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Mad Genius Revisited:

Vulnerability to Psychopathology, Biobehavioral Approach-Avoidance, and Creativity

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Abstract

Although many believe that creativity associates with a vulnerability to psychopathology, research findings are inconsistent. Here we address this possible linkage between risk of psychopathology and creativity in non-clinical samples. We propose that propensity for specific psychopathologies can be linked to basic motivational approach and avoidance systems, and that approach and avoidance motivation differentially influences creativity. Based on this reasoning, we predict that propensity for approach-based psychopathologies (e.g., positive schizotypy and risk of bipolar disorder) associates with increased creativity, whereas propensity for avoidance-based psychopathologies (e.g., anxiety, negative schizotypy, depressive mood) associates with reduced creativity. Previous meta-analyses resonate with this proposition and showed small positive relations between positive schizotypy and creativity and small negative relations between negative schizotypy and creativity and between anxiety and creativity. To this we add new meta-analytic findings showing that risk of bipolar disorder (e.g., hypomania, mania) positively associates with creativity ($k = 28$; $r = .224$), whereas depressive mood negatively associates (albeit weakly) with creativity ($k = 39$, $r = -.064$). Our theoretical framework, along with the meta-analytic results, indicates when and why specific psychopathologies, and their inclinations, associate with increased or, instead, reduced creativity.

Keywords: psychopathology, creativity, mental disorder, motivation, dopamine

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Many believe that creativity, the ability to generate novel and potentially useful ideas and products (Runco & Jaeger, 2012), is linked to a vulnerability to psychopathology. This "mad genius hypothesis" is fueled by anecdotes, archival studies, and interviews with highly creative individuals (Simonton, 2014a; 2014b). For instance, highly creative people run higher risks of developing psychopathologies (Damian & Simonton, 2015) and several examinations of highly creative people indicated a relatively high prevalence of symptoms of mania, mood disorders, and bipolar disorders (Ludwig, 1992; Post, 1994; Wills, 2003).

The generality and validity of the "mad genius hypothesis" may nevertheless be questionable. The validity of many archival and interview studies has been heavily criticized (Schlesinger, 2009). In addition, systematic study of the linkages between (vulnerability to) psychopathology and creativity in both clinical and non-clinical populations has yielded mixed results (Kaufman, 2014). Whereas some studies observed positive relations between common psychopathologies and creativity (e.g., Claridge, Pryor, & Watkins, 1990; Johnson et al., 2012; Keri, 2009; Rybakowski & Klonowska, 2011; Simonton, 2014b), others obtained null-results (e.g., Lauronen et al., 2004; Rothenberg, 1990; Santosa et al., 2007; Simeonova, Chang, Strong, & Ketter, 2005), or even negative relations (e.g., Abraham, Windmann, McKenna, & Güntürkün, 2007; Crowe, 1996). Likewise, empirical studies on the link between vulnerability to common psychopathologies, such as depression, bipolar disorder, and schizophrenia, have found positive associations (Acar & Sen, 2013; Furnham, Batey, Anand, & Manfield, 2008; Young, Winner, & Cordes, 2013), but also no or even negative relations have been found (Acar & Sen, 2013; Fulford, Feldman, Tabak, McGillicuddy, & Johnson, 2013; Silvia & Kimbrel, 2010; Verhaeghen, Joormann, & Kahn, 2005). Finally, it

is possible that inclinations towards some psychopathologies enhance creative functioning while others may block or impede it. For example, risk of bipolar disorder and psychotic disorders may more strongly relate to creative achievements than vulnerability to depression (Zabelina, Condon, & Beeman, 2014).

The inconsistent findings from the extant literature are puzzling as well as troubling, because whether and how vulnerability to psychopathologies relates to creativity matters for several reasons. First, creativity is highly valued in our society, and allows people to create and enjoy art, novels, and music (Amabile, 1996), to deal with the threats and challenges of everyday life (Runco, 2004), and to sustain and promote our health and well-being (Hirt, Devers, & McCrea, 2008). Thus, creativity is fundamental to individual survival and societal prosperity, and so is understanding its root causes and correlates. Second, because specific psychopathologies and their inclinations are increasingly being understood in terms of neuroendocrine systems (Carson, 2014; Whittle, Allen, Lubman, & Yücel, 2006), understanding the linkages between propensity for specific psychopathologies and creativity may be quite revealing about the neural bases of creative performance (Abraham, 2014a; Flaherty, 2005). Third, many people suffer from, or are at risk of, mental disorders: Estimates are that between one-sixth and one-third of the population suffers from, or did suffer from, a common mental disorder, with lifetime prevalence approximating ten percent for mood disorders (e.g., major depressive disorder, bipolar disorder) and exceeding the ten percent for anxiety disorders (e.g., generalized anxiety disorder, specific phobic and panic disorders) (Kessler et al., 2005; Steel et al., 2014). An even higher proportion of people experience subclinical symptoms associated with common mental disorders (Verdoux & Van Os, 2002). Accordingly, understanding creative performance as a function of propensity for psychopathology can have broad implications for millions of people, and for the treatments aimed at improving their functioning in society.

Here we aim to elucidate whether and how creativity links to inclinations towards commonly occurring psychopathologies, including depressive, anxiety, and bipolar disorders, and schizophrenia and psychosis. These inclinations are typically measured in non-clinical samples as the degree to which people experience symptoms associated with a specific disorder along a continuum ranging from low to high (Brown & Barlow, 2009; Crow, 1990; Gore & Widiger, 2013; Nelson, Seal, Pantelis, & Phillips, 2014; Saulsman & Page, 2004; Verdoux & Van Os, 2002). For example, people may have weak inclination towards depression and experience no depressive symptoms, may experience mild symptoms of depression, or may suffer severe symptoms of depression. The severity and duration of the symptoms determine the diagnostic criteria for clinical mental disorders (Barlow, 2004; Clark & Watson, 1991), especially if people are additionally exposed to environmental risk factors, such as substance use and traumatic experiences (Van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009).

The starting point for our analysis was, first, that inclinations towards specific psychopathologies can be linked to basic motivational approach and avoidance systems (Alloy et al., 2009; Chirila & Feldman, 2012; Ormel et al., 2013). Second, we predicted that approach and avoidance motivation differentially predicts creativity (Baas, De Dreu, & Nijstad, 2008; Friedman & Förster, 2010). Accordingly, we expected that inclinations towards psychopathologies that are linked to the approach system, such as hypomania and positive schizotypy, associate with increased creativity, whereas inclinations towards psychopathologies that are linked to the avoidance system, such as anxiety, depressive mood, and negative schizotypy, associate with reduced creativity. We examine the evidence for these predictions, focusing on existing meta-analytic work on schizotypy and creativity, and trait anxiety and creativity, and report new meta-analytic evidence for the relation between depressive mood and creativity and between risk of bipolar disorder and creativity.

Vulnerability to Psychopathology, Biobehavioral Approach/Avoidance, and Creativity

Converging evidence suggests that core personality, affect, and motivation are grounded in two motivational systems: approach and avoidance (Carver, Sutton, & Scheier, 2000; Depue & Collins, 1999; Elliot, 2008; Gray, 1990; Ormel et al., 2013; Watson, Wiese, Vaidya, & Tellegen, 1999). The approach system relies on dopaminergic brain circuitries (Depue & Collins, 1999; Flaherty, 2005) and deals with appetitive motivation and approach behavior towards rewarding and novel stimuli (Carver et al., 2000; De Fruyt, Van de Wiele, & Van Heeringen, 2000; Elliot, 2008). It associates with feelings of elation, cheerfulness, and eagerness when there is good progress toward, and successful attainment of, rewards and desired end states (Baas, De Dreu, & Nijstad, 2011; Idson, Liberman, & Higgins, 2000). Chronic sensitivity of the approach system, accordingly, associates with extraversion, positive affectivity, openness to experience, and individual differences in the Behavioral Activation System (BAS) (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; De Fruyt et al., 2000; Depue & Collins, 1999; Elliot & Thrash, 2002; Robinson, Moeller, & Ode, 2010).

Because approach motivation is usually triggered in benign and safe situations, an approach orientation facilitates loose and inclusive thinking (Baas et al., 2008; Friedman & Förster, 2010), access to remote semantic concepts (Derryberry & Tucker, 1994), and flexible switching among categories and perspectives (De Dreu, Nijstad, & Baas, 2011; Roskes, De Dreu, & Nijstad, 2012). Moreover, dopamine agonists and approach-related personality traits are related to reduced Latent Inhibition (LI)—the lowered capability to filter out from current attentional focus those stimuli that were previously experienced as irrelevant (Peterson, Smith, & Carson, 2002). Reduced LI associates with flat associative hierarchies and higher creativity: during a creativity task, more seemingly irrelevant concepts and information enter attention, which in turn increases the span of elements to work with, leading to more flexible and original responses (e.g., Carson, Peterson, & Higgins, 2003; Eysenck, 1993). Finally,

individual differences in approach orientation, incidental manipulations of approach motivation, and activation of the dopaminergic brain circuitry, all associate with enhanced flexibility and creativity (Ashby, Isen, & Turken, 1999; Baas et al., 2011; Chermahini & Hommel, 2010; De Dreu et al., 2011; Flaherty, 2005; Friedman & Förster, 2010).

The avoidance system deals with withdrawal motivation and avoidance behavior away from aversive stimuli and threatening circumstances (Carver et al., 2000), and associates with feelings of fear, tension, and vigilance when people regulate aversive circumstances and stimuli (Baas et al., 2011; Idson et al., 2000). Accordingly, chronic sensitivity of the avoidance system associates with neuroticism, negative affectivity, and individual differences in the Behavioral Inhibition System (BIS) (Elliot & Thrash, 2002; Robinson et al., 2010; Watson et al., 1999). It engenders a narrow attentional scope (Derryberry & Tucker, 1994; Friedman & Förster, 2010), consideration of a few perspectives and categories (De Dreu, Baas, & Nijstad, 2008), constrained, vigilant, and focused information processing (Baas, De Dreu, & Nijstad, 2012), and reduced attentional shifting and flexibility (e.g., Baas et al., 2008). Moreover, avoidance-related traits and states are associated with reduced working memory capacity (Eysenck, Derakshan, Santos, & Calvo, 2007), which is needed for assembling novel and appropriate combinations of previously stored knowledge (Chuderski, 2014; De Dreu, Nijstad, Baas, Roskes, & Wolsink, 2012). Consequently, avoidance orientation has been linked to reduced flexibility and creativity (Baas et al., 2008; Friedman & Förster, 2010).

Biobehavioral Approach/Avoidance underlying Inclinations towards Psychopathologies

Key to our analysis is that creativity-enhancing approach orientation and creativity-reducing avoidance orientation differentially associate with specific sets of (inclinations towards) common psychopathologies. Table 1 groups propensity for a set of common psychopathologies in terms of its underlying biobehavioral approach/avoidance. As can be

seen, and as will be elaborated upon in the remainder of this section, risk of psychopathologies involving anxiety, depressive mood, and negative schizotypy has been linked to increased sensitivity in the avoidance system, with anxiety predicting anxiety disorders, depressive mood predicting depressive disorder, and negative schizotypy predicting negative symptoms of schizophrenia. In contrast, (hypo)mania and, to a lesser extent, positive schizotypy have been linked to increased sensitivity in the approach system, with positive schizotypy predicting psychosis and the positive symptoms of schizophrenia, and (hypo)mania predicting bipolar disorder.

Anxiety. Anxiety refers to an unpleasant arousing state, often accompanied by nervous behavior, rumination, somatic complaints, and worries about future events (Lang, Davis, & Öhman, 2000). It may result in anxiety disorders when anxious feelings are exceedingly intense, occur frequently, and continue for prolonged periods of time (Barlow, 2004; Beck, Steer, & Carbin, 1988). Anxiety and anxiety disorders are strongly grounded in the avoidance system. For instance, trait anxiety is related to high neuroticism, BIS, negative emotionality, and avoidance tendencies (Bishop & Forster, 2013; Degnan & Fox, 2007; Elliot, 2008; Klein, Kotov, & Bufferd, 2011; Kotov, Gamez, Schmidt, & Watson, 2010; Matthews & Gilliland, 1999; Suzuki, Samuel, Pahlen, & Krueger, 2015). Moreover, lifetime diagnoses of generalized anxiety disorder associates with BIS but not with BAS (Johnson, Turner, & Iwata, 2003), and symptoms and diagnosis of generalized anxiety disorder associate with enhanced anxiety sensitivity (Naragon-Gainey, 2010).

Depressive mood. Depressive mood is an unpleasant state characterized by low levels of positive emotionality and energy, and high levels of negative emotionality (the non-specific or shared component of both anxiety and depression; Clark & Watson, 1991). Depressive feelings may result in depressive disorder when they are pervasive and persistent. Depression is strongly related to anxiety, BIS, neuroticism, and negative emotionality (Beck

et al., 1988; Klein et al., 2011; Kotov et al., 2010; Suzuki et al., 2015). Twin studies on major depressive disorder show strong positive associations with negative emotionality and neuroticism and weaker negative relations with positive emotionality (Klein et al., 2011). Moreover, depressive symptoms are related to BIS-hypersensitivity (Alloy et al., 2006; Carver & Johnson, 2009; Hirshfeld-Becker et al., 2003) and anxiety sensitivity (Naragon-Gainey, 2010). Similarly, lifetime diagnoses of depression associated with BIS but not with BAS (Johnson et al., 2003), and compared to non-psychiatric controls, participants with major depression showed hyperactive BIS and hypo-active BAS (Pinto-Meza et al., 2006).

Schizotypy. Schizotypy refers to a set of behavioral, affective, and cognitive eccentricities, which constitute the foundation of psychotic disorders, including schizophrenia (Acar & Sen, 2013; Laruelle, Kegeles, & Abi-Dargham, 2003; Van Os et al., 2009; Nelson et al., 2013). It consists of four subtypes. First, unusual experiences refer to the disposition to have unusual perceptual and other cognitive experiences, such as hallucinations and magical and superstitious interpretation of events. Second, impulsive nonconformity is the disposition towards unstable mood and behavior particularly with regard to rules and social conventions. Third, withdrawn schizoid traits (social and physical anhedonia) refer to the tendency towards introverted, emotionally flat and asocial behavior, associated with reduced ability to derive pleasure from social and physical stimulation. Fourth and finally, cognitive disorganization is the tendency for thoughts to become derailed and disorganized. Withdrawn schizoid traits and cognitive disorganization are regarded as "negative" schizotypy, and unusual experiences and impulsive non-conformity are often labeled as "positive" schizotypy. Positive and negative schizotypal experiences that characterize full-blown psychotic disorders are also expressed, and are much more prevalent, at subclinical levels (Van Os et al., 2009). Subclinical schizotypal experiences often disappear over time, but they may progress to psychotic disorders if these experiences persist and individuals are

additionally exposed to environmental risk factors, such as substance use and traumatic experiences (Van Os et al., 2009).

Initial work on how schizotypal traits associate with dopaminergic deregulation and indicators of approach and avoidance sensitivity suggests that negative schizotypy more strongly associates with chronic avoidance orientation, whereas positive schizotypy links to chronic approach orientation Positive and negative schizotypal experiences at both clinical and subclinical levels result from deregulation of dopaminergic brain circuitries that are involved in behavioral reinforcement and approach motivation. Both in patients with schizophrenia and in people with subclinical schizotypal traits the dopaminergic system is in a hyper-responsive state (Grace, 2012), with elevated presynaptic dopamine activity and higher striatal dopamine receptor availability (Fusar-Poli & Meyer-Lindenberg, 2013; Howes et al., 2011). Dopaminergic hyperactivity in the striatum presumably underlies the positive symptoms of schizophrenia, whereas decreased dopaminergic activity in the frontal cortex gives rise to negative symptoms and cognitive impairments (Abi-Dargham, 2004; Durstewitz & Seamans, 2008; Fletcher & Frith, 2009; Laruelle et al., 2003; Meyer-Lindenberg et al., 2002). For example, drug-induced upregulated dopamine function in the striatum is associated with activation of positive schizotypal experiences in schizophrenic participants (Laruelle et al., 1996).

Studies that did not distinguish between positive and negative symptoms found that individuals with schizophrenia score higher on negative affectivity and lower on positive affectivity than healthy controls (Horan, Blanchard, Clark, & Green, 2008), and that self-ratings of psychotic disorder showed weak negative associations with facets of extraversion (Watson et al., 2015). However, studies that explicitly distinguish between positive and negative schizotypy tend to converge on the idea that positive schizotypal experiences may be linked to increased sensitivity in the approach system, whereas negative schizotypal

experiences may be linked to increased sensitivity in the avoidance system and reduced sensitivity in the approach system. In a large sample study involving healthy participants, negative symptoms negatively correlated with extraversion, whereas positive symptoms were positively correlated with extraversion (Claridge et al., 1996). Other studies also found positive relations of positive schizotypy with extraversion (Mason, Claridge, & Jackson, 1995; Muntaner, Garcia-Sevilla, Fernandez, & Torrubia, 1988; Zuckerman, Bone, Neary, Mangelsdorff, & Brustman, 1972, but see Larøi, DeFruyt, van Os, Aleman, & Van der Linden, 2005), novelty seeking (Daneluzzo, Stratta, & Rossi, 2005, but see Hori et al., 2012), and openness to experience (Edmundson, Lynam, Miller, Gore, & Widiger, 2011; Kwapil et al., 2008, 2013; Larøi et al., 2005; Miller & Tal, 2007; Suzuki et al., 2015). Negative symptoms, on the other hand, were positively related to neuroticism and social anxiety (Miller & Tal, 2007), and were either negatively related or unrelated to extraversion and openness to experience (Miller & Tal, 2007; Edmundson et al., 2011; Kwapil, Barrantes-Vidal, & Silvia, 2008; Larøi et al., 2005; Vollema & Van den Bosch, 1995). Negative symptoms in schizophrenia have also been associated with a deficit in anticipatory pleasure (the experience of pleasure related to future activities; Gard, Kring, Gard, Horan, & Green, 2007; Gold, Waltz, Prentice, Morris, & Heerey, 2008). Thus, as shown in Table 1, preliminary evidence suggests that negative (positive) schizotypy more strongly associates with chronic avoidance (approach) orientation.

Risk of bipolar disorder. The risk factors of bipolar disorder, hypomania and mania, are characterized by pervasive elevated or irritable moods, as well as thoughts and behaviors that are consistent with such moods (Johnson et al., 2008; Mansell & Pedley, 2008). Individuals in a (hypo)manic state are extremely energetic, outgoing and confident, and have a decreased need for sleep. (Hypo)mania is strongly associated with bipolar spectrum disorders, with Bipolar I Disorder defined by at least one lifetime manic episode and Bipolar

II Disorder by less severe hypomanic and depressive episodes. For example, subclinical hypomanic symptoms are good predictors of bipolar onset (Kwapil et al., 2000) and diagnoses of bipolar spectrum disorders (Walsh, Royal, Brown, Barrantes-Vidal, & Kwapil, 2012).

Hypomania and mania are related to dopaminergic modulation (O'Sullivan, Szczepanowski, El-Deredy, Mason, & Bentall, 2011; Schwartz, Ksir, Koob, & Bloom, 1982) and are characterized by positive emotionality (Gruber, Johnson, Oveis, & Keltner, 2008), impulsivity (Swann, Dougherty, Pazzaglia, Pham, & Moeller, 2004), reward sensitivity (Mason, O'Sullivan, Blackburn, Bentall, & El-Deredy, 2012), high openness to experience and extraversion (DeGeorge, Walsh, Barrantes-Vidal, & Kwapil, 2014; Meyer, 2002; Walsh et al., 2012), and high BAS activation and BAS hyper-sensitivity (Alloy et al., 2006, 2009; Carver & Johnson, 2009). Moreover, individuals with bipolar spectrum disorders score high on BAS sensitivity and BAS (but not BIS-) relevant cognitive dimensions of performance concerns (Alloy et al., 2009; Hirshfeld-Becker et al., 2003).

Comorbidity. From Table 1 and the above review, it follows that (inclinations towards) psychopathologies that are associated with the same motivational system would covary. This fits work on comorbidity among psychopathologies. Comorbidity among psychopathologies is high with more than 60% of affected individuals having at least two or more disorders (Borsboom & Cramer, 2013; Kessler et al., 2005; Krueger, 1999). However, fitting the conjecture that specific disorders are to a large extent grounded in different motivational systems, we tend to see indeed higher comorbidity among (risk of) psychopathologies associated with the same motivational system. Thus, the highest life-time odds ratios of non-affective psychosis are with bipolar disorder (11.4) as compared to 2.2 for major depressive disorder and 3.9 for generalized anxiety disorder (Kessler et al., 2005). The prevalence of hallucinations in bipolar disorder is 18% (Goodwin & Jamison, 1990), and

positive, but not negative, schizotypy predict manic episodes and higher (hypo)manic symptoms at a 10-year follow-up (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994; Kwapil et al., 2008, 2013). Conversely, there is an overlap in genetic risk factors for major depression and generalized anxiety disorder (Kendler, Neale, Kessler, Heath, & Eaves, 1992) and strong associations are observed between major depressive disorder, dysthymia, and generalized anxiety disorders, with tetrachoric correlations ranging from .59 to .69 (Krueger, 1999).

Similar differential strengths in associations are found for subclinical symptoms. For example, measures of depressive mood and trait anxiety show high covariance. In one study involving multiple measures of depressive mood and anxiety, Hollon and Kendall (1980) observed covariance estimates ranging between 36% and 61%. In a review of the literature on experienced depressive mood and anxiety in hospitals, Bjelland, Dahl, Haug, and Neckelmann (2002) obtained a mean covariance of 31%. In a similar vein, hypomania strongly covaries with positive (32%), but not with negative schizotypy (0%; Applegate, El-Deredy, & Bentall, 2009; also see Thalbourne, Keogh, & Crawley, 1999). The covariance between hypomania and positive schizotypy is considerably higher than, for example, the covariance between risk of bipolar disorder and depressive mood (7%; Walsh et al., 2012; 2%; Meyer, 2002), risk of bipolar disorder and anxiety (1%; Preti et al., 2015), positive schizotypy and depressive mood (9%; Lee, Cougle, & Telch, 2005), and positive schizotypy and anxiety (7%; Lee et al., 2005).

Risk of Psychopathologies and Creativity

Taken together, there is reason to assume that (a) some inclinations towards psychopathologies share heightened sensitivity of the avoidance system, whereas others share heightened sensitivity of the approach system, and that (b) avoidance orientation generally impedes creativity, whereas approach orientation is a reliable positive predictor of creativity.

If true, we should see that risk of psychopathologies that are grounded in the avoidance system (anxiety, negative schizotypy, depressive mood) negatively predicts creativity, whereas risk of psychopathologies that are grounded in the approach system (risk of bipolar disorder, positive schizotypy) positively predicts creativity.

There is some evidence for these possibilities. Meta-analytic evidence by Byron and Khazanchi (2011; k = 56 non-clinical samples) shows a small to medium effect size, indicating that trait anxiety associates with reduced creative performance (r = -.17; 95% Confidence Interval [*CI*] = -.15; -.19). Furthermore, Acar and Sen (2013) meta-analyzed findings from studies about the relation between schizotypy and creativity and, indeed, observed small effect sizes indicating that negative schizotypy negatively associates with creativity (r = -.09; 95% *CI* = -.12; -.06; k = 76 non-clinical samples), whereas positive schizotypy positively associates with creativity (r =.14; 95% *CI* =.12; .17; k = 121 non-clinical samples).

Meta-analysis of the link between depressive mood and creativity is, however, missing. This is unfortunate also because results from primary studies are inconclusive. In some non-clinical samples, depressive mood and the depression sub-dimension of neuroticism negatively related to creativity (Furnham, Crump, Batey, & Chamorro-Premuzic, 2009; Schuldberg, 2001; Sutin et al., 2011). However, Young et al. (2013) found modestly more depressive mood for adolescents involved in the arts, and in other studies involving non-clinical samples correlations between depressive mood and creativity were either positive (Frantom & Sherman, 1999), or not significant (Silvia & Kimbrel, 2010; Verhaeghen et al., 2005; 2014). Thus, whereas meta-analytic work pertaining to trait anxiety and negative schizotypy resonates with our general prediction that vulnerability to avoidance-related psychopathologies negatively associates with creativity, the available evidence for depressive mood is mixed, and subjected here to new meta-analysis.

From our reasoning, it also follows that (hypo)mania should positively predict creativity. Indeed, most of the empirical studies shows positive relations between risk of bipolar disorder and creativity. In non-clinical samples, hypomania ratings are positively associated with creativity (e.g., Furnham et al., 2008; Schuldberg, 2001; Zabelina et al., 2014). This resonates with the finding that both elated and irritable moods that are characteristic of hypomania and cyclothymia are associated with enhanced creativity (Baas et al., 2008). However, other studies fail to show significant relations between hypomania and creativity (Drapeau & DeBrule, 2013; Frantom & Sherman, 1999; Rawlings & Locarnini, 2008; Wohl, 2003), which questions the robustness of the relation between risk of bipolar disorder and creativity. Again, we subjected this relationship to new meta-analysis.

Summary and Introduction of Meta-Analysis

Our review revealed some (meta-analytic) evidence for parts of our reasoning, yet in many cases counter-evidence or null results were reported. For example, meta-analytic work on schizotypy and anxiety generally fits our hypotheses, with avoidance-based negative schizotypy and anxiety being negatively associated with creativity, whereas approach-based positive schizotypy positively associated with creativity. However, the relation between depressive mood (avoidance-related) and risk of bipolar disorder (approach-related) on the one hand, and creativity on the other, is less clear. Therefore, our goal was to meta-analyze available studies linking depressive mood and risk of bipolar disorder to creativity. Combining this with existing meta-analytic findings regarding schizotypy and anxiety (Acar & Sen, 2013; Byron & Khazanchi, 2011) provides with a first-time and comprehensive test of our hypothesis that inclinations towards approach-related psychopathologies associate with heightened creativity, whereas inclinations towards avoidance-related psychopathologies associate with reduced creative performance.

Inclusion Criteria and Literature Search

We determined *a priori* the breadth of conceptual territory of our meta-analysis. Studies were included in the meta-analysis if they (a) included a measure of inclinations towards depression (depressive mood) or bipolar disorder (hypomania, mania, cyclothymia); (b) included a measure of creativity (See Table 2 and 3); (c) included a sample from the general, non-clinical population; and (d) provided the necessary statistical information to compute effect sizes.

A literature search was conducted using the online databases PsycINFO and ProQuest (searched in September 2015). We used the following search term: (For depressive mood: *depressive OR depression OR dysthymia OR dysthymic OR dysphoria OR dysphoric;* for risk of bipolar disorder: *bipolar OR cyclothymia OR cyclothymic OR hyperthymia OR hyperthymic OR hypomania OR mania OR manic*) *AND* (*creative OR creativity OR "divergent thinking" OR "insight performance" OR "remote associates" OR originality*). The search did not include restrictions related to date or geography, although only materials published in English were included. This search yielded 1,384 citations for the relation between depressive mood and creativity and 447 citations for the relation between risk of bipolar disorder and creativity. Two authors read the titles and, if needed, abstracts and eliminated studies involving clinical samples, studies that were clearly not related to depressive mood, risk of bipolar disorder or creativity, or studies that did not contain quantitative data. Articles were only eliminated if both authors agreed on their elimination. Rater agreement was very good (99.2% for the relation between depressive mood and creativity; 95.8% for the relation between risk of bipolar disorder and creativity). We retrieved the remaining studies that were read in full to determine whether they met the inclusion criteria (see below).

In addition to searching the online databases PsycINFO and ProQuest, the following search strategies were used. First, we performed a more informal search on Google Scholar for which we combined the same key word terms as in our other database searches, along with searches in which key words for creativity were combined with common questionnaires of depressive mood (e.g., Beck's Depression Inventory [BDI] by Beck et al., 1988; Center for Epidemiological Studies - Depression symptoms index [CES-D] by Radloff, 1977), or risk of bipolar disorder (e.g., Hypomanic Personality Scale [HPS] by Eckblad & Chapman, 1986; General Behavior Inventory [GBI] by Depue, Krauss, Spoont, & Arbisi, 1989). Second, we conducted a backward search of the reference section of each retrieved article as well as that of review articles (e.g., Johnson et al., 2012; Murray & Johnson, 2010) and conducted a forward search, considering references citing these articles. Third, we posted a request for unpublished data on the open forum of the Society of Personality and Social Psychology. Fourth, we examined conference proceedings of the American Psychological Association, Association for Psychological Science, and the Society for Personality and Social Psychology for meetings held in the period from 2014 to 2015. Fifth and finally, we contacted authors that studied the relation between risk of bipolar disorder or depressive mood with creativity for unpublished datasets. These additional search strategies resulted in the discovery of 41 extra studies for the relation between depressive mood and creativity and 40 extra studies for the relation between risk of bipolar disorder and creativity. These studies were read in full to determine whether they met the inclusion criteria (see below).

Description of Included and Excluded Work

First, we determined a priori that studies should directly measure the inclinations towards mental disorders of interest. Sample questionnaires of depressive mood were BDI (Beck et al., 1988), CES-D (Radloff, 1977), Geriatric Depression Scale (GDS; Yesavage et al., 1983), Zung Self-rating Depression Scale (Zung, 1965), Temperament Evaluation of

Memphis, Pisa, Paris and San Diego-Autoquestionnaire - Dysthymia (TEMPS-A; Akiskal, Akiskal, Haykal, Manning, & Connor et al., 2005), and the Depression Adjective Check List (DACL; Lubin, 1965). Sample questionnaires of risk of bipolar disorder were the HPS (Eckblad & Chapman, 1986), the Altman Self-Rating Mania Scale (ARMS; Altman, Hedeker, Peterson, & Davis, 2001), GBI (Depue et al., 1989), and TEMPS-A- Cyclothymia and Hyperthymia subscales (Akiskal et al., 2005). Some other questionnaires tapped into constructs that are related to the constructs of interest, yet deemed unsuitable for present purposes. For example, the Children's Personality Questionnaire (Porter & Cattell, 1963) includes a cyclothymia-subscale, but its items measure warm-blooded vs. aloof temperament.

Second, we selected personality and performance measures of creativity. Included self-assessment personality and behavior measures of creativity were self-ratings of creative behavior (e.g., Creative Achievement Questionnaire [CAQ] by Carson, Peterson, & Higgins, 2005) and the Gough Adjective Checklist (ACL; Gough, 1979; see Table 2). Included performance measures of creativity were *divergent thinking performance, performance on insight tasks,* and *creativity ratings of products*, such as poems (See Table 3). Although creative attitude and interest inventories are commonly used as indicators of creativity (Hocevar & Bachelor, 1989), we considered these to be indirect indicators of creativity and thus we did not include studies in the meta-analysis that used these measures (e.g., Barron-Welsh Art-scale on which participants indicate their preference for complex (vs. simple) pictures; Barron & Welsh, 1952).

Third, because of our interest in psychological processes in non-clinical samples, we excluded research reports that linked bipolar disorder and depression to creativity and that involved clinical participants. Fourth and finally, we could only include studies in the meta-analysis if they provided the necessary statistical information to compute effect sizes. Therefore, we contacted authors of relevant empirical articles when their articles did not

provide the necessary information to calculate effect sizes. Authors responded with usable data in 100% of these cases.

Studies were independently coded by two raters (two authors of this article) for inclusion criteria. Interrater reliabilities were excellent (Cohen's *Ks* > .91), and differences were settled through discussion. The inclusion criteria resulted in a total of 33 reports (k = 39 independent samples) with 7,391 participants for the relation between depressive mood and creativity. These samples comprised a mix of published journal articles (k = 31), dissertations/theses (k = 2), and unpublished studies (k = 6). For the relation between risk of bipolar disorder and creativity, our inclusion criteria resulted in a total of 24 reports (k = 28 independent samples) with 4,882 participants. These samples comprised a mix of published journal articles (k = 19), dissertations/theses (k = 4), and unpublished studies (k = 5). A summary of studies in the meta-analysis is provided in the Supplemental Materials (Appendixes 1 and 2) online.

Coded Variables

Each study was independently coded by two raters (two authors of this article) for the following dichotomous study characteristics: creativity component (see below), publication status (published vs. unpublished), population type (children, undergraduate students, general adult population, or senior citizens), country of primary data collection (i.e. United States/Canada vs. Other; also see Grijalva, Newman, Tay, Donnellan, & Harms, 2015), artistic profile of study population (artists or art students vs. participants not involved in artistic work), type of inventory with questionnaires that were used in less than three studies being grouped in one category "Other" (for depressive mood: CES-D, BDI, GDS, TEMPS-A Dysthymia, and Other; for risk of bipolar disorder: HPS, ARMS, TEMPS-Cyclothymia, TEMPS-A Hyperthymia, and Other), and for risk of bipolar disorder whether mania, hypomania, cyclothymia, or a combination (diffuse) were measured. Interrater reliabilities

were good to excellent (Cohen's *Ks* > .84 for depressive mood-creativity; Cohen's *Ks* > .78 for risk of bipolar disorder-creativity) and any disagreements were discussed and resolved between the coders.

In addition, each study was independently coded by the same two raters for the following continuous variables: year of publication, gender composition (percentage of women in the sample), and mean age of the sample. Many studies involving undergraduate samples did not report the age and gender composition of their participants. We used the mean age of the available undergraduate samples in our meta-analysis for these missing values (*M* = 22.28 years for depressive mood-creativity; *M* = 21.97 years for risk of bipolar disorder-creativity). Interrater reliabilities were excellent (*ICC* > .99 for depressive mood-creativity; *ICC* > .98 for risk of bipolar disorder-creativity) and any disagreements were discussed and resolved between the coders.

Component of creativity. We coded component of creativity into performance measures (insight tasks, divergent thinking performance, product creativity) and self-ratings of creativity (self-ratings of creative personality and behavior; see Table 2 and 3). Insight or eureka tasks, such as the Remote Associates Test (Mednick, 1962), have only one known solution and typically need restructuring of the presented material to solve the problem. These were coded into the performance category. Studies or subsets of studies that included divergent thinking tasks typically provided data on both the number of unique, non-redundant ideas or problem solutions that were generated (fluency), the number of non-redundant conceptual categories from which these ideas were sampled (flexibility), and measures of originality or uncommonness of generated ideas (Baas et al., 2008; Guilford, 1967; Torrance, 1966); these were first averaged and then coded in the performance category. Studies or subsets of studies that included creativity ratings of products, such as poems, were also coded into the performance category. Accordingly, only creativity indicators that were derived

from self-assessment, including ratings of own creativity (e.g., CAQ), and ratings on creative personality (e.g., ACL), were coded in the self-ratings category.

Computation and Analysis of Effect Sizes

The Hedges and Olkin (1985) approach was used to compute the effect size (*r*) on the basis of a random effects model in which each sample is weighted by the inverse of its variance (Borenstein, Hedges, Higgins, & Rothstein, 2009). The correlations were coded such that positive signs indicate better creative performance when there is higher risk of psychopathologies. We computed effect sizes that were based on reports of zero-order correlations with the aid of a computer program (Comprehensive Meta-Analysis Version 3, 2014). We were first and foremost interested in testing our predictions using effect size estimates for the overall relation between of risk of psychopathology and creativity. Because in many studies multiple assessments of creativity and/or risk of psychopathology were available, many studies yielded more than one relevant effect size. However, using more than one effect size per sample violates the independence assumptions of meta-analysis (Cooper & Hedges, 1994). Thus, when a study reported multiple effects sizes (e.g., when there were effect sizes for multiple creativity measures, and/or multiple measures of depressive mood or risk of bipolar disorder in the same sample), we created a composite of the effect sizes across measures (Borenstein et al., 2009). This method leads to a single and precise effect size for each sample, taking into consideration the correlation between the different measures to estimate the overall variance for the composite *r* (Borenstein et al., 2009). When the correlations between different creativity measures were not available, we used the mean correlation provided by other studies in the literature.

We also calculated the within-class goodness-of-fit statistic Q_w (approximately chi-square distributed, with k - 1 degrees of freedom, where k is the number of effect sizes), which offers a test for homogeneity in the true correlations across studies. A low percentage

of variance explained and a significant Q_w statistic indicate evidence for nonrandom variation in effect size estimates, pointing to the existence of moderators that explain variability in the correlations across studies. The following strategies were undertaken to examine whether moderators explained variability among effect sizes. First, to examine whether categorical moderators (e.g., creativity measurement, primary location of study, population type, artistic profile of study population) explained variability among effect sizes, we performed subgroup analyses (Bohrenstein et al., 2009). Some studies contained both performance measures and self-ratings of creativity (k = 8 for the relation between depressive mood and creativity; k = 11 for the relation between risk of bipolar disorder and creativity), multiple measures of depressive mood (k = 5) and risk of bipolar disorder (k = 4), or multiple types of risk of bipolar disorder (k = 4). In these cases, we allowed more than one effect size per study for moderator analyses.

Second, to examine whether continuous moderators (age, gender composition, year of publication) explained variability among effect sizes, we performed random effects meta-regressions using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2 (Hedges & Olkin, 2014). Third, and finally, to examine the relative contributions of the moderators in explaining variability among effect sizes, we performed random effects meta-regressions using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2 with multiple moderators as covariates in the regression model.

Results

Depressive Mood-Creativity

The literature search identified 39 independent studies of the link between depressive mood and creativity covering a total of 7,391 participants. The characteristics of the sample are described in Table 4. Noteworthy is that the majority of studies involved students (72%)

and only three studies contained participants with an artistic profile (either artists or art students). The BDI and CES-D were the most often used measures of depressive mood, and creative performance measures were used in 77% of the studies and creativity estimates derived from self-ratings were used in 44% of the studies. Finally, most studies were conducted in the last decade.

Overall effects and moderating study variables. Results revealed a small overall effect size, showing that depressive mood is weakly, but negatively related to creativity (r = -.064; 95% *CI* = -.094 -.034; see Figure 1). Testing for potential publication bias, nonparametric "trim and fill" methods (cf. Duval & Tweedie, 2000) showed that two studies should be trimmed-and-filled for the relation between depressive mood and creativity; this led to a trivial change in the overall effect: r = -.060 (95% *CI* = -.090; -.029). In addition, effect sizes for published (r = -.062; 95% *CI* = -.093; -.031) and unpublished work (r = -.067 (95% *CI* = -.151; .019) did not differ, Q_b (1) = 0.01, p = .922). Thus, it is unlikely that publication bias affected our meta-analytic results.

A significant Q_w-value indicates that some variance may be explained by moderator variables, Q_w = 63.36, p = .006. To examine whether categorical moderators (depressive mood inventory, creativity measurement, primary location of study, population type, artistic profile of study population) explained this variability among effect sizes, we first performed subgroup analyses (Bohrenstein et al., 2009). Because some studies contained both performance measures and self-ratings of creativity (k = 8) or multiple measures of depressive mood (k = 5), we computed multiple effect sizes per study. We included 47 effect sizes differentiated for component of creativity, and 44 effect sizes differentiated for depressive mood inventory. Figure 1 shows that primary location of study (USA/Canada vs. Elsewhere; Q_b (1) = 0.36, p = .547), component of creativity (performance vs. self-report; Q_b (1) = 0.91, p = .339), and measurement of depressive mood (Q_b (6) = 1.43, p = .964) did not

play a moderating role. However, population type (children, undergraduate students, general adult population, senior citizens) played a moderating role; Q_b (3) = 10.58, p = .014) with depressive mood being more negatively related to creativity in senior citizens (r = -.140; 95% *CI* = -.189 -.090) than in students (r = -.051; 95% *CI* = -.085 -.016). Finally, whereas the relation between depressive mood and creativity was negative in populations without a clear artistic profile (r = -.070; 95% *CI* = -.099 -.040), it was positive in a group that consisted of artists and art students (although the 95% Confidence Interval included zero; r = .100; 95% *CI* = -.061 .256), Q_b (1) = 4.13, p = .042.

Second, to examine whether continuous moderators (age, gender composition, year of publication) explained variability among effect sizes, we performed a random effects meta-regression using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2. Meta-regression showed a trend that the estimated decrease in *z*-transformed effect size for creativity per year of age increase was -0.0014 (*SE* = 0.0007, 95% *CI* = -.0029, .0001; t(37) = -1.89, p = .066). The intercept was not significant at -.0185 (*SE* = 0.028, 95% *CI* = -.075, .038; t(37) = -0.66, p = .511). Of the studies that reported gender characteristics of the study sample (k = 33), gender composition (percentage of female participants in a sample) did not predict the effect size for the relation between depressive mood and creativity (coefficient = 0.0002; *SE* = 0.0004, 95% *CI* = -.0007, .0011; t(31) = 0.46, p = .649; the intercept was significant at -.081; *SE* = 0.034, 95% *CI* = -.150, -.012; t(31) = -2.38, p = .024); nor did year of publication for the published studies (k = 31; coefficient = 0.0035; *SE* = 0.0023, 95% *CI* = -.0011, .0082; t(29) = 1.55, p = .133; the intercept was not significant at -7.119; *SE* = 4.567, 95% *CI* = -16.459, 2.222; t(29) = -1.56, p = .130).

Third, and finally, to examine the relative contributions of the different moderators in explaining variability among effect sizes, we performed a random effects meta-regression using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2

with depressive mood inventory, creativity measurement, primary location of study, population type, and artistic profile of study population as covariates (k = 53). Gender composition, year of publication, and age were not included as covariates, either because studies did not report on (some of) these demographics, or because demographics were confounded with study population. First, we tested the regression model with a simultaneous test that all covariates (except the intercept) are zero. The outcome of this test suggests that at least one of the covariates was related to effect size ($F(12, 40) = 2.53$, $p = .014$). Indeed, Table 5 shows that population type is related to effect size, with depressive mood being more negatively related to creativity in senior citizens than in students. In addition, artistic profile of the study population moderated the effect size, with depressive mood being more positively related to creativity in study populations with an artistic profile. Finally, creativity component had an effect, with depressive mood being more negatively related to creativity when self-ratings were used. Finally, we tested whether there is any unexplained variance in the true effect sizes using this model. A Q of 46.32, with df = 40, and $p = .228$ suggests this is not the case. Put differently, the model is complete.

Risk of Bipolar Disorder-Creativity

The literature search identified 28 independent studies of the link between risk of bipolar disorder and creativity covering a total of 4,882 participants. The characteristics of the sample are described in Table 4. Noteworthy is that the majority of studies involved students (89%) and only two studies contained participants with an artistic profile (either artists or art students). The HPS was the most often used measure of risk of bipolar disorder and hypomania the most often studied risk factor of bipolar disorder. Creative performance measures were used in 64% of the studies and creativity estimates derived from self-ratings were used in 75% of the studies. Finally, most studies were conducted in the last decade and in USA or Canada.

Overall effects and moderating study variables. Results revealed a small to moderate overall effect size, showing that risk of bipolar disorder is positively related to creativity (r = .224; 95% *CI* =.184; .263; see Figure 2). Testing for potential publication bias, nonparametric "trim and fill" methods showed that zero studies should be trimmed-and-filled for the relation between risk of bipolar disorder and creativity. Moreover, effect sizes for published (r = .241; 95% *CI* = .192; .290) and unpublished studies (r = .188; 95% *CI* = .115; .258) did not differ, Q_b (1) = 1.47, p = .226. Thus, it is highly unlikely that publication bias affected our meta-analytic results.

A significant Q_w-value indicates that some variance may be explained by moderator variables, Q_w = 65.40, p < .001. To examine whether categorical moderators (measurement of risk of bipolar disorder inventory, type of risk of bipolar disorder, creativity measurement, primary location of study, population type, artistic profile of study population) explained this variability among effect sizes, we first performed subgroup analyses (Bohrenstein et al., 2009). Because some studies contained both performance measures and self-ratings of creativity (k = 11) or multiple measures (k = 4) or types (k = 4) of risk of bipolar disorder, we computed multiple effect sizes per study. We included 39 effect sizes differentiated for component of creativity, and 32 effect sizes differentiated for measurement or type of risk of bipolar disorder. Figure 2 shows that primary location of study (USA/Canada vs. Elsewhere; Q_b (1) = 3.00, p = .083), population type (students vs. adults; Q_b (1) = 0.14, p = .710), artistic profile of the study sample (Q_b (1) = 0.04, p = .847), measurement of risk of bipolar disorder (HPS, ARMS, TEMPS-C, TEMPS-H, other; Q_b (4) = 7.95, p = .094), and type of risk of bipolar disorder (mania, hypomania, cyclothymia, diffuse; Q_b (3) = 2.52, p = .472) did not play a moderating role. However, effect sizes for the relation between risk of bipolar disorder and creativity were stronger when self-reports were used to measure creativity (r =

.277; 95% *CI* = .237; .316) than with performance measures (*r* = .130; 95% *CI* = .071; .189), Q_b (1) = 16.61, $p < .001$.

Second, to examine whether continuous moderators (age, gender composition, year of publication) explained variability among effect sizes, we performed a random effects meta-regression using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2. Age did not predict the effect size for the relation between risk of bipolar disorder and creativity (coefficient = -0.0029; *SE* = 0.0049, 95% *CI* = -.0131, .0072; *t*(26) = -0.60, *p* = .555; the intercept was significant at .296; *SE* = 0.117, 95% *CI* = .056, .536; *t*(26) = 2.54, *p* = .018). Of the studies that reported gender characteristics of the study sample (*k* = 22), gender composition (percentage of female participants in a sample) did not predict the effect size for the relation between depressive mood and creativity (coefficient = 0.0000; *SE* = 0.0002, 95% *CI* = -.0004, .0004; *t*(20) = 0.20, *p* = .843; the intercept was significant at .214; *SE* = 0.032, 95% *CI* = .149, .280; *t*(20) = 6.79, $p < .001$); nor did year of publication for the published studies (*k* = 19; coefficient = 0.0056; *SE* = 0.0034, 95% *CI* = -.0015, .0127; *t*(17) = 1.67, *p* = .113; the intercept was not significant at -11.066; *SE* = 6.761, 95% *CI* = -25.330, 3.198; *t*(17) = -1.64, *p* = .120).

Third, and finally, to examine the relative contributions of the different moderators in explaining variability among effect sizes, we performed a random effects meta-regression using Knapp-Hartung adjustment and the maximum likelihood approach for estimating τ^2 with inventory of risk of bipolar disorder, creativity measurement, primary location of study, population type, and artistic profile of study population as covariates (k = 46). As before, gender composition, year of publication, and age were not included as covariates. Type of risk of bipolar disorder was not included either, because it was confounded with inventory of risk of bipolar disorder. First, we tested the regression model with a simultaneous test that all covariates (except the intercept) are zero. The outcome of this test suggests that at least one

of the covariates was related to effect size ($F(8, 37) = 3.86$, $p = .002$). Indeed, Table 6 shows that inventory of risk of bipolar disorder is related to effect size. Most importantly, creativity component had an effect, with risk of bipolar disorder being more positively related to creativity when self-ratings were used. Finally, we tested whether there is any unexplained variance in the true effect sizes using this model. A Q of 80.81, with df = 37, and $p < .001$ suggests this is the case. Put differently, the model is incomplete.

Discussion of Meta-Analytic Findings

In non-clinical samples, our meta-analysis revealed a weak but negative relation between depressive mood and creativity, and a stronger and positive relation between risk of bipolar disorder and creativity. For both relationships, it is highly unlikely that publication bias affected our meta-analytic results. Moreover, significant Q_w-values indicated that some variance may be explained by moderator variables. Effect sizes were not affected by study location, year of publication, gender composition, and measurement of risk of psychopathology. Results did show that whereas the relation between depressive mood and creativity was negative in populations without clear artistic profiles, it was positive in artistic populations (we return to this finding below). Additionally, age of study population seemed to affect the relation between depressive mood and creativity as the effect sizes were more negative in senior citizens than in students and tended to become more negative as age of study population increased. Finally, the effect size for the relation between risk of bipolar disorder and creativity was stronger with self-reported creativity than with creative performance measures. Potentially, (hypo)manic states are associated with overconfidence and overestimation of own abilities.

General Discussion

Previous research has shown inconsistent findings regarding the relation between vulnerability to psychopathology and creativity. Given the prevalence of mental disorders

and their subclinical symptoms (Kessler et al., 2005; Steel et al., 2014; Verdoux & Van Os, 2002) and the importance of creativity to progress, functioning and welfare in contemporary society, we set out to resolve these inconsistent findings by studying the relation between inclinations towards common mental disorders and creativity. Together with previous meta-analytic findings regarding schizotypy and anxiety (Acar & Sen, 2013, Byron & Khazanchi, 2011), current findings regarding depressive mood and risk of bipolar disorder fit our prediction that inclinations towards avoidance-related mental disorders negatively associate with creativity, whereas the inclinations towards approach-related mental disorders positively associate with creativity. Indeed, meta-analytic findings show that creativity is negatively associated with the avoidance-based negative schizotypy (r = -.07; Acar & Sen, 2013), anxiety (r = -.17; Byron & Khazanchi, 2011), and depressive mood (r = -.06; current study), and positively associated with the approach-based positive schizotypy (r = .14; Acar & Sen, 2013) and risk of bipolar disorder (r = .22; current study).

From an empirical point of view, one might consider the negative relationships between inclinations towards avoidance-related psychopathologies and creativity to be rather weak. Although significant, these effect sizes were small to trivial according to guidelines by Cohen (1992) and McGrath and Meyer (2006). For example, Hyde and Linn (2006) label r = -.050 as trivial, suggesting that the observed effect size for the relation between depressive mood and creativity (r = -0.064) is bordering on being trivial. Accordingly, from an empirical perspective, current findings suggest that vulnerability to psychopathology explains limited variance in creativity (ranging between 0.4% for the relation between depressive mood and creativity and 5.0% for the relation between risk of bipolar disorder and creativity).

Small effect sizes are not uncommon in social and personality psychology (Richard, Bond, & Stokes-Zoota, 2003), and small effects can have big consequences (Prentice & Miller, 1992). In addition, small effects – and their direction – can be theoretically very

meaningful. Indeed, the meta-analytic relationships between creativity and inclinations towards various psychopathologies strongly and without exception support our prediction that inclinations towards approach-related psychopathologies relate positively to creative performance, while inclinations towards avoidance-related psychopathologies are negatively related to creativity. Below we elaborate on this issue, by reviewing the evidence for our thesis that mental disorders and their inclinations are orchestrated by two fundamental motivational systems that alter creativity. We also identify boundary conditions, and highlight avenues for future research.

Vulnerability to Psychopathology, Motivation Systems, and Creativity

Converging evidence suggests that core personality and affect, as well as common mental disorders and their inclinations, are grounded in dopaminergic brain circuitries dealing with appetitive motivation and approach behavior towards rewarding stimuli (i.e., approach system) and brain circuitries dealing with withdrawal motivation and avoidance behavior away from aversive stimuli (i.e., avoidance system; Alloy et al., 2006, 2009; Baas et al., 2013; Carver et al., 2000; Depue & Collins, 1999; Elliot & Thrash, 2002; Ormel et al., 2013; Watson et al., 1999). For example, anxiety and anxiety disorders are strongly grounded in the avoidance system (Degnan & Fox, 2007; Klein et al., 2011; Kotov et al., 2010; Matthews & Gilliland, 1999) and (hypo)mania and bipolar disorders are related to dopaminergic modulation (O'Sullivan et al., 2011; Schwartz et al., 1982) and the approach system (Alloy et al., 2006, 2009; Carver & Johnson, 2009). Similarly, depressive mood and negative schizotypy are characterized by both low levels of chronic approach sensitivity (Clark & Watson, 1991) and high levels of chronic avoidance sensitivity (e.g., Beck et al., 1988; Carver & Johnson, 2009; Klein et al., 2011; Kotov et al., 2010; Miller & Tal, 2007; Vollema & Van den Bosch, 1995), whereas preliminary evidence suggests that positive schizotypy (unusual experiences and impulsive non-conformity) is typically associated with

openness to experience and extraversion (e.g., Claridge et al., 1996; Kwapil et al., 2008, 2013; Mason et al. 1995; Miller & Tal, 2007; Suzuki et al., 2015).

Together these findings suggest that mental disorders and their inclinations are orchestrated by two fundamental motivational systems. Importantly, this may lead to more parsimonious explanations about relationships between symptoms of common mental disorders, their origination, and their consequences. Furthermore, on the basis of the intricate links between mental disorders and basic motivational systems, new research hypotheses may be derived. Indeed, because approach and avoidance are known to affect creativity and its underlying processes (Baas et al., 2008; Friedman & Förster, 2010; Nijstad, De Dreu, Rietzschel, & Baas, 2010; Roskes et al., 2012), we derived predictions regarding the relation between inclinations towards common mental disorders and creativity.

Because approach motivation is a reliable positive predictor of cognitive flexibility and creativity (Baas et al., 2008; Friedman & Förster, 2010; Roskes et al., 2012), we predicted that inclinations towards mental disorders associated with the approach system (e.g., positive schizotypy, (hypo)mania) would lead to greater creativity. Supporting our prediction, meta-analytic findings showed that inclinations towards approach-related mental disorders, including (hypo)mania (the current meta-analysis) and positive schizotypy (Acar & Sen, 2013) are associated with enhanced creativity. Avoidance, on the other hand, leads to reduced flexibility (Baas et al., 2008; Friedman & Förster, 2010) and this generally undermines creativity (Friedman & Förster, 2010). Accordingly, we predicted that inclinations towards mental disorders that associate with avoidance would negatively predict creativity. This prediction received moderate support. Meta-analytic findings show small-sized effects that inclinations towards avoidance-related mental disorders, including depressive mood (the current meta-analysis), trait anxiety (Byron & Khazanchi, 2011), and negative schizotypy (Acar & Sen, 2013) are associated with reduced creativity.

Taken together, our findings show that the relation between risks of common mental disorders and creativity depends on the specific mental disorder chosen. Negative associations between risk of mental disorders and creativity are more likely with risk of avoidance-related psychopathologies, whereas positive associations are expected when risk of approach-related mental disorders are studied. As evidenced by the present findings, this is true for risks of common mental disorders, such as schizophrenia, psychosis, anxiety, bipolar, and depressive disorders. In the following section, we will discuss some boundary conditions for the prediction that mental disorders and their inclinations are orchestrated by two fundamental motivational systems that influence creativity, and highlight avenues for future research.

Boundaries and Future Directions

Motivation as underlying mechanism. Our thesis that mental disorders and their inclinations are orchestrated by two fundamental motivational systems that alter creativity follows from meta-analytic findings concerning the relation between risks of common mental disorders and creativity and from scattered findings linking common mental disorders and their inclinations to approach and avoidance sensitivity. New research is required to integrate both lines of research and show that inclinations towards mental disorders that are linked to the approach system (e.g., hypomania, positive schizotypy) associated with increased creativity, whereas inclinations towards mental disorders that are linked to the avoidance system (e.g., anxiety, depressive mood, negative schizotypy) associated with reduced creativity, with approach and avoidance sensitivity mediating these relationships.

Most work on the relation between (risk of) mental disorders and approach and avoidance sensitivity tends to focus exclusively on a single mental disorder. This is unfortunate given that there is often a high comorbidity among (symptoms of) mental disorders (Borsboom & Cramer, 2013), which may obscure clear associations between

mental disorders or their precursors and motivational sensitivity. On the basis of our theoretical framework, we predict that inclinations towards mental disorders that are linked to the approach system (e.g., hypomania, positive schizotypy) form a cluster and predict indicators of approach sensitivity, whereas inclinations towards mental disorders that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) form a cluster and predict indicators of avoidance sensitivity. Crucially, this requires the assessment of multiple inclinations towards mental disorders and indicators of approach and avoidance sensitivity in one study.

Other risk factors of psychopathology. The finding that inclinations towards common mental disorders are associated with creativity depending on their approach and avoidance tendencies also has implications for other disorders associated with such tendencies. For example, people with attention-deficit/hyperactivity disorder (ADHD) experience difficulties with working memory and focused attention, but also show behavioral symptoms that can be linked to increased approach motivation and dopaminergic involvement, such as impulsivity, risk taking, and a strong preference for immediate (vs. delayed) rewards (Castellanos & Tannock, 2002; Depue & Collins, 1999; Mitchell, Robertson, Kimbrel, & Nelson-Gray, 2011; Toplak, Jain, & Tannock, 2005). According to our theory and findings, these symptoms should be associated with enhanced creative performance. Indeed, preliminary evidence suggests that people with ADHD generate more original ideas and report more real-life creative achievements than healthy controls (White & Shah, 2006, 2011; but see Abraham, Windmann, Siefen, Daum, & Güntürkün, 2006 for mixed findings). Similarly, based on the notion that compulsive-obsessive disorder is linked to increased avoidance tendencies (Gillan et al., 2014), we may predict that risk of compulsive-obsessive disorder will negatively associate with creativity. Future studies may investigate this, and examine whether the relationship between these disorders and their

inclinations on the one hand, and creativity on the other, is mediated by differences in approach and avoidance sensitivity.

Issues of causality. We uncovered that risks of mental illnesses that are associated with the approach system are associated with enhanced creativity, whereas risks of mental illnesses that are associated with the avoidance system are associated with reduced creativity. Because these results are based on correlational evidence, causal inferences cannot be made. There are three possibilities about the mechanistic role that risks towards mental disorders play in the relation between psychopathology and creativity. First, sub-clinical symptoms associated with mental illnesses may cause diminished or enhanced creativity. According to this account, sub-clinical symptoms that activate the approach system trigger creativity, possibly through increased flexibility of thought, whereas sub-clinical symptoms that activate the avoidance system cause reduced creativity, possibly through decreased flexibility. Although findings from the current study do not allow conclusions about causality, earlier work has shown that symptoms that are associated with approach-related mental disorders, including positive affect and approach motivation, can cause increased flexibility and creativity (Baas et al., 2008; De Dreu et al., 2008; Roskes et al., 2012), whereas symptoms that are associated with avoidance-related mental disorders, including anxiety and avoidance motivation, can sometimes cause decreased flexibility and creativity (Friedman & Förster, 2010).

A second possibility reverses the causal relation: being (highly) creative may threaten mental health. Highly unconventional products, whether they take the form of ideas, work procedures, or pieces of art, are often controversial and severely criticized. Moreover, there is extensive evidence of bias against creative people in the workplace, schools, and in general (Mueller, Melwani, & Goncalo, 2011; Runco & Johnson, 2002). For example, the very traits that characterize highly creative people, such as unconventionality, risk-taking,

and dominance (Feist, 1998), make them easy targets for rejection (Kim, Vincent, & Goncalo, 2013; Kurzban & Leary, 2001; Zhang, Chan, Zhong, & Yu, 2015). Social exclusion, coping with rejection and criticism, and other negative experiences, in turn, associate with increased levels of stress and negative affect (see e.g., Wilkinson & Marmot, 2003). Just as is it possible that creative people are ridiculed and criticized, they may also receive praise and admiration, and experience success (Nettle & Clegg, 2006). Ironically, depending on the appraisal and type of praise, praise may both lead to enhanced well-being and positive affect as well as stress and reduced well-being (Kamins & Dweck, 1999). In addition, whereas the very act of being creative and coming up with an original insight brings positive affect and motivates to push further the creative idea (Hirt et al., 2008; Thrash, Maruskin, Cassidy, Fryer, & Ryan, 2010), creative achievements sometimes are listed also as important personal stressors (Holmes & Rahe, 1967; Schaller, 1997). In other words, being highly creative and the consequences of being creative may both associate with feelings and behavior that characterize (hypo)mania and depression and anxiety.

Thirdly, it is possible that the cognitive, motivational and affective antecedents that put the individual at increased risk for psychopathological symptoms also influence processes that are conducive to creativity. For instance, flexible thinking and creativity benefits from greater cognitive disinhibition and the use of flat associative hierarchies, cognitive mechanisms also associated with tendencies toward psychopathology, including schizophrenia (Carson, 2014; Eysenck, 1993). In a similar vein, varying levels of approach and avoidance sensitivity may alter cognitive processes that affect creativity and simultaneously put people at more or less risk towards psychopathology. These explanations suggest that third variables may be responsible for a relation between risks of mental illnesses and creativity (cf. Damian & Simonton, 2015).

Although all three interpretations may account for some of our findings, they offer different guidelines for future research, and lead to different research questions, samples, and paradigms. Our results do not allow preferential treatment of one interpretation, and new empirical research on the relationship between risk of psychopathology and creativity is needed to disentangle the different mechanisms. For example, to establish the causal role of (approach-related) dopaminergic modulation of the relationship between (hypo)mania and creativity (taking a third variable-interpretation), researchers may choose placebo controlled treatment studies with dopamine agonists and antagonists that directly target dopamine functioning.

Clinical psychopathology. An important question is whether our findings would generalize to full-blown mental disorders in which symptoms are much more severe than the subclinical symptoms in our meta-analytic investigation. Based on archival and interview studies on eminent creative people, some authors have concluded that highly creative people are characterized by greater mania and bipolar disorder, but also greater severe depression and anxiety disorders (Andreasen, 1987; Ludwig, 1992; Post, 1994). Although the association between bipolar disorder and creativity is in line with our meta-analytic findings, the observed association between depression and anxiety disorders and creativity clearly contrasts meta-analytic evidence concerning depressive mood and trait anxiety.

A reasonable question to ask is why the discrepancies occur. A first and rather pessimistic possibility is that interview and archival studies, if not carefully conducted, are more prone to experimenter bias, which undermines the validity of the findings (Schlesinger, 2009). Experimenter bias may occur at the interview stage in which personal history of psychopathology must be uncovered and at the categorization stage in which personal accounts or biographical information is used to assign specific mental disorders to the study object. Moreover, those studies that relied on interviews as a research methodology tend to

have relatively low sample sizes. For instance, Andreasen's (1987) report that 80% of writers had mood disorders was based on interviews with 30 writers. Thus, despite the obvious merit of linking psychopathology to highly eminent and creative people, experimenter bias and statistical power issues lead to concerns about the validity of the findings and conclusions.

A second possibility, related to the difficulty of diagnosing specific mental disorders in creative people on the basis of personal and bibliographical accounts, is that there is often a high comorbidity among (symptoms of) mental disorders (Borsboom & Cramer, 2013). This may obscure clear associations between mental disorders or their precursors and creativity. For instance, although (hypo)mania associates with depressive mood (Angst, 1998), current meta-analytic and experimental findings show that depressive mood predicts reduced creativity, whereas hypomania predicts enhanced creativity. Therefore, an important implication of our findings is that future research on psychopathology and creativity should measure multiple inclinations towards, or diagnoses of, psychopathology.

A third possibility relates to the interpretation discussed above that being (highly) creative may threaten mental health. Indeed, archival and interviews studies typically focus on highly creative people that run higher risks of facing severe criticism and being rejected and ridiculed. These negative social consequences may, in turn, associate with increased levels of stress, negative affect, and depressive mood.

Another line of research compares the creativity of people diagnosed with major depressive disorder or bipolar disorder with the creativity of controls, using measures of non-eminent creativity (see Table 2 and 3). Of the six studies on major depressive disorder that were retrieved from a literature search, four found no significant differences with controls, whereas two showed diminished creativity in people diagnosed with major depressive disorder (Table 7 upper panel). A random effects meta-analysis of the six studies showed a

Cohen's d of -0.272 (equivalent to r = -.124) but the 95% confidence interval included zero (-0.700; 0.156)[1]. Thus, although the confidence interval excludes zero (probably due to small sample sizes), the effect size for the relation between major depressive disorder and creativity is actually stronger (r = -.124) than that of the relation between depressive mood and creativity in non-clinical populations (r = -.064).

Although speculative, this could indicate a linear negative relation with increasing severity of depressive symptoms. This would also follow from earlier work showing that availability of cognitive resources and individual differences in working memory capacity may modulate the relation between avoidance-related traits and states and creativity (cf. Baas et al., 2013; De Dreu et al., 2012; Roskes et al., 2012, 2013). Because the severity of symptoms of mental disorders are associated with taxed or reduced working memory capacity, ability to concentrate, and other cognitive deficits (APA, 1994), it logically follows that the association between symptoms of depressive disorder and creativity becomes more negative with increasing symptom severity. In addition, because cognitive functioning, including flexibility and fluid intelligence, deteriorates with age in adults (Kray & Lindenberger, 2000; Salthouse, Atkinson, & Berish, 2003), it would also follow that the negative relation between depressive symptoms and creativity becomes stronger with increasing age. Indeed, we found that depressive mood was more negatively related to creativity in senior citizens than in students and meta-regression showed a trend that the relation between depressive mood and creativity became more negative as age increased. An interesting avenue for future research is to examine the moderator function of cognitive abilities and variables associated with cognitive abilities, such as age and symptom severity, in the relation between risk of avoidance-related mental disorders and creativity.

Of the five studies on bipolar disorder and creativity, three found no significant differences with controls, whereas two showed enhanced creativity in people diagnosed with

bipolar disorder (Table 7 lower panel). A random effects meta-analysis of the five studies showed a Cohen's d of 0.128 (equivalent to r = .064) with the 95% confidence interval including zero (-0.122; 0.378). This is considerably smaller than the effect size for the relation between risk of bipolar disorder and creativity in non-clinical populations (r = .224). Although speculative, this could indicate a curvilinear relation between severity of bipolar symptoms and creativity. Curvilinear relations have also been found between schizotypal symptoms and creativity. Subclinical positive schizotypal symptoms are associated with enhanced creativity (Acar & Sen, 2013), whereas more severe schizophrenic symptoms seem to impair creative performance on both verbal and visual divergent thinking tasks (Abraham, 2014b; Abraham et al., 2007). In the case of approach-related psychopathologies, the cognitive flexibility that characterized mild symptoms and that is beneficial for creativity, may turn into cognitive disorganization and increased distractibility when severity of symptoms increases (Dreisbach & Goschke, 2004; Franke, Maier, Hardt, Hain, & Cornblatt, 1994). Possible curvilinear and linear relationships between symptom severity and creativity is another important avenue for future research.

Domain specificity. Meta-analytic findings regarding the relation between depressive mood and creativity showed that depressive mood was negatively related to creativity in people not involved in artistic activities, but positively related to creativity in artists and art students (although the 95% confidence interval included zero). Although the latter result was based on only three studies, including 186 participants, these results suggest that the nature of the relationship between mental disorders and creativity may be domain-specific. This is in line with archival studies on eminent people by Simonton (2014b), who observed that rates and intensities of mental disorders varied across domains of creative achievement. For example, whereas eminent scientists have a low probability of severe psychopathology, eminent thinkers, writers, and artists had higher risks of such mental

problems. Similar differential relations have been observed with regards to non-eminent creativity, with acts of artistic creativity being more strongly related to diagnosed psychopathology than acts of everyday creativity (Ivcevic, 2007).

An important avenue for future research would be to find more support for the possibility that the relationship between psychopathology and creativity is domain-dependent. This can be done by relating (vulnerability to) different psychopathologies to achievements in different creative domains as assessed with the creative achievement questionnaire (Carson et al., 2005). This research may additionally seek answers to the question *why* this would be the case. One possibility is that different domains of creativity capitalize on different cognitive processes (Baer & Kaufman, 2005; Simonton, 2009) that associate with different types of mental disorders. For example, it has been argued that poetry and art may especially require divergent and flexible thinking, whereas scientific creativity may require more disciplined, convergent and persistent thinking (Kyllonen, Walters, & Kaufman, 2005; Nettle, 2006). However, from our work it follows that avoidance-related disorders and their precursors, including depressive mood, actually associate with diminished flexibility of thought. Another possibility, mentioned earlier, is that being creative may have consequences that threaten mental health, including increased criticism and the risk of social exclusion (see e.g., Wilkinson & Marmot, 2003). This may be particularly the case in domains where there is low consensus about what outcomes are valued and considered as creative, such as the expressive arts (Simonton, 2014b).

Shared versus unique variance. In the current investigation, we took a shared variance approach (Bishop & Forster, 2013) and identified two biobehavioral systems underlying both propensity for different psychopathologies and the relation between propensity for psychopathologies on the one hand, and creativity on the other. Notwithstanding the evidence and value of this approach, by no means do we want to imply

that all variance in specific mental disorders and their inclinations could be fully explained by biobehavioral approach and avoidance tendencies. For example, depressive mood and anxiety both have shared (most likely because of their association with the avoidance system) and unique variance. Their unique features and symptoms set them apart, with depressive mood typically being characterized by lower arousal than anxiety (Clark & Watson, 1991). Moreover, the unique features that are tied to specific mental disorders and their inclinations may explain additional variance in creativity over and above the observed relations in the current investigation.

In sum, the current investigation suggests a number of areas for future study, including examining cognitive abilities as a moderator of the relation between vulnerability to mental disorders and creativity, the consideration of other mental disorders, examining issues of causality, looking more closely at comorbidity of psychopathologies when examining the psychopathology-creativity relation, examining domain specificity of the psychopathology and creativity relation, and examining the shared and unique contributions of specific types of psychopathology to creative behavior and achievements. Together, investigations into these issues will further our understanding of vulnerability to psychopathology and its relation with mental functioning.

Conclusions

The possibility that creativity is linked to risk of psychopathology intrigues and inspires many people, scientists included, yet the empirical evidence for this "mad genius hypothesis" is inconsistent. Using existing and newly conducted meta-analyses we addressed these inconsistent findings and uncovered that both negative and positive associations between risk of psychopathology and creativity exist – the precise relation between inclinations towards psychopathology and creativity crucially depends on the bio-behavioral approach-avoidance system involved and the specific psychopathology chosen. Specifically,

propensities for psychopathologies that are grounded in the approach system (positive schizotypy, (hypo)mania) positively relate to creativity; propensities for psychopathologies that are grounded in the avoidance system (e.g., depressive mood, anxiety, negative schizotypy) tend to be negatively associated with creativity (albeit weakly). This important insight not only helps to obtain a better understanding of the relation between psychopathology and creativity, but also to understand more generally the relations among different types of psychopathology and cognitive functioning. It appears that the 'mad geniuses' may especially be found among those individuals that are at risk of bipolar disorder or those that have positive schizotypal experiences.

References

References marked with an asterisk indicate studies included in the meta-analysis.

Abi-Dargham, A. (2004). Do we still believe in the dopamine hypothesis? New data bring new evidence. *The International Journal of Neuropsychopharmacology*, *7*, S1-S5.

Abraham, A. (2014a). Neurocognitive mechanisms underlying creative thinking: Indications from studies of mental illness. In J. C. Kaufman (Ed.), *Creativity and mental illness* (pp. 79-101). New York: Cambridge University Press.

Abraham, A. (2014b). Is there an inverted-U relationship between creativity and psychopathology?. *Frontiers in psychology*, *5,* 750.

Abraham, A., Windmann, S., McKenna, P., & Güntürkün, O. (2007). Creative thinking in schizophrenia: The role of executive dysfunction and symptom severity. *Cognitive Neuropsychiatry*, *12*(3), 235-258.

Abraham, A., Windmann, S., Siefen, R., Daum, I., & Güntürkün, O. (2006). Creative thinking in adolescents with attention deficit hyperactivity disorder (ADHD). *Child Neuropsychology*, *12*(2), 111-123.

Acar, S., & Sen, S. (2013). A multilevel meta-analysis of the relationship between creativity and schizotypy. *Psychology of Aesthetics, Creativity, and the Arts*, *7*(3), 214-228.

Akiskal, H. S., Akiskal, K. K., Haykal, R. F., Manning, J. S., & Connor, P. D. (2005). TEMPS-A: Progress towards validation of a self-rated clinical version of the Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego Autoquestionnaire. *Journal of Affective Disorders*, *85*(1), 3-16.

Alloy, L. B., Abramson, L. Y., Walshaw, P. D., Gerstein, R. K., Keyser, J. D., Whitehouse,

W. G., ... & Harmon-Jones, E. (2009). Behavioral approach system (BAS)–relevant cognitive styles and bipolar spectrum disorders: Concurrent and prospective associations. *Journal of Abnormal Psychology*, *118*(3), 459-471.

Alloy, L. B., Abramson, L. Y., Walshaw, P. D., Cogswell, A., Smith, J. M., Neeren, A. M., ... & Nusslock, R. (2006). Behavioral approach system (BAS) sensitivity and bipolar spectrum disorders: A retrospective and concurrent behavioral high-risk design. *Motivation and Emotion*, *30*(2), 143-155.

Altman, E., Hedeker, D., Peterson, J. L., & Davis, J. M. (2001). A comparative evaluation of three self-rating scales for acute mania. *Biological Psychiatry*, *50*(6), 468-471.

Amabile, T. M. (1996). *Creativity in context: Update to "The social psychology of creativity."* Boulder, CO: Westview Press.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (DSM)*. Washington, DC: American Psychiatric Association.

Andreasen, N. C. (1987). Creativity and mental illness. *American Journal of Psychiatry*, *144*(10), 1288-1292.

Angst, J. (1998). The emerging epidemiology of hypomania and bipolar II disorder. *Journal of Affective Disorders*, *50*(2), 143-151.

Applegate, E., El-Deredy, W., & Bentall, R. P. (2009). Reward responsiveness in psychosis-prone groups: Hypomania and negative schizotypy. *Personality and Individual Differences*, *47*(5), 452-456.

Ashby, F. G., Isen, A. M., & Turken, A. U. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review, 106*, 529-550.

Baas, M., De Dreu, C. K. W., & Nijstad, B. A. (2008). A meta-analysis of 25 years of research on mood and creativity: Hedonic tone, activation, or regulatory focus? *Psychological Bulletin, 134*, 739-756.

Baas, M., De Dreu, C. K. W., & Nijstad, B. A. (2011). When prevention promotes creativity: The role of mood, regulatory focus, and regulatory closure. *Journal of Personality and Social Psychology, 100,* 794-809.

Baas, M., De Dreu, C. K. W., & Nijstad, B. A. (2012). Emotions that associate with uncertainty lead to structured ideation. *Emotion, 12*, 1004-1014.

*Baas, M., Nijstad, B. A., Boot, N. C., & De Dreu, C. K. W. (2015). [Four studies on psychopathology and creativity in non-clinical samples]. University of Amsterdam, unpublished raw data.

Baas, M., Roskes, M., Sligte, D., Nijstad, B. A., & De Dreu, C. K. W. (2013). Personality and creativity: The dual pathway to creativity model and a research agenda. *Social & Personality Psychology Compass*, *7*, 732-748.

Baer, J., & Kaufman, J. C. (2005). Bridging generality and specificity: The Amusement Park Theoretical (APT) model of creativity. *Roeper Review*, *27*(3), 158-163.

Barlow, D. H. (2004). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. New York: Guilford press.

Barron, F., & Welsh, G. S. (1952). Artistic perception as a possible factor in personality style: Its measurement by a figure preference test. *Journal of Psychology, 33*, 199–203.

Beatty, W. W., Wonderlich, S. A., Staton, R. D., & Ternes, L. A. (1990). Cognitive functioning in bulimia: Comparison with depression. *Bulletin of the Psychonomic Society*, *28*(4), 289-292.

Beck, A. T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*, *8*(1), 77-100.

Bishop, S., & Forster, S. (2013). Trait anxiety, neuroticism and the brain basis of

vulnerability to affective disorder. In J. Armony & P. Vuilleumier (Eds.), *The Cambridge handbook of human affective neuroscience* (pp. 553-574). Cambridge: Cambridge University Press.

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, *52*(2), 69-77.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., Rothstein, H. R., 2009. *Introduction to meta-analysis*. Chichester, UK: John Wiley.

Borsboom, D., & Cramer, A. O. (2013). Network analysis: An integrative approach to the structure of psychopathology. *Annual Review of Clinical Psychology*, *9*, 91-121.

Brown, T. A., & Barlow, D. H. (2009). A proposal for a dimensional classification system based on the shared features of the DSM-IV anxiety and mood disorders: Implications for assessment and treatment. *Psychological Assessment*, *21*(3), 256-271.

*Bryan, J., & Luszcz, M. A. (2000). Measures of fluency as predictors of incidental memory among older adults. *Psychology and Aging*, *15*(3), 483-489.

*Bryan, J., Luszcz, M. A., & Crawford, J. R. (1997). Verbal knowledge and speed of information processing as mediators of age differences in verbal fluency performance among older adults. *Psychology and Aging*, *12*, 473-478.

Byron, K. & Khazanchi, S. (2011). A meta-analytic investigation of the relationship of state and trait anxiety to performance on figural and verbal creative tasks. *Personality and Social Psychology Bulletin, 37*, 269-283.

Carson, S. H. (2014). Cognitive disinhibition, creativity, and psychopathology. In D. K. Simonton (Ed.), *The Wiley handbook of genius* (pp. 198-221). Oxford, UK: Wiley.

Carson, S. H., Peterson, J. B., & Higgins, D. M. (2003). Decreased latent inhibition is associated with increased creative achievement in high-functioning individuals. *Journal of Personality and Social Psychology, 85*, 499-506.

Carson, S. H., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, *17*(1), 37-50.

Carver, C. S., & Johnson, S. L. (2009). Tendencies toward mania and tendencies toward depression have distinct motivational, affective, and cognitive correlates. *Cognitive Therapy and Research*, *33*(6), 552-569.

Carver, C. S., Sutton, S. K., & Scheier, M. F. (2000). Action, emotion, and personality: Emerging conceptual integration. *Personality and Social Psychology Bulletin, 26,* 741–751.

Castellanos, F. X, & Tannock, R. (2002). Neuroscience of attention-deficit/hyperactivity disorder: The search for endophenotypes. *Nature Reviews Neuroscience, 3*, 617–628.

Chapman, L. J., Chapman, J. P., Kwapil, T. R., Eckblad, M., & Zinser, M. C. (1994). Putatively psychosis-prone subjects 10 years later. *Journal of Abnormal Psychology*, *103*(2), 171-183.

Chermahini, S. A., & Hommel, B. (2010). The (b)link between creativity and dopamine: Spontaneous eye blink rates predict and dissociate divergent and convergent thinking. *Cognition, 115,* 458–465.

Chirila, C., & Feldman, A. (2012). Study of latent inhibition at high-level creative personality: The link between creativity and psychopathology. *Procedia-Social and Behavioral Sciences*, *33*, 353-357.

Chuderski, A. (2014). How well can storage capacity, executive control, and fluid reasoning explain insight problem solving. *Intelligence*, *46*, 258-270.

*Claridge, G., & Blakey, S. (2009). Schizotypy and affective temperament: Relationships with divergent thinking and creativity styles. *Personality and Individual Differences*, *46*, 820-826.

Claridge, G., McCreery, C., Mason, O., Bentall, R., Boyle, G. J., Slade, P., & Popplewell, D. (1996). The factor structure of" schizotypal" traits: A large replication study. *British Journal* of *Clinical Psychology, 35,* 103-115.

Claridge, G., Pryor, R., & Watkins, G. (1990). *Sounds from the bell jar: Ten psychotic authors*. New York: St Martin's Press.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*, 316-336.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159.

Cooper, H., & Hedges, L. V. (Eds.). (1994). *The handbook of research synthesis.* New York: Russell Sage Foundation.

Crews, W. D., Harrison, D. W., & Rhodes, R. D. (1999). Neuropsychological test performances of young depressed outpatient women: An examination of executive functions. *Archives of Clinical Neuropsychology*, *14*(6), 517-529.

Crow, T. J. (1990). The continuum of psychosis and its genetic origins. The sixty-fifth Maudsley lecture. *British Journal of Psychiatry, 156*, 788–797.

Crowe, S. F. (1996). The performance of schizophrenic and depressed subjects on tests of fluency: Support for a compromise in dorsolateral prefrontal functioning. *Australian Psychologist*, *31*(3), 204-209.

Damian, R. I., & Simonton, D. K. (2015). Psychopathology, adversity, and creativity: Diversifying experiences in the development of eminent African Americans. *Journal of Personality and Social Psychology*, *94*, 623–636.

Daneluzzo, E., Stratta, P., & Rossi, A. (2005). The contribution of temperament and character to schizotypy multidimensionality. *Comprehensive Psychiatry*, *46*(1), 50-55.

De Dreu, C. K. W., Baas, M., & Nijstad, B. A. (2008). Hedonic tone and activation in the mood–creativity link: Towards a Dual Pathway to Creativity model. *Journal of Personality and Social Psychology*, *94*, 739–756.

De Dreu, C. K. W., Nijstad, B. A., & Baas, M. (2011). Behavioral activation links to creativity because of increased cognitive flexibility. *Social Psychological and Personality Science, 2,* 72-80.

De Dreu, C. K. W., Nijstad, B. A., Baas, M., Roskes, M., & Wolsink, I. (2012). Working memory benefits creative insight, musical improvisation and original ideation through maintained task-focused attention. *Personality and Social Psychology Bulletin, 38*, 656-669.

De Fruyt, F., Van De Wiele, L., & Van Heeringen, C. (2000). Cloninger's psychobiological model of temperament and character and the five-factor model of personality. *Personality and Individual Differences, 29,* 441–452.

DeGeorge, D. P., Walsh, M. A., Barