affects me strongly” (reward responsiveness); and “I will often do things for no other reasons that they might be fun” (fun seeking). Response scales range from 1 (*Very false for me*) to 4 (*Very true for me*).

The BIS/BAS scales have demonstrated adequate internal consistency, test–retest reliability, and convergent as well as discriminant validity (Carver & White, 1994; Heubeck, Wilkinson, & Cologon, 1998; Jorm et al., 1999). In the present sample, internal consistency coefficients were acceptable and comparable to previous research (Carver & White, 1994; Meyer, Johnson, & Carver, 1999); Cronbach’s α was .81 for BIS, .61 for reward responsiveness, .80 for drive, .71 for fun seeking, and .80 for a total BAS scale. As theoretically expected, the BIS scale predicts negative affect in response to impending punishment, and the BAS scales predict positive affect in response to impending reward (Carver & White, 1994). The relative strength of BIS and BAS scale elevations has also been related to asymmetries in frontal cortical activation (Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997).

Current mood—A 15-item adjective checklist was used to measure “*how you are feeling today*”, with response options ranging from 1 (*not at all*) to 5 (*extremely*). For anxious mood, the adjectives *tense*, *on edge*, and *restless* were selected; for dysphoric mood, *miserable*, *sad*, and *hopeless*; for angry mood, *angry*, *annoyed*, and *furious*; for energetic mood, *cheerful*, *energetic*, and *lively*; and for fatigued mood, *worn out*, *exhausted*, and *fatigued*. These adjectives are commonly used in brief mood measures, such as the Profile of Mood States (McNair, Lorr, & Droppelman, 1971).

RESULTS

Descriptive statistics are presented in Table 1, which shows that all scales had adequate to excellent internal consistency. As expected, participants endorsed greater approach motivation in response to incentive scenarios, compared to threat scenarios (see Table 1), $t(460) = 24.08$, $p < .001$, paired. The approach motivation indexes were nearly normally distributed, without significant skew (skewness $-.21$ and $.02$) or kurtosis ($-.40$ and $-.34$, for incentive and threat

approach motivation, respectively). In response to relatively more appealing (incentive) vignettes, approach motivation was above the midpoint of 5 on the 1 to 9 response scale, and in response to more threatening scenarios, approach motivation was below this midpoint. This pattern suggests that the manipulation of incentive versus threat strength was successful. Table 1 also shows that the mean depression (BDI-II) was similar (though perhaps slightly higher), compared to normative samples (e.g., the mean BDI-II among 1022 undergraduates in a study by Dozois et al., 1998, was 9.11; $SD = 7.57$).

Correlations

Table 2 shows the correlations of the bipolar vulnerability scales with approach motivation and with other related constructs. As expected, the GBI depression scale related to lower approach motivation, less current mania, more current depression, high BIS, low BAS, pessimism, low self-esteem, and negative mood. The GBI hypomania scale showed a somewhat similar pattern of associations, with some exceptions. GBI hypomania was linked with both current hypomanic as well as current depressive symptoms, with high BAS, pessimism, low self-esteem, and negative mood. However, because GBI hypomania and depression are highly correlated ($r = .62$, $p < .001$), it is difficult to interpret this pattern of associations. To what degree do these correlations reflect unique or confounded aspects of depression and mania vulnerability?

Table 2 also shows the correlations involving the unique vulnerability scales. Unique depression vulnerability was linked with low approach motivation, low hypomanic symptoms, current depression, high BIS, low BAS, pessimism, low self-esteem, and negative mood. Thus, a unique aspect of depression vulnerability appears to be a deficit in approach motivation and incentive responsiveness. Unique mania vulnerability, in turn, was linked with high approach motivation (particularly with regard to threat approach motivation), current hypomanic symptoms, low BIS, high BAS, optimism, high self-esteem, and energetic, non-dysphoric mood. Thus, a unique aspect of mania vulnerability appears to be heightened approach motivation, incentive responsiveness, heightened activation and energy, and positive appraisals about the self and future. These analyses clearly demonstrate that approach motivation and incentive responsiveness have distinct associations with mania and depression vulnerability only when unique aspects of each vulnerability are taken into account.

