Published in final edited form as:
Int J Cogn Ther. 2013 March 1; 6(1): 1–16. doi:10.1521/ijct.2013.6.1.1.

Positive Affect Enhances the Association of Hypomanic Personality and Cognitive Flexibility

Daniel Fulford,
University of Miami

Greg Feldman,
Simmons College

Benjamin A. Tabak,
University of Miami

Morgan McGillicuddy, and
Simmons College

Sheri L. Johnson
University of California, Berkeley

Abstract

Several lines of research have suggested a link between mania and creativity, The goal of the present study was to test whether positive affect moderated the relationship between risk for mania (assessed with the Hypomanic Personality Scale [HPS]) and a variable postulated to be a cognitive component of creativity: cognitive flexibility. Fifty-three undergraduate students were randomly assigned to either a neutral or positive mood induction condition. They then completed the Delis-Kaplan Executive Function System (DKEFS) Sorting Test as a measure of cognitive flexibility. Consistent with our hypothesis, higher HPS scores were associated with greater cognitive flexibility among participants in the positive mood induction condition. Covariate analyses revealed that results were not confounded by verbal intelligence or the presence of current depression symptoms. Our findings suggest a mood-dependent link between hypomanic personality and one potential component of creative cognition.

Although bipolar spectrum disorders only occur in about 2.1% of the population (Merikangas et al., 2007), about 10% of artists endorse symptoms of bipolar disorder when surveyed (Goodwin & Jamison, 2007; Rothenberg, 2001). Creativity appears to be more evident among those with milder forms of the disorder; in a survey of accomplished authors, more of the authors (30%) met criteria for bipolar II disorder than for bipolar I disorder (13%; Andreasen, 1987). Nonetheless, both mild and severe forms of disorder appear to be much more common in creative populations than one would expect in the general population. Consistent with these findings, persons diagnosed with bipolar disorder score higher on standardized measures of creativity than healthy controls, those with cyclothymia, and those with major depressive disorder (Richards, Kinney, Lunde, Benet, & Merzel, 1988; Santosa et al., 2007).

Not only do people with bipolar disorder demonstrate heightened creativity, but so do their first-degree relatives (Andreasen, 1987; Kyaga et al., 2011; Richards et al., 1988;

Address correspondence to Daniel Fulford, Ph.D., University of California, San Francisco, Department of Psychiatry, 401 Parnassus Avenue, San Francisco, CA 94143. Daniel.Fulford@ucsf.edu...

Simeonova, Chang, Strong, & Ketter, 2005). For example, unaffected family members evidence higher scores on a measure of lifetime creativity than do those with bipolar disorder (Richards et al., 1988).[1] Although family vulnerability to bipolar disorder appears related to greater creativity, aspects of the disorder including the duration (Simeonova et al., 2005) and severity of the illness (Richards et al., 1988) may interfere with creative accomplishment (Shaw, Mann, Stokes, & Manevitz, 1986). Given that the sequelae of mania may interfere with creativity, studies examining persons at risk for the disorder may be more informative regarding links with creativity than examining those with diagnosed bipolar I disorder (Furnham, Batey, Anand, & Manfield, 2008; Johnson et al., 2012).

The Hypomanic Personality Scale (HPS; Eckblad & Chapman, 1986) is often conceptualized as a measure of mania risk in light of evidence that it is predictive of the onset of bipolar spectrum disorders over a 13-year period (Kwapil et al., 2000). Several researchers have found positive correlations with subsyndromal mania symptoms and self-rated creativity (Furnham et al., 2008; Shapiro & Weisberg, 1999) as well as preference for novel and complex figures, a measure that has often been found to predict creative occupational pursuits (Rawlings & Georgiou, 2004; Schuldberg, 2000-2001). However, studies with behavioral measures of creativity are relatively rare.

Cognitive Flexibility as a Building Block of Creativity and Correlate of Mania

A comprehensive review of creativity is beyond the scope of this article; here we focus on cognitive flexibility as a precursor of creativity. Creativity has been defined as “divergent thinking” (Guilford, 1950) leading to both original and adaptive ideas (Simonton, 1999) that are novel, usefull, and appropriate to a given situation (Amabile, 1983). Certain mental processes (typically conceptualized as building blocks of creativity) appear to predict creative output (Abraham, Windmann, Daum, & Güntürkün, 2005; Finke, Ward, & Smith, 1992; Smith, Ward, & Finke, 1995). Amabile (1983) has suggested that cognitive abilities that facilitate creative insight include breaking out of typical ways of solving problems or performing tasks, among others.

This conceptualization of cognitive precursors of creativity is consistent with one aspect of the broader construct of cognitive flexibility, spontaneous flexibility, which has been defined as “the ability to produce diverse ideas, consider response alternatives and modity plans” (Rende, 2000, p. 123) and is measured with tests of idea and figure fluency and divergent thinking. A recent study (Furnham et al., 2008) in a nonclinical sample found a small positive correlation between the HPS and a measure of divergent thinking, a construct that has been conceptualized as a marker for both creativity (Guilford, 1967) and spontaneous flexibility (Rende, 2000). It is important to note that cognitive flexibility, though, is a complex construct with multiple components, which may not demonstrate parallel links with bipolar disorder. A second facet of cognitive flexibility is reactive flexibility, which has been defined as “the ability to shift cognition or behavior in response to changing task or situational demands” (p. 122) and is measured with tests of set-shifting and inhibition. Past research has found that compared to healthy controls, relatives of people with bipolar disorder (Clark, Sarna, & Goodwin, 2005) and children with bipolar disorder (Dickstein et al., 2007) evidence *impaired* performance in attentional set-shifting tasks, which these authors characterize as measures of “cognitive flexibility,” but, as noted above, may tap only reactive flexibility (Rende, 2000). Hence there is a need for more precise

[1]In this study, it is worth noting that even those affected by bipolar disorder obtained higher scores than did healthy controls.

measurement of cognitive flexibility in studies of creativity and mania risk. That is the goal of this study.

Widely used measures of cognitive flexibility often highlight one aspect of cognitive flexibility but neglect others (Rende, 2000). In the present study, we used a measure of cognitive flexibility, the Sorting Test from the Delis-Kaplan Executive Function System (DKEFS; Delis, Kaplan, & Kramer, 2001), which captures spontaneous flexibility (especially idea fluency) in that participants are asked to generate as many as 16 different ways to categorize a group of six cards; however, the task also measures reactive flexibility (set-shifting) as participants must shift between verbal and perceptual categories.

The Role of Positive Affect in Creativity

Findings of a meta-analysis of over 100 studies suggest that positive moods bolster creativity compared to neutral moods (Baas, De Dreu, & Nijstad, 2008). The effects of mood state are typically more powerful in studies that rely on experimental mood induction procedures as opposed to measurement of naturalistically occurring moods (Davis, 2009). Cognitive flexibility may be a mechanism through which positive mood increases creativity (Ashby, Isen, & Turken, 1999; De Dreu, Baas, & Nijstad, 2008; Hirt, 1999). Despite some conflicting findings (George & Zhou, 2002; Kaufmann & Vosburg, 1997), substantial theory and research suggest that positive affect contributes to heightened creativity.

In literature on bipolar disorder, biographical studies of accomplished writers and artists often note intense creative production during manic periods as opposed to depressed or well periods (Jamison, 1989). Similarly, people with affective disorders report that their periods of heightened everyday creativity tended to occur during periods of mildly positive mood states (Richards & Kinney, 1990). Clinically, the idea that positive mood states bolster creativity is often cited as a reason for nonadherence to mood stabilizing medications (Johnson & Fulford, 2008). These studies point toward the need to experimentally examine the role of positive affect in promoting creativity among persons with varying degrees of mania vulnerability.

Fodor (1999) conducted an experiment in which participants either high or low in hypomanic traits (as assessed by the Millon Clinical Multiaxial Inventory-III [MCMI-III, Millon, 1994]) were randomly assigned to a positive or neutral mood induction before completing a standard measure of creativity (The Remote Associates Test [RAT]; Mednick & Mednick, 1967). A significant interaction was found such that the effects of mood enhancement were most pronounced among the individuals high in hypomanic traits. In contrast, the performance of individuals low in hypomanic traits was less impacted by the mood manipulation. We are unaware of any published replications of this mood-dependent effect of hypomania on creative cognition.

Goals of the Current Study

Given the need for studies examining creativity among healthy persons at risk for mania (Johnson et al., 2012), we sought to expand understanding of the relationship between manic vulnerability and cognitive precursors of creativity by using a behavioral measure of cognitive flexibility. We also included a mood induction to examine the role of positive affect in this relationship. Consistent with previous research, we predicted two main effects: both higher hypomanic personality traits and positive affect would be associated with greater cognitive flexibility. We also predicted an interaction between manic vulnerability and positive affect, such that the highest levels of cognitive flexibility would be found among persons higher in manic vulnerability who were randomly assigned to the positive (versus neutral) mood induction.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Given previous literature that depression (Fossati, Ergis, & Allilaire, 2001) and lower IQ (Delis et al., 2007; Floyd, Bergeron, Hamilton, & Parra, 2010; Friedman et al., 2006; Morice, 1990) can both interfere with creativity, we conducted analyses to examine these potential confounds. We predicted that this effect would not be explained by current symptoms of depression or verbal IQ.

METHOD

Participants

Fifty-three unselected college undergraduates completed the study to partially satisfy the research component of introductory psychology courses at a private university in the southeastern United States.[2] The sample was comprised of 52.8% women, and all participants were between ages 17 and 23 (M = 18.85, SD = 1.03). The sample was ethnically diverse (49.1% White/Caucasian, 34.0% Hispanic/Latino, 3.8% Black/African American, 5.7% Asian American/Pacific Islander, 1.9% American Indian or Alaskan Native, 5.7% Other/Mixed Heritage). All participants were proficient in English, and 52.8% percent reported that they were fluent in a language other than English. We did not collect data on the medical and/or psychiatric history of this sample, though we have no reason to believe that they were any different than that of the general undergraduate population (i.e., generally healthy).

Measures

Hypomanic Personality Scale (HPS)—The HPS (Eckblad & Chapman, 1986) is a 48-item true-false self-report measure designed to identify people at risk for manic episodes. Sample items include “I often feel excited and happy for no apparent reason,” and “I often have moods where I feel so energetic and optimistic that I feel I could outperform almost anyone at anything.” In previous studies, more than 75% of persons with HPS scores more than two standard deviations above the mean were found to meet diagnostic criteria fur bipolar spectrum disorders (Eckblad & Chapman, 1986), and scores robustly predicted the onset of manic symptoms over a 13-year period (Kwapil et al., 2000). This measure has also been associated with markers of creativity in nonclinical samples (Furnham et al., 2008; Schuldberg, 2000-2001). The HPS has high reliability (15-week test-retest reliability = .81; α = .87) and, in this study, internal consistency was high (α = .85).

Delis-Kaplan Executive Function System Sorting Test (DKEFS)—The DKEFS (Delis, Kaplan, & Kramer, 2001) Sorting Test: Free Sorting Condition was selected for this study as a measure of cognitive flexibility tapping primarily spontaneous flexibility as well as aspects of reactive flexibility. Participants sort stimulus cards into groups based on shared semantic or perceptual principles with the instruction to complete as many distinct sorts as possible. Participants are scored on the number of confirmed correct sorts as defined by identifying a “target” or correct sorting category as defined in the testing manual (Delis et al., 2001). Scores range from 0 to 16, with higher scores reflecting greater cognitive flexibility. An earlier version of the test (then called the California Card Sorting Test [CCST]) has been validated in a range of psychiatric (Beatty, Jocic, Monson, & Katzuug, 1994; Beatty, Katzung, Nixon, & Moreland, 1993; Fossati et al., 2001) and neurological patient populations (Beatty & Monson, 1990, 1996). For instance, patients with unipolar depression generated fewer categories than age- and IQ-matched controls (Fossati, Ergis, & Allilaire, 2001). More recently, evidence of the construct validity of the DKEFS Sorting

[2]The study was approved by the Institutional Review Board before data collection commenced. Participants completed written informed consent procedures before participating. Beyond the measures reported here, participants completed other measures of emotion regulation styles and cognitive performance.

Test has been documented. Scores have been found to be positively correlated with other measures of cognitive flexibility in clinical samples (Parmenter et al., 2007).

The DKEFS has not been well-integrated in the literature on creativity to date. What it measures, however, is consistent with several definitions of creativity and creative cognition. First, it involves identifying associations between disparate stimuli through higher-order categorization (Mumford, Mobley, Uhlman, & Reiter-Palmon, 1991). Second, because credit is only given for the number of target categories identified rather than idiosyncratic groupings, it is consistent with the conceptualization of creativity as the ability to generate ideas that are not only novel, but useful and appropriate to a given situation (Amabile, 1983).

Mood and Anxiety Symptoms Questionnaire (MASQ)—Symptoms of depression were assessed with the General Distress (GD): Depression Symptoms and Anhedonic Depression subscales of the MASQ (Watson, Clark et al., 1995; Watson, Weber et al., 1995). This measure has demonstrated strong convergent and divergent validity in previous studies (Watson, Clark, et al., 1995; Watson, Weber et al., 1995). Anhedonic Depression measures symptoms of depression that do not commonly occur with anxiety, such as the inability to experience pleasure and feelings of psychomotor slowing; GD: Depression Symptoms, on the other hand, represent symptoms traditionally associated with depression but that are commonly comorbid with anxiety. Both Anhedonic Depression and GD: Depression scales demonstrated high internal consistency (α = .88 and .91, respectively).

Vocabulary Subtest of the Wechsler Adult Intelligence Scale, Third Edition (WAIS-III)—The WAIS-III (Wechsler, 1997), a widely used measure of verbal intelligence, was administered individually and scored following standardized procedures. The vocabulary subtest is a valuable marker of overall intelligence as it is the WAIS subtest that demonstrates the strongest loading on a general ability (*g*) factor (Flanagan, McGrew, & Ortiz, 2000; Kaufman & Lichtenberger, 1999).

Procedure

Overview—Participants were randomly assigned to complete either a positive or neutral mood induction procedure before completing the DKEFS Sorting Test. Participants were given a short break (10 min) before being asked to complete the HPS and MASQ to ensure that any lingering effects of the mood induction did not impact responses to the measures. The WAIS vocabulary test was administered prior to the mood induction.

Mood Inductions—Before completing the mood induction procedures, participants were asked to rate their current mood on a 9-point scale ranging from −4 (“*extremely unpleasant*”) to 4 (“*extremely pleasant*”). The positive mood inductions were based on procedures described and validated by Eich and Metcalfe (1989). In the positive mood condition, participants were asked to complete a procedure that would help them “get into a pleasant mood.” They were asked to listen to some “upbeat, happy classical music” on headphones (a recording of W. A. Mozart’s “Eine Kleine Nachtmusik” played at standard tempo) and to recall a pleasant event. In the neutral mood induction designed for this study, participants were asked to complete a procedure that they were told would help “clear your mind.” In this condition, participants were asked to create a clear mental picture of the contents of their bedroom (Cervone, Kopp, Schaumann, & Scott, 1994). No music was played during this task. In both conditions, participants were given specific instructions to increase the vividness of the scene they were imagining. After the mood induction instructions were read, the experimenter left the room.

Three minutes after the mood induction instructions were read, the experimenter returned to the room to re-administer a mood scale. In the positive mood condition, the experimenter continued with the next part of the study when the participants' mood reached a score of "2" ("*moderately pleasant*") or higher. If participants in this condition did not reach a score of "2" after 3 minutes, the experimenter asked the participant to continue to imagine the positive event and returned up to two more times at 3-minute intervals to reassess mood. If the participant did not achieve a score of "2" or higher after 9 minutes, the induction was discontinued and the participant was asked to complete the DKEFS Sorting Test.[3] The neutral mood condition lasted 3 minutes. For the manipulation check, the final mood rating was used.

Sorting Test and Questionnaires—(Delis et al., 2001). Participants completed the DKEFS Sorting Test immediately after the mood induction procedure. The experimenter read participants a standardized set of instructions explaining that they would be presented with six stimulus cards. Participants were instructed to sort the cards into two groups, with three cards in each group, based on some shared semantic or perceptual principle and then verbally state the rationale for the two groupings. Participants were then told that the experimenter would scramble the cards and that they would be instructed to repeat the process making different groups each time they sorted them. A brief five-line summary of the instructions were presented to participants and left in view to reference while they completed the task. Next, using a set of sample cards, the experimenter demonstrated the process of sorting the categories into groups, verbally describing both groups, scrambling tile cards, and re-sorting the cards into two new groups. Participants were then instructed to complete as many distinct groupings as they could and to work as quickly as possible. After the instructions, they were presented with the first set of cards.

The task was discontinued after one of the following events occurred: the examinee indicated that he or she could not identify any additional ways to sort the cards (after receiving one prompt to keep trying), 240 seconds of cumulative sorting time elapsed,[4] or the examinee completed ten attempted sorts. Feedback about whether participants' work was right or wrong was not provided during testing. After the first set of cards was discontinued, the procedure was then repeated with a second set of six distinct cards. After a 10-minute break, participants completed the HPS and MASQ.

RESULTS

Before conducting formal analyses, we examined descriptive statistics on key variables. Then, we examined the effectiveness of the mood induction in changing mood state. We examined how risk for mania (HPS) and mood influenced cognitive flexibility using univariate analyses and then examined the hypothesized interaction using hierarchical multiple regression analyses. Finally, we conducted additional analyses to examine whether depression symptoms and intelligence operated as confounds.

Preliminary Analyses

As shown in Table 1, HPS, MASQ, DKEFS, and WAIS vocabulary scores were within an expected range, with significant variability. Randomization to the mood conditions was successful in ensuring that groups were comparable: As shown in Table 1, independent sample *t*-tests revealed that the positive and neutral mood induction groups did not

[3]23 of 26 participants in the positive mood condition achieved a score of 2 or higher following one 3-minute interval, 2 participants were given an additional interval and 1 required two additiona1 3-minute intervals.
[4]The experimenter used a stop watch to record the cumulative amount of time the participant spent sorting the cards. The experimenter paused the stopwatch while participants were describing the categories and while the experimenter scrambled the cards.

significantly differ on Mood Pre-Prime, HPS scores, GD: depression, anhedonic depression, verbal IQ, or age. Furthermore, gender did not differ across groups, $\chi^2(1) = .16$, *ns.* Cohen's *d* was also calculated to estimate effect sizes for potential group differences not equalized through randomization. Relative to the neutral mood condition, the positive mood induction group tended to report lower pre-prime mood ($d = -.50$), higher anhedonic depression scores ($d = .41$), and somewhat lower HPS scores ($d = -.27$). Applying Cohen's (1988) interpretation of *d* (i.e., small [$d > .2$], moderate [$d > .5$], and large [$d > .8$]), the pre-prime mood differences were moderate in magnitude, the anhedonic depression score differences were small to moderate, and the HPS differences were small.

Manipulation Check: Effects of the Mood Induction

As a manipulation check, a repeated measures Analysis of Variancc (ANOVA) was conducted to measure whether the mood induction conditions differentially influenced mood ratings. As expected, there was a significant interaction of time (pre/post) and prime condition on mood, $F(1, 51) = 15.60$, $p < .001$. Among those in the positive mood induction condition, mood ratings were significantly higher after the mood prime than those in the neutral mood induction condition (mood did not change in the neutral condition, $t = 0.75$, $p > .05$, whereas it increased significantly in the positive condition, $t = 6.99$, $p < .001$). This difference was moderate to large in magnitude ($d = .67$). HPS scores were not related to mood ratings at baseline, ($r = -.02$, *ns*) or post-induction ($r = -.01$, *ns*).

Examining the Relations Among Mood, Hypomanic Personality, and Cognitive Flexibility

Before conducting primary analyses, we examined the main effects of mood and HPS scores on cognitive flexibility scores. As shown in Table 1, the positive mood group exhibited a small, nonsignificant tendency toward generating more correct sorts ($d = .24$). The bivariate correlation of HPS and DKEFS scores was also nonsignificant ($r = .01$).

To test the primary hypothesis that mood would moderate the effect of HPS scores on cognitive flexibility, we conducted hierarchical multiple regression analysis with DKEFS scores as the outcome variable (see Table 2). In Block 1, we entered mood prime condition (dummy coded as 0 = neutral mood condition; 1 = positive mood condition). In Block 2, we entered HPS scores. In Block 3, we entered the interaction of the Prime condition and HPS scores. HPS scores were centered before entry. Consistent with univariate analyses, the combined main effects of mood prime condition and HPS were not significant. However, the interaction of HPS and mood prime condition significantly predicted DKEFS scores ($p = .03$) and accounted for an additional 10% of the variance in this variable.

The interaction was graphed (see Figure 1) using the procedures described by Aiken and West (1991). Consistent with predictions, this graph suggests that the highest scores on the DKEFS Sorting test were obtained by higher scorers in HPS who were assigned to a positive mood prime. In the positive mood condition, the correlation between HPS scores and number of correct sorts was positive and approached statistical significance ($r = .36$, $p = .07$); HPS scores were negatively and nonsignificantly correlated with number of correct sorts in the neutral mood condition ($r = -.27$, $p = .17$). A test of significant differences between independent correlations (Cohen & Cohen, 1983) revealed that these two correlations were significantly different from each other ($z = 2.24$, $P < .05$). Simple slope analyses revealed that neither slopes were significant (neutral condition $\beta = .35$, $p > .05$; positive condition $\beta = .47$, $p > .05$). In addition, we conducted a "regions of significance" test to examine at what level of HPS score the mood effect is significant (Aiken & West, 1991). This analysis revealed a lower bound of −29.15 and an upper bound of 5.82, indicating that the significant effect of mood prime on DKEFS score was significant for those with HPS scores of 26.19 or higher (28% of the current sample). The analysis also suggested that the reverse finding (people in neutral condition outperform those in the positive condition) would occur only at impossibly low HPS scores (−8.78). In other words, it is unlikely that those low in HPS scores who were in the neutral condition would score higher on the DKEFS relative to those in the positive condition. Thus, the meaningful effect of this interaction is at the high end of HPS scores.

Assessing the Role of Depression and Intelligence as Potential Confounds

We examined depression symptoms (GD Depression and Anhedonic Depression scales) and Intelligence (WAIS Vocabulary) as predictors of DKEFS scores and as covariates in the regression analyses reported above. Neither depression score was a significant predictor of number of correct sorts (GD Depression, $r = .25$, *ns* and Anhedonic Depression, $r = -.18$, *ns*), either as a main effect or in interaction with mood prime condition. Intelligence was not significantly correlated with HPS ($r < .01$, *ns*) or DKEFS scores ($r = .06$, *ns*). Furthermore, the interaction between HPS scores and mood prime in predicting cognitive flexibility remained significant when the analyses were repeated with intelligence and both depression variables entered as covariates.

DISCUSSION

Past research has found elevated creativity among people with bipolar disorder and their unaffected relatives, as well as those with elevated hypomanic personality traits. Little work, though, has examined cognitive or behavioral indices of creativity. Despite a huge emphasis on the role of mood in these effects in the clinical literature, very little research has been conducted on the role of mood in the link between creativity and mania (Johnson et al., 2012). The present study found that hypomanic personality style interacted with a mood induction to predict cognitive flexibility, a potential element involved in the cognitive process of creativity. As hypothesized, individuals obtaining the highest cognitive flexibility scores were those with elevated hypomanic personality traits who received a positive rather than neutral mood induction. This present study replicates a prior study finding that positive affect enhances the links of mania risk with creative cognition (Fodor, 1999), and extends the pattern to different measures. The conceptual replication in the present study using different methodologies bolsters the evidence that positive affect is key to understanding creative cognition among those at risk for mania. Results were not confounded by verbal intelligence or the presence of current depression symptoms.

Despite support for the primary hypothesis, we were surprised not to find the two hypothesized main effects. First, even though a small effect in the hypothesized direction was observed, our findings did not replicate previous reports of a main effect of positive affect on cognitive flexibility (Baas et al., 2008). It is worth noting that other researchers have failed to find effects of positive affect on creative cognition (Clapham, 2000-2001; George & Zhou, 2002; Kaufmann & Vosburg, 1997). Nonetheless, findings of a meta-analysis suggest that mood induction procedures designed to induce high arousal positive affect may be particularly powerful (Baas et al., 2008). Our induction would not be expected to generate these states. Second, although the positive mood induction procedures we used are well-validated (Eich & Metcalfe, 1989) and induced a significant increase in self-rated mood, participants were aware that our goal was to improve their mood, and so demand characteristics may have interfered with the validity of our induction. Furthermore, subtle difference (e.g., use of music) between the positive mood induction and the neutral mood induction developed for this. study may have also introduced additional unanticipated confounds. Thus, within-subjects repeated-measures designs and mood induction procedures designed to amplify arousal might be important to consider in future research.

Beyond the absence of direct effects for the mood induction, we did not find direct effects of mania risk on creative cognition in this nonclinical sample. Previous studies showing significant main effects for mania risk on measures of creative cognition (Rawlings & Georgiou, 2004; Schuldberg, 2000-2001; Shapiro & Weisberg, 1999) employed measures of creativity that were primarily attitudinal in nature (e.g., preference for novel figures, or self-ratings of ability or personality), whereas the present study employed a behavioral measure of creative cognition. Indeed, the one prior study exan1ining hypomanic personality (assessed by the HPS) scores as predictors of both self-report and behavioral measures of creativity (Furnham et al., 2008) found HPS to be a more robust predictor of self-report creativity than behavioral measures.

A third unanticipated finding was that higher HPS scores related (albeit weakly) to less cognitive flexibility among those in the neutral mood condition. Although some previous research showed no link of mania risk and creativity after a neutral mood induction (Fodor, 1999), the present study is consistent with prior research showing that without a mood induction, children with bipolar disorder (Dickstein et al., 2007) and adult unaffected relatives of people with bipolar disorder (Clark et al., 2005) show deficits in at least one form of cognitive flexibility (reactive flexibility) compared to healthy controls. Taken together with previous findings, effects observed in the neutral mood condition suggest that people prone to mania may underperform on measures of flexibility when not in happy moods.

In addition to the issues noted above, there are several limitations in the present study that warrant mention. A first concern is the small sample size. Second, because we expected levels to be quite low in an analog sample, we did not measure current hypomanic symptoms. Third, this study examined only one theorized element of cognitive processes associated with creativity: cognitive flexibility, and did not measure a battery of creativity precursors nor lifetime creative achievement (Amabile, 1993; Csikszentmihali, 1993). Links between manic vulnerability and creative thinking may not necessarily translate into an ability to realize creative achievements.

Further research is needed to clarify the mechanisms underlying the moderating effect of positive affect on the association of hypomanic personality and cognitive flexibility. Rapid thinking (which characterizes hypomanic states) produces increases in both positive mood and subjective feelings of creativity (Pronin & Wegner, 2006); as such, this construct may further explain the mood-dependent effects of hypomania on creative cognition. At a biological level, activating mood states which characterize mania have been associated with higher levels of dopamine and noradrenaline which impact working memory capacity and the potential for creativity (for a review see De Dreu, Baas, & Nijstad, 2008). Future studies examining biological correlates of both mania and creativity in both clinical and nonclinical samples could benefit from experimentally inducing positive affect before assessing behavioral markers of creative cognition.

Despite limitations, the current results suggest that during positive moods, those at greater risk for mania demonstrate an enhancement of cognitive flexibility that was not observed among those at low risk for mania. There are two broader implications for this finding. First, it is important to note that protecting creativity is reported as a major reason for treatment nonadherence among people with bipolar disorder (Johnson & Fulford, 2008; Polatin & Fieve, 1971). Thus, there is a significant need to understand the role of creativity in mania to build acceptable intervention programs for people with bipolar disorder (Murray & Johnson, 2010). Our findings suggest that full-blown mania may not be needed to bolster creativity, but rather that quite mild mood shifts could be helpful. Second, the focus on the association of creativity and hypomania is consistent with other recent calls in the wider literature to better understand how personality traits that are risk factors for psychopathology can also confer adaptive advantages in some contexts (e.g., Ein-dor et al., 2010).

Historically, much of the literature on mania and creativity has focused on studies of eminence. Although many eminent creative persons are suspected to have experienced bipolar disorder, little is known about how or why this relationship might exist. Findings from the current study suggest that the interaction between hypomania and positive affect may contribute to creative cognition. Thus, this study joins a limited literature in pointing toward a cognitive aspect of creativity that might be enhanced for this population during periods of elevated mood states.

Acknowledgments

The authors wish to acknowledge Ron Hudak, Michael Lopez, and Nicole Lupei for their role in the collection of these data. Preparation of this manuscript was facilitated by NIMH grant R01 MH 076021 to Sheri Johnson and T32 MH 018261-27 to Daniel Fulford.

REFERENCES

Abraham A, Windmann S, Daum I, Güntürkün O. Conceptual expansion and creative imagery as a function of psychoticism. Consciousness and Cognition: An International Journal. 2005; 14(3):520–534.

Aiken, LS.; West, SG. Multiple regression: Testing and interpreting interactions. Sage; Newbury Park, CA: 1991.

Amabile T. The social psychology of creativity: A componential conceptualization. Journal of Personality and Social Psychology. 1983; 45(2):357–376.

Amabile T. What does a theory of creativity require? Psychological Inquiry. 1993; 4(3):179–181.

Andreasen NJC. Creativity and mental illness: Prevalence rates in writers and their first-degree relatives. American Journal of Psychiatry. 1987; 144:1288–1292. [PubMed: 3499088]

Ashby F, Isen A, Turken A. A neuropsychological theory of positive affect and its influence on cognition. Psychological Review. 1999; 106(3):529–550. [PubMed: 10467897]

Baas M, De Dreu C, Nijstad B. A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus? Psychological Bulletin. 2008; 134(6):779–806. [PubMed: 18954157]

Beatty W, Jocic Z, Monson N, Katzung V. Problem solving by schizophrenic and schizoaffective patients on the Wisconsin and California Card Sorting Tests (WCST, CCST). Neuropsychology. 1994; 8(1):49–54.

Beatty W, Katzung V, Nixon S, Moreland V. Problem-solving deficits in alcoholics: Evidence from the California Card Sorting Test (CCST). Journal of Studies on Alcohol. 1993; 54(6):687–692. [PubMed: 8271804]

Beatty W, Monson N. Problem solving in Parkinson's disease: Comparison of performance on the Wisconsin and California Card Sorting Tests (WCST, CCST). Journal of Geriatric Psychiatry cmd Neurology. 1990; 3(3):163–171.

Beatty W, Monson N. Problem solving by patients with multiple sclerosis: Comparison of performance on the Wisconsin and California Card Sorting Tests (WCST, CCST). Journal of the International Neuropsychological Society. 1996; 2(2):134–140. [PubMed: 9375198]

Cervone D, Kopp DA, Schaumann L, Scott WD. Mood, self-efficacy, and performance standards: Lower moods induce higher standards for performance. Journal of Personality and Social Psychology. 1994; 67(3):499–512.

Clapham MM. The effects of affect manipulation and information exposure on divergent thinking. Creativity Research Journal. 2000-2001; 13:335–350.

Clark L, Sarna A, Goodwin G. Impairment of executive function but not memory in first-degree relatives of patients with bipolar I disorder and in euthymic patients with unipolar depression. American Journal of Psychiatry. 2005; 162(10):1980–1982. [PubMed: 16199852]

Cohen, J.; Cohen, P. Applied multiple regression/correlation analysis for the behavioral sciences. Erlbaum; Hillsdale, NT: 1983.

Coryell W, Endicott J, Keller M, Andreasen N, Grove W, Hirschfeld RMA, et al. Bipolar affective disorder and high achievement: A familial association. American Journal of Psychiatry. 1989; 146:983–988. [PubMed: 2750997]

Csikszentmihali M. Does overinclusiveness equal creativity? Psychological Inquiry. 1993; 4(3):188–189.

Davis MA. Understanding the relationship between mood and creativity: A meta-analysis. Organizational Behavior and Human Decision Processes. 2009; 108(1):25–38.

De Dreu C, Baas M, Nijstad B. Hedonic tone and activation level in the mood-creativity link: Toward a dual pathway to creativity model. Journal of Personality and Social Psychology. 2008; 94(5): 739–756. [PubMed: 18444736]

Delis, D.; Kaplan, E.; Kramer, J. Delis-Kaplan Executive Function System (DKEFS): Examiner's manual. The Psychological Corporation; San Antonio, TX: 2001.

Delis D, Lansing A, Houston W, Wetter S, Han S, Jacobson M, et al. Creativity lost: The importance of testing higher-level executive functions in school-age children and adolescents. Journal of Psycho-educational Assessment. 2007; 25(1):29–40.

Dickstein D, Nelson E, McClure E, Grimley M, Knopf L, Brotman M, et al. Cognitive flexibility in phenotypes of pediatric bipolar disorder. Journal of the American Academy of Child and Adolescent Psychiatry. 2007; 46(3):341–355. [PubMed: 17314720]

Eckblad M, Chapman LJ. Development and validation of a scale for hypomanic personality. Journal of Abnormal Psychology. 1986; 95:214–222. [PubMed: 3745642]

Eich E, Metcalfe J. Mood dependent memory for internal versus external events. Journal of Experimental Psychology: Learning, Memory, and Cognition. 1989; 15(3):443–455.

Ein-Dor T, Mikulincer M, Doron G, Shaver PR. The attachment paradox: How can so many of us (the insecure ones) have no adaptive advantages? Perspectives on Psychological Science. 2010; 5:123–141.

Estrada C, Isen A, Young M. Positive affect improves creative problem solving and influences reported source of practice satisfaction in physicians. Motivation and Emotion. 1994; 18(4):285–299.

Filipowicz A. From positive affect to creativity: The surprising role of surprise. Creativity Research Journal. 2006; 18(2):141–152.

Finke, R.; Ward, T.; Smith, S. Creative cognition: Theory, research, and applications. MIT Press; Cambridge, MA: 1992.

Flanagan, DP.; McGrew, KS.; Ortiz, SO. The Wechsler Intelligence Scales (WTS) and Gc-Gf theory. Allyn and Bacon; Boston: 2000.

Floyd RG, Bergeron R, Hamilton G, Parra GR. How do executive functions fit with the Cattell-Horn-Carroll model? Some evidence from a joint factor analysis of the Delis-Kaplan Executive Function System and the Woodcock-Johnson III Tests of Cognitive Abilities. Psychology in the Schools. 2010; 47(7):721–738.

Fodor E. Subclinical inclination toward manic-depression and creative performance on the Remote Associates Test (RAT). Personality and Individual Differences. 1999; 27(6):1273–1283.

Fossati P, Ergis A, Allilaire J. Problem-solving abilities in unipolar depressed patients: Comparison of performance on the modified version of the Wisconsin and the California Sorting Tests (WCST, CCST). Psychiatry Research. 2001; 104(2):145–156. [PubMed: 11711168]

Fredrickson B. The role of positive emotions in positive psychology: The broadenand-build theory of positive emotions. American Psychologist. 2001; 56(3):218–226. [PubMed: 11315248]

Friedman NP, Miyake A, Corley RP, Young SE, DeFries JC, Hewitt JK. Not all executive functions are related to intelligence. Psychological Science. 2006; 17:172–179. [PubMed: 16466426]

Furnham A, Batey M, Anand K, Manfield J. Personality, hypomania, intelligence and creativity. Personality and Individual Differences. 2008; 44(5):1060–1069.

George J, Zhou J. Understanding when bad moods foster creativity and good ones don't: The role of context and clarity of feelings. Journal of Applied Psychology. 2002; 87(4):687–697. [PubMed: 12184573]

Goodwin, FK.; Jamison, KR. Manicdepressive illness: Bipolar and recurrent unipolar disorders. Oxford University Press; New York: 2007.

Greene T, Noice H. Influence of positive affect upon creative thinking and problem solving in children. Psychological Reports. 1988; 63(3):895–898.

Guilford J. Creativity. American Psychologist. 1950; 5(9):444–454. [PubMed: 14771441]

Guilford, JP. The nature of human intelligence. McGraw-Hill; New York: 1967.

Henry C, Mitropoulou V, New A, Koenigsberg HW, Silverman J, Siever LJ. Affective instability and impulsivity in borderline personality and bipolar II disorders: Similarities and differences. Journal of Psychiatric Research. 2001; 35:307–312. [PubMed: 11684137]

Hirt E, Devers E, McCrea S. I want to be creative: Exploring the role of hedonic contingency theory in the positive mood-cognitive flexibility link. Journal of Personality and Social Psychology. 2008; 94(2):214–230. [PubMed: 18211173]

Hirt, ER. Mond. In: Runco, MA.; Pritzker, SR., editors. Encyclopedia of creativity. Academic; San Diego, CA: 1999. p. 241-250.

Isen, A. Handbook of cognition and emotion. Wiley; New York: 1999. Positive affect; p. 521-539.

Isen A, Daubman K. The influence of affect on categorization. Journal of Personality and Social Psychology. 1984; 47(6):1206–1217.

Isen A, Daubman K, Nowicki G. Positive affect facilitates creative problem solving. Journal of Personality and Social Psychology. 1987; 52(6):1122–1131. [PubMed: 3598858]

Jamison KR. Mood disorders and patterns of creativity in British writers and artists. Psychiatry: Journal for the Study of Interpersonal Processes. 1989; 52(2):125–134.

Jamison, KR. Touched with Fire: Manic-Depressive Illness and the Artistic Temperament. Free Press; New York: 1993.

Johnson SL. Mania and dysregulation in goal pursuit: A review. Clinical Psychology Review. 2005; 25(2):241–262. [PubMed: 15642648]

Johnson SL, Fulford D. Development of the Treatment Attitudes Questionnaire in bipolar disorder. Journal of Clinical Psychology. 2008; 64:466–481. [PubMed: 18357575]

Johnson SL, Murray G, Fredrickson B, Youngstrom EA, Hinshaw S, Bass JM, et al. Creativity and bipolar disorder: Touched by fire or burning with questions? Clinical Psychology Review. 2012; 32:1–12. [PubMed: 22088366]

Judd L, Akiskal H, Schettler P, Coryell W, Endicott J, Maser J, et al. A prospective investigation of the natural history of the long-term weekly symptomatic status of bipolar II disorder. Archives of General Psychiatry. 2003; 60(3):261–269. [PubMed: 12622659]

Kaufman, A.; Lichtenberger, EO. Essentials of WAIS-III assesnnent. Wiley; New York: 1999.

Kaufmann G, Vosburg S. “Paradoxical” mood effects on creative problem-solving. Cognition & Emotion. 1997; 11(2):151–170.

Kwapil T, Miller M, Zinser M, Chapman L, Chapman J, Eckblad M. A longitudinal study of high scorers on the Hypomanic Personality Scale (HPS). Journal of Abnormal Psychology. 2000; 109(2):222–226. [PubMed: 10895560]

Kyaga S, Lichtenstein P, Boman M, Hultman C, Langsttrom N, Landen M. Creativity and mental disorder: Family study of 300,000 people with severe mental disorder. The British Journal of Psychiatry. 2011; 199:1–7. [PubMed: 21719872]

Mednick, SA.; Mednick, MT. Remote Associates Test (RAT). Houghton Mifflin.; Boston: 1967. Examiner’s manual.

Merikangas K, Akiskal H, Angst J, Greenberg P, Hirschfeld R, Petukhova M, et al. Lifetime and 12-month prevalence of bipolar spectrum disorder in the National Comorbidity Survey Replication. Archives of General Psychiatry. 2007; 64(5):543–552. [PubMed: 17485606]

Millon, T. Millon Clinical Multiaxial Inventory-III (MCMI-III). National Computer Systems; Minneapolis: 1994.

Morice R. Cognitive inflexibility and prefrontal1 dysfunction in schizophrenia and mama. British Journal of Psychiatry. 1990; 157:50–54. [PubMed: 2397362]

Mumford M, Mobley M, Uhlman C, Reiter-Palmon R. Process analytic models of creative capacities. Creativity Research Journal. 1991; 4(2):91–122.

Murray G, Johnson SL. The clinical significance of creativity in bipolar disorder. Clinical Psychology Review. 2010; 30(6):721–732. [PubMed: 20579791]

Myin-Germeys I, Peeters R, Havermans R, Nicolson N, deVries M, Delespaul P, et al. Emotional reactivity to daily life stress in psychosis and affective disorder: An experience sampling study. Acta Psychiatrica Scandinavica. 2003; 107(2):124–131. [PubMed: 12534438]

Parmenter B, Zivadinov R, Kerenyi L, Gavett R, Weinstock-Guttman B, Dwyer M, et al. Validity of the Wisconsin Card Sorting (WCST) and Delis-Kaplan Executive Function System (DKEFS) Sorting Tests in multiple sclerosis. Journal of Clinical and Experimental Neuropsychology. 2007; 29(2):215–223. [PubMed: 17365256]

Polatin P, Fieve RR. Patient rejection of lithium carbonate prophylaxis. Journal of the American Medical Association. 1971; 218(6):864–866. [PubMed: 5170924]

Pronin E, Wegner DM. Manic thinking: Independent effects of thought speed and thought content on mood. Psychological Science. 2006; 17:807–813. [PubMed: 16984299]

Rawlings D, Georgiou G. Relating the components of figure preference to the components of hypomania. Creativity Research Journal. 2004; 16(1):49–57.

Rende B. Cognitive flexibility: Theory, assessment, and treatment. Seminars in Speech and Language. 2000; 21(2):121–132. [PubMed: 10879545]

Richards R, Kinney D. Mood swings and creativity. Creativity Research Journal. 1990; 3(3):202–217.

Richards R, Kinney DK, Lunde I, Benet M, Merzel AP. Creativity in manic-depressives, cyclothymes, their normal relatives, and control subjects. Journal of Abnormal Psychology. 1988; 97(3):281–288. [PubMed: 3192819]

Rothenberg A. Bipolar illness, creativity, and treatment. Psychiatric Quarterly. 2001; 72(2):131–147. [PubMed: 11433879]

Santosa C, Strong C, Nowakowska C, Wang P, Rennicke C, Ketter T. Enhanced creativity in bipolar disorder patients: A controlled study. Journal of Affective Disorders. 2007; 100(1):31–39. [PubMed: 17126406]

Schuldberg D. Six subclinical spectrum traits in normal creativity. Creativity Research Journal. 2000-2001; 13(1):5–16.

Schwarz, N.; Clore, GL. Feelings and phenomenal experiences. In: Higgins, ET.; Kruglanski, AW., editors. Social psychology: Handbook of basic principles. Guilford; New York: 2007. p. 433-465.

Shapiro PJ, Weisberg RW. Creativity and bipolar diathesis: Common behavioral and cognitive components. Cognition and Emotion. 1999; 13(6):741–762.

Shaw ED, Mann JJ, Stokes PE, Manevitz AZA. Effects of lithium carbonate on associative productivity and idiosyncrasy in bipolar outpatients. American Journal of Psychiatry. 1986; 143(9):1166–1169. [PubMed: 3092681]

Simeonova D, Chang K, Strong C, Ketter T. Creativity in familial bipolar disorder. Journal of Psychiatric Research. 2005; 39(6):623–631. [PubMed: 16157163]

Simonton, DK. Creativity and genius. In: Pervin, LA.; John, O., editors. Handbook of personality theory and research. 2nd ed. Guilford; New York: 1999. p. 629-652.

Smith, S.; Ward, T.; Finke, R. The creative cognition approach. MIT Press; Cambridge, MA: 1995.

Tsuchiya KJ, Agerbo E, Byrne M, Mortensen PB. Higher socio-economic status of parents may increase risk for bipolar disorder in the offspring. Psychological Medicine. 2004; 34:787–793. [PubMed: 15500299]

Watson D, Clark L, Weber K, Assenheimer J, Strauss M, McCormick R. Testing a tripartite model: II. Exploring the symptom structure of anxiety and depression in student, adult, and patient samples. Journal of Abnormal Psychology. 1995; 104(1):15–25. [PubMed: 7897037]

Watson D, Weber K, Assenheimer J, Clark L, Strauss M, McCormick R. Testing a tripartite model: I. Evaluating the convergent and discriminant validity of anxiety and depression symptom scales. Journal of Abnormal Psychology. 1995; 104(1):3–14. [PubMed: 7897050]

Wechsler, D. Wechsler Adult Intelligence Scale. 3rd ed. Vol. WAIS-III. Psychological Corporation; San Antonio, TX: 1997.

Woodruff RA, Robins LN, Winokur G, Reich T. Manic depressive illness and social achievement. Acta Psychiatrica Scandinavica. 1971; 47:237–249. [PubMed: 5142566]

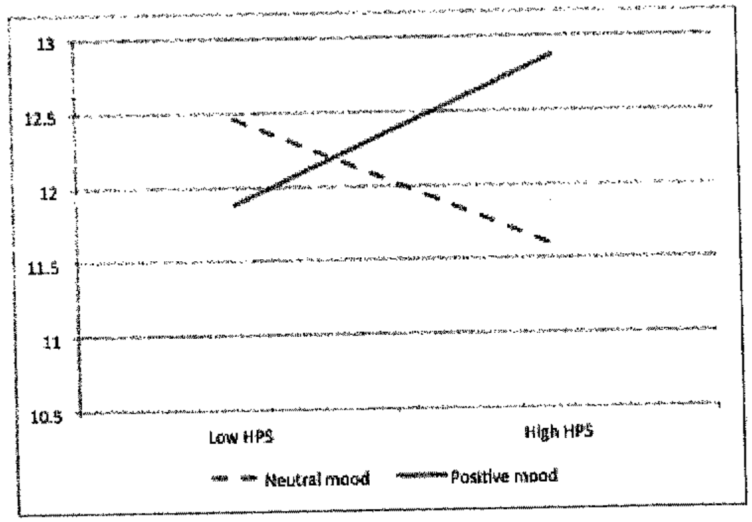

FIGURE 1.

Cognitive flexibility (number of correct sorts on the DKEFS Sorting Test) as a function of HPS scores and mood prime condition (Neutral vs. Positive Mood). The figure shows predicted regression lines for the relationship between HPS and number of correct sorts in the two groups. Values for low and high HPS reflect one standard deviation below and above centered HPS scores for this sample.

Note. DKEFS = Delis-Kaplan Executive Function System; HPS = Hypomanic Personality Scale.

TABLE 1

Descriptive Statistics

	Full Sample		Positive Mood Prime[1]		Neutral Mood Prime[2]		Group Differences	
	M	*SD*	*M*	*SD*	*M*	*SD*	*t*	*d*
Age	18.85	1.03	18.81	1.13	18.89	.93	−0.29	−.08
Mood Pre-Prime	1.02	1.31	0.69	1.22	1.33	1.33	1.82	−.50
Mood Post-Prime	1.83	0.99	2.15	0.88	1.52	1.01	2.43*	.67
Hypomanic Personality (HPS)	20.37	8.18	19.23	8.39	21.48	7.97	−1.00	−.27
General Distress: Depression (MASQ)	27.98	10.65	28.19	12.37	27.78	8.93	0.14	.04
Anhedonic Depression (MASQ)	59.26	13.09	61.97	12.21	56.67	13.59	1.49	.41
WAIS Vocabulary	13.49	2.52	13.46	2.37	13.52	2.69	0.08	−.02
DKEFS Correct Sorts	12.13	1.48	12.31	1.38	11.96	1.58	0.85	.24

Note. DKEFS = Dells-Kaplan Executive Function System, HPS = Hypomanic Personality Scale. MASQ = Mood and Anxiety Symptoms Questionnaire; WAIS = Wechsler Adult Intelligence Scale;

[1] n = 26,

[2] n = 27,

* $p < .05$.

TABLE 2

Predictors of Number of Correct Sorts on the DKEFS Sorting Test (*N* = 53)

Variable Entered	R^2	R^2 Change	Final *b*(*SE*)
Prime condition	.01	.01	.35(.40)
HPS	.01	.00	−.05(.04)
HPS × Prime Condition	.11	.10*	.11(.05)*

Note. DKEFS = Delis-Kaplan Executive Function System; HPS = Hypomanic Personality Scale;

*$p < .05$.