Regressions

Additional analyses tested whether the links between unique mania vulnerability and approach motivation would remain even when controlling for alternative predictors, such as BIS/BAS sensitivity, optimism, self-esteem, current symptoms, and mood. Two hierarchical multiple regression analyses were conducted, with both of the approach motivation scales as dependent variables. In both analyses, GBI depression was entered in a first step, followed in step 2 by the current symptom scales, in step 3 by BIS/BAS sensitivities, in step 4 by self-esteem and optimism, in step 5 by current mood, and finally in step 6 by GBI hypomania. Thus, these analyses tested whether mania vulnerability would be uniquely associated with approach motivation, even when controlling not only for concurrent depression vulnerability but also for a host of other potential predictors of approach motivation.

In the first analysis—predicting incentive approach motivation—only low BIS and high BAS emerged as unique predictors. It appeared that mania vulnerability did not predispose participants to respond with greater approach motivation to the more appealing scenarios. Of the variance (adjusted R^2) in incentive approach motivation, 7.8% was explained by the predictors entered up to step 3, the final significant step in this analysis (see Table 3).

In the second analysis—predicting threat approach motivation—mania vulnerability, low BIS, optimism, and energetic mood all predicted stronger approach motivation (see Table 4). Thus, there was evidence that, even after controlling for other predictors, mania vulnerability uniquely predisposed participants to respond with strong approach motivation to relatively threatening situations. Of the variance (adjusted R^2) in threat approach motivation, 16.3% was explained by the combined set of predictors in this analysis.

Table 5 provides another impression of how the constructs other than mania and depression vulnerability related to approach motivation. Current hypomanic symptoms were positively linked with approach motivation, but only in response to threatening rather than appealing scenarios. Current depression, by contrast, was inversely related to approach motivation. BIS sensitivity was associated with less approach motivation, especially in response to threatening scenarios. By contrast, BAS sensitivity was associated with more approach motivation, especially in response to incentive-related scenarios. Optimism, self-esteem, and energetic mood were both moderately and positively linked with approach motivation, and anxious, dysphoric, and fatigued mood were weakly associated with lower approach motivation, especially in response to more threatening situations.

DISCUSSION

Mania-prone individuals are typically also at risk for depression, given that bipolar disorder involves fluctuations between these states over time. Because of the conceptual, phenomenological, and statistical overlap between mania and depression vulnerability, it becomes difficult to disentangle the unique versus shared correlates of these vulnerabilities. In this study, the focus was on a set of vulnerability correlates that has received increasing attention in recent years: approach motivation, incentive responsiveness, active-energetic mood, and positive appraisals of the self and future. By systematically examining the associations of these constructs with unique markers of bipolar disorder vulnerability, it became clear that mania proneness appears to be uniquely linked with approach motivation, even after controlling for the effects of alternative predictors.

This higher approach motivation was evident primarily when participants were exposed to potentially rewarding scenarios that also involved an element of threat. Especially when goal attainment is difficult, then, mania-prone people may be motivated to approach the situation and pursue the perceived, but potentially blocked, reward. At the risk of oversimplifying the issue, it seemed that the more mania-prone respondents liked a good challenge and were eager to take a risk.

These findings are consistent with a number of theoretical models of bipolar disorder vulnerability, such as the views expressed recently by Leahy (e.g., 1999), Beck (e.g., Beck & Weishaar, 1995), Gray (e.g., 1994), Fowles (e.g., 2001), and Johnson et al. (e.g., 2005), among others. All these theorists have speculated (and reported varying degrees of evidence) that mania vulnerability involves heightened confidence, approach motivation, incentive responsiveness, or overly positive appraisals of ambiguous situations. The present study further supports these models by clearly documenting the unique associations of mania risk with such aspects of approach motivation. One particular strength of this study was that a number of alternative predictors of approach motivation—beyond mania vulnerability—were measured, and that the link between mania risk and approach strength remained significant even when controlling for these other variables. These analyses also showed that the association between lifetime mania risk and approach motivation is indeed obscured unless one statistically controls for concurrent depression risk.

The reliance on self-reports and the non-clinical nature of the sample must be viewed as limitations of this study. However, as Depue et al. (1989) pointed out, university student populations may be an ideal target for studies investigating bipolar disorder vulnerability, for at least three reasons: First, it is more feasible in many settings to recruit large samples of college students than clinically diagnosed subjects; second, college students exceed the common age of onset of at least milder forms of mood disorders (i.e., the age of 12–18; Depue et al., 1981); and third, the prevalence of both unipolar and bipolar mood conditions actually appears to be surprisingly high in such samples (Depue et al., 1981, 1989). Such studies also allow for an examination of psychological processes among individuals who are not reacting to the aftermath of painful, psychotic episodes, and who do not need to struggle with severe side effects and intensive treatments.

The present findings suggest the potential utility of further investigations in this area. Several questions for future researchers to consider may include: What are the psychological and biological mediators by which heightened approach motivation confers mania risk? What moderators enhance or reduce the probability that a person with high approach motivation will cycle into unrestrained reward seeking and manic hyperactivity? How can excessive approach motivation and risk taking be targeted by psychological interventions? Research on psychological processes in bipolar disorder is still lagging behind the work on unipolar depression (cf Lyon et al., 1999), but this study, along with other studies, suggests that cognitive and motivational processes may play a critical role in manic and depressive vulnerability and should therefore not be neglected in future research.

Indeed, the current findings add to a growing literature that suggests that people diagnosed with bipolar disorder, and those at risk for bipolar disorder, are characterised by many differences in the way they approach goals. Current empirical evidence suggests that this is a disorder characterised by increased sensitivity to rewards (Meyer et al., 2001), and elevated life ambitions (Johnson & Carver, 2006). It also appears to be the case that facets of this reward sensitivity could help predict the course of mania. That is, persons with a history of mania appear to be at increased risk of symptoms after major life successes (Johnson et al., 2000), and increases in goal engagement also appear to be a harbinger of impending symptoms (Lozano & Johnson, 2001). Taken together, the findings suggest that the study of how people with bipolar disorder respond to reward cues is an important focus for future research.

Key questions for ongoing research might involve examining the neural and cognitive underpinnings of this reward sensitivity. On an applied level, it will be important to consider whether interventions focused on reward sensitivity and approach behaviour can be used to prevent mania. Interestingly, people with bipolar disorder report naturalistically using strategies to calm early signs of increased goal-oriented behaviour (Wong & Lam, 1999). Teaching people these types of coping strategies has formed one aspect of current psychological treatments for bipolar disorder (Lam & Wong, 2005). Interventions designed to teach such strategies might be promising avenues for treatment development.

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REFERENCES

- Altman EG, Hedeker D, Peterson JL, Davis JM. The Altman Self-Rating Mania Scale. *Biological Psychiatry* 1997;42:948–955. [PubMed: 9359982]
- Beck, AT.; Steer, RA.; Brown, GK. Manual for the Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation; 1996.

- Beck, AT.; Weishaar, ME. Cognitive therapy. In: Corsini, RJ.; Wedding, D., editors. *Current psychotherapies*. 5th ed.. Itasca, IL: Peacock; 1995. p. 229-261.
- Carver CS, White TL. Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology* 1994;67:319–333.
- Depue RA, Iacono WG. Neurobehavioral aspects of affective disorders. *Annual Review of Psychology* 1989;40:457–492.
- Depue RA, Kleiman R, Davis P, Hutchinson M, Krauss S. The behavioral high-risk paradigm and bipolar affective disorder: VIII. Serum free cortisol in nonpatient cyclothymic subjects selected by the General Behavior Inventory. *American Journal of Psychiatry* 1985;142:175–181. [PubMed: 3970242]
- Depue, RA.; Klein, D. Identification of unipolar and bipolar affective conditions by the General Behavior Inventory. In: Dunner, D.; Gershon, E.; Barrett, J., editors. *Relatives at risk for mental disorder*. New York: Raven Press; 1988. p. 257-282.
- Depue RA, Krauss S, Spoont MR, Arbisi P. General Behavior Inventory identification of unipolar and bipolar affective conditions in a nonclinical university population. *Journal of Abnormal Psychology* 1989;98:117–126. [PubMed: 2708652]
- Depue R, Slater J, Wolfstetter-Kausch H, Klein D, Goplerud E, Farr D. A behavioral paradigm for identifying persons at risk for bipolar depressive disorders: A conceptual framework and five validation studies. *Journal of Abnormal Psychology* 1981;90:381–437. [PubMed: 7298991]
- Depue, RA.; Zald, DH. Biological and environmental processes in nonpsychotic psychopathology: A neurobehavioral perspective. In: Costello, CG., editor. *Basic issues in psychopathology*. New York: Guilford Press; 1993. p. 127-237.
- Dozois DJA, Dobson KS, Ahnberg JL. A psychometric evaluation of the Beck Depression Inventory-II. *Psychological Assessment* 1998;10:83–89.
- Fowles, DC. Biological variables in psychopathology: A psychobiological perspective. In: Adams, HE.; Sutker, PB., editors. *Comprehensive handbook of psychopathology*. 3rd ed.. New York: Kluwer; 2001. p. 85-104.
- Gray, JA. The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system. New York: Oxford University Press; 1982.
- Gray JA. Brain systems that mediate both emotion and cognition. *Cognition and Emotion* 1990;4:269–288.
- Gray, JA. Framework for a taxonomy of psychiatric disorder. In: Van Goozen, SHM.; Van de Poll, NE.; Sergeant, JA., editors. *Emotions: Essays on emotion theory*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc; 1994. p. 29-59.
- Harmon-Jones E, Allen JJB. Behavioral activation sensitivity and resting frontal EEG asymmetry: Covariation of putative indicators related to risk for mood disorders. *Journal of Abnormal Psychology* 1997;106:159–163. [PubMed: 9103728]
- Henriques JB, Davidson RJ. Decreased responsiveness to reward in depression. *Cognition and Emotion* 2000;14:711–724.
- Heubeck BG, Wilkinson RB, Cologon J. A second look at Carver and White's (1994) BIS/BAS scales. *Personality and Individual Differences* 1998;25:785–800.
- Johnson S, Roberts JR. Life events and bipolar disorder: Implications from biological theories. *Psychological Bulletin* 1995;117:34–449.
- Johnson S, Winett C, Meyer B, Greenhouse W, Miller I. Social support and the course of bipolar disorder. *Journal of Abnormal Psychology* 1999;108:558–566. [PubMed: 10609420]
- Johnson SL, Carver CS. Extreme goal setting and vulnerability to mania among undiagnosed young adults. *Cognitive Therapy and Research* 2006;30:377–395.
- Johnson, SL.; Kizer, A. Bipolar and unipolar depression: A comparison of clinical phenomenology and psychosocial predictors. In: Gotlib, IH.; Hammen, CL., editors. *Handbook of depression*. New York: Guilford Press; 2002. p. 141-165.
- Johnson, SL.; Meyer, B. Psychosocial predictors of symptoms. In: Johnson, SL.; Leahy, RL., editors. *Psychological treatment of bipolar disorder*. New York: Guilford Press; 2004. p. 83-105.
- Johnson SL, Ruggero CJ, Carver CS. Cognitive, behavioral, and affective responses to reward: Links with hypomanic symptoms. *Journal of Social and Clinical Psychology* 2005;24:894–906.

- Johnson SL, Sandrow D, Meyer B, Winters R, Miller I, Keitner G, et al. Increases in manic symptoms after life events involving goal-attainment. *Journal of Abnormal Psychology* 2000;109:721–727. [PubMed: 11195996]
- Johnson, SL.; Winters, R.; Meyer, B. A polarity-specific model of bipolar disorder. In: Joiner, TE.; Brown, JS.; Kistner, J., editors. *The interpersonal, cognitive, and social nature of depression*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc; 2006. p. 153-171.
- Jorm AF, Christensen H, Henderson AS, Jacom PA, Korten AE, Rodgers B. Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: Factor structure, validity and norms in a large community sample. *Personality and Individual Differences* 1999;26:49–58.
- Klein D, Depue RA. Continued impairment in persons at risk for bipolar affective disorder: Results of a 19-month follow-up study. *Journal of Abnormal Psychology* 1984;93:345–347. [PubMed: 6470321]
- Lam D, Wong G. Prodromes, coping strategies and psychological interventions for bipolar disorders. *Clinical Psychology Review* 2005;25:1028–1042. [PubMed: 16125292]
- Leahy RL. Decision-making and mania. *Journal of Cognitive Psychotherapy* 1999;13:83–105.
- Lozano BE, Johnson SL. Can personality traits predict increases in manic and depressive symptoms? *Journal of Affective Disorders* 2001;63:103–111. [PubMed: 11246086]
- Lyon HM, Startup M, Bentall RP. Social cognition and the manic defense: Attributions, selective attention, and self-schema in bipolar affective disorder. *Journal of Abnormal Psychology* 1999;108:273–282. [PubMed: 10369037]
- MacKinnon D, Jamison K, DePaulo J. Genetics of manic-depressive illness. *Annual Review of Neuroscience* 1997;20:355–373.
- Manji HK, Lenox RH. The nature of bipolar disorder. *Journal of Clinical Psychiatry* 2000;61(Suppl 13): 42–57. [PubMed: 11153812]
- McGuffin P, Rijsdijk F, Andrew M, Sham P, Katz R, Cardno A. The heritability of bipolar affective disorder and the genetic relationship to unipolar depression. *Archives of General Psychiatry* 2003;60:497–502. [PubMed: 12742871]
- McNair, D.; Lorr, M.; Droppelman, L. *Profile of Mood States Manual*. San Diego, CA:: EDITS; 1971.
- Meyer B, Beevers CG, Johnson SL. Goal appraisals and vulnerability to bipolar disorder: A personal projects analysis. *Cognitive Therapy and Research* 2004;28:173–182.
- Meyer B, Johnson SL, Carver CS. Exploring behavioral activation and inhibition sensitivities among college students at risk for bipolar-spectrum symptomatology. *Journal of Psychopathology and Behavioral Assessment* 1999;21:275–292.
- Meyer B, Johnson SL, Winters R. Responsiveness to threat and incentive in bipolar disorder: Relations of the BIS/BAS scales with symptoms. *Journal of Psychopathology and Behavioral Assessment* 2001;23:133–143.
- Miklowitz DJ, Goldstein MJ, Nuechterlein KH, Snyder KS. Family factors and the course of bipolar affective disorder. *Archives of General Psychiatry* 1998;45:225–231. [PubMed: 3341878]
- Norris SD, Krishnan KR, Ahearn E. Structural changes in the brain of patients with bipolar affective disorder by MRI: A review of the literature. *Progress in Neuropsychopharmacology and Biological Psychiatry* 1997;21:1323–1337.
- Rosenberg, M. *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press; 1965.
- Rosenberg, M. *Conceiving the self*. New York: Basic Books; 1979.
- Roy-Byrne P, Post RM, Uhde TW, Porcu T, Davis D. The longitudinal course of recurrent affective illness: Life chart data from research patients at the NIMH. *Acta Psychiatrica Scandinavica* 1985;71 (Suppl 317):1–34. [PubMed: 3969837]
- Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the life orientation test. *Journal of Personality and Social Psychology* 1994;67:1063–1078. [PubMed: 7815302]
- Spielberger CD, Parker JB, Becker J. Conformity and achievement in remitted manic-depressive patients. *Journal of Nervous and Mental Disease* 1963;137:162–172. [PubMed: 14047823]
- Sutton SK, Davidson RJ. Prefrontal brain asymmetry: A biological substrate of the behavioral approach and inhibition systems. *Psychological Science* 1997;8:204–210.

Winokur, G.; Tsuang, MT. The natural history of mania, depression, and schizophrenia. Washington, DC: American Psychiatric Press, Inc; 1996.

Wong G, Lam D. The development and validation of the coping inventory for prodromes of mania. *Journal of Affective Disorders* 1999;53:57–65. [PubMed: 10363667]

APPENDIX

Vignette 1: Summer job

Imagine that for a summer job you're working in an advertising agency. Although you've enjoyed certain aspects of this job, you've also found it somewhat boring and have neglected tasks that you probably should have been working on. After work one day, your supervisor asks you to join him for dinner. As you begin to eat, he talks to you about a new project, and you tell him about your ideas on how to turn this into a better advertising campaign. You're not sure how he likes your ideas, and the look on his face doesn't reveal his true feelings. The next day, your supervisor calls you into his office.

Positive (incentive)

At this point, you're not sure what to expect. As you get ready to enter his office, a coworker gives you a big smile. You remember that your supervisor recently rewarded some of your colleagues' good ideas with a raise. In fact, the supervisor is known to be a very generous person, always looking to hire and reward talented people.

Negative (threat)

The next day, your supervisor calls you into his office. At this point, you're not sure what to expect. As you get ready to enter his office, a coworker gives you a worried look. You remember that this supervisor can be very moody. Although he recently rewarded some of your colleagues' good ideas with a raise, he also fired a colleague who had messed up on an important project.

Vignette 2: Business opportunity

Imagine that your best friend tells you about a great opportunity to make a lot of money. This involves investing some of your own money and otherwise "letting your friend take care of business". This friend tells you a story about buying some computers wholesale at a great bargain and then reselling them to a local company at a good profit margin. You've known and trusted this friend for a long time, and you know that he has been pretty successful in the past with similar deals. As it happens, you also recently inherited a substantial amount of money, so you probably have the resources to make this kind of an investment. Just to make sure, you consult with another friend who also recently invested some money into this friend's dealings.

Positive (incentive)

She tells you that she invested some money about 3 months ago, and that she has made a very good profit already. In fact, she tells you that several of her friends had also made good money on this deal.

Negative (threat)

She tells you that she invested some money about 3 months ago, and that she has made some profit already. However, she also warns you that several other friends lost some money on this deal.

Vignette 3: Class presentation

Imagine you're taking a class in a subject that really interests you. You've been looking forward to taking this class ever since you started college; in fact, you've been interested in this topic ever since you were a child. Despite your enthusiasm for this class, your test grades during the first half of the semester have been rather disappointing. Your professor talks to you after class about your performance. She gives you an interesting chance to improve your grade. She asks if you would be interested in leading an entire class next week. This would involve giving a formal presentation and leading class discussion. This sounds great because you really do know the topic well, and if you do well it would significantly improve your grade.

Positive (incentive)

You also know that this professor is very supportive of students who are making class presentations.

Negative (threat)

However, you know that this professor is difficult to impress.

Vignette 4: Trip to Europe

Imagine you're travelling by train through Europe during summer vacation. As your train pulls into the station at your next destination, you meet a group of fellow travellers from England and Australia. You start talking, and they invite you to join a party that evening in their hotel room.

Positive (incentive)

Although you don't know them very well, you have a good feeling about this invitation, given the way these travellers look and talk. Their sense of humour seems great. The vacation has been going well so far, so you're now in a position to decide whether or not to follow the invitation and join the party.

Negative (threat)

Although you don't know them very well, you have a bad feeling about this invitation, given the way these travellers look and talk. Their sense of humour seems weird. The vacation has been going well so far, so you're now in a position to decide whether or not to follow the invitation and join the party.

Figure 1.
Conceptual overlap between mania and depression vulnerability.

Table 1

Descriptive statistics ($N = 461$)

Cronbach's					
Variables	Items	α	Range	M	SD
<i>Approach motivation strength</i>					
Incentive approach motivation	6	.81	3.09–9	6.54	1.20
Threat Approach Motivation	6	.80	1.42–8.41	4.75	1.33
<i>Incentive/threat responsiveness</i>					
BIS (threat responsiveness)	7	.81	1.14–4	3.09	0.57
BAS total (incentive responsiveness)	13	.80	2.08–1	3.23	0.39
Reward responsiveness	5	.61	2–4	3.57	0.36
Drive	4	.80	1–4	2.90	0.61
Fun seeking	4	.71	1.50–4	3.11	0.58
<i>Current symptom severity</i>					
Depression (BDI-II)	21	.89	0–43	11.86	8.46
Hypomania (ASRM)	5	.69	0–18	4.73	3.62
<i>Cognitive appraisals</i>					
Self-esteem (RSE)	10	.88	1.40–5	3.81	0.70
Optimism (LOT-R)	6	.85	1–5	2.47	0.86
<i>Current mood</i>					
Anxiety	3	.77	1–5	2.15	0.94
Depression	3	.78	1–5	1.52	0.73
Anger	3	.72	1–4.67	1.47	0.65
Energy	3	.90	1–5	2.92	1.03
Fatigue	3	.93	1–5	2.68	1.30
<i>Confounded vulnerability scales</i>					
GBI Depression Scale	46	.97	1–3.63	1.70	.52
GBI Hypomania Scale	21	.88	1–3.63	1.67	.43
<i>Unique vulnerability scales</i>					
Unique mania vulnerability	–	<i>b</i>	–90–1.12	.00	.33
Unique depression vulnerability	–	<i>b</i>	–1.09–1.72	.00	.40

Notes: a = Cronbach's alpha for the approach motivation scales ranged from .84 (vignette 1) to .97 (vignette 4); b = internal consistency coefficients were not computed for these scales because they represent unstandardised residual scores (e.g., unique mania vulnerability = GBI hypomania scores not accounted for by variability in GBI depression scores).

Table 2Correlations: Bipolar vulnerability, approach motivation, and related constructs ($N = 461$)

	Confounded vulnerability scales		Unique vulnerability scales	
	Depression	Hypomania	Depression	Hypomania
<i>Approach motivation strength</i>				
Incentive	-.07	.05	-.14**	.13**
Threat	-.17**	.09	-.29**	.25**
<i>Current symptom severity</i>				
Mania (ASRM)	-.24**	.16**	-.43**	.39**
Depression (BDI-II)	.74**	.39**	.63**	-.09
<i>Threat and incentive responsiveness</i>				
BIS (threat resp.)	-.40**	.08	.44**	-.21**
BAS total (inc. resp.)	-.14**	.20**	-.34**	.37**
Reward resp.	-.12*	.04	-.19**	.15**
Drive	-.15**	.12**	-.29**	.27**
Fun seeking	-.04	.28**	-.28**	.39**
<i>Cognitive appraisals of future and self</i>				
Optimism (LOT-R)	-.49**	-.17**	-.49**	.18**
Self-esteem (RSE)	-.58**	-.24**	-.55**	.15**
<i>Current mood</i>				
Anxiety	.28**	.18**	.21**	.01
Dysphoria	.44**	.16**	.44**	-.15**
Anger	.23**	.20**	.14**	.07
Energy	-.33**	-.01	-.42**	.25**
Fatigue	.31**	.15**	.27**	-.05

*Note:** $p < .05$;** $p < .01$.

Table 3

Hierarchical multiple regression: Predicting incentive approach motivation

Predictors	F-change (df)	R ² -change	Beta
Step 1: Depression vulnerability	2.59 (1, 459)	.01	
GBI depression			-.08
Step 2: <i>Current symptom severity</i>	2.44 (2, 457)	.01	
Depression (BDI-II)			-.10
Hypomania (ASRM)			-.03
Step 3: <i>Threat/incentive responsiveness</i>	18.01 (2, 455)**	.07	
BIS			-.15**
BAS total			.24**
Step 4: <i>Cognitive appraisals</i>	0.44 (2, 453)	.002	
Self-esteem (RSE)			-
Optimism (LOT-R)			-
Step 5: <i>Current mood</i>	0.91 (5, 448)	.009	
Anxiety			-
Dysphoria			-
Anger			-
Energy			-
Fatigue			-
Step 6: <i>Mania vulnerability</i>	0.01 (1, 447)	.00002	
GBI hypomania			-

Note: Betas from the model at step 3 are shown (given that predictors entered in subsequent steps were not significant).

*
 $p < .05$;

**
 $p < .01$.

Table 4

Hierarchical multiple regression: Predicting threat approach motivation strength

Predictors	F-change (df)	R ² -change	Beta
<i>Step 1: Depression vulnerability</i>	13.50 (1, 459)**	.03	
GBI depression			-.15
<i>Step 2: Current symptom severity</i>	6.37 (2, 457)**	.03	
Depression (BDI-II)			.05
Hypomania (ASRM)			-.01
<i>Step 3: Threat/incentive responsiveness</i>	16.14 (2, 455)**	.06	
BIS			-.20**
BAS total			-.01
<i>Step 4: Cognitive appraisals</i>	7.57 (2, 453)**	.03	
Self-esteem (RSE)			-.06
Optimism (LOT-R)			.21**
<i>Step 5: Current mood</i>	2.37 (5, 448)	.02	
Anxiety			-.01
Dysphoria			.05
Anger			-.06
Energy			.17**
Fatigue			.05
<i>Step 6: Mania vulnerability</i>	10.05 (1, 447)**	.02	
GBI hypomania			.21**

Note: Betas from the final model (at step 6) are shown.

*
p<.05;

**
p<.01.

Table 5Predictors of approach motivation: Considering other variables ($N = 461$)

	Approach motivation	
	Incentive	Threat
<i>Current symptom severity</i>		
Mania (ASRM)	.08	.19**
Depression (BDI-II)	-.12**	-.18**
<i>Threat and incentive responsiveness</i>		
BIS (threat resp.)	-.17**	-.31**
BAS total (inc. resp.)	.25**	.14**
Reward resp.	.14**	.03
Drive	.22**	.19**
Fun seeking	.20**	.08
<i>Cognitive appraisals of future and self</i>		
Optimism (LOT-R)	.15**	.31**
Self-esteem (RSE)	.13**	.22**
<i>Current mood</i>		
Anxiety	-.08	-.10*
Dysphoria	-.07	-.14**
Anger	.04	-.08
Energy	.14**	.27**
Fatigue	-.05	-.10*

*Note:**
 $p < .05$;**
 $p < .01$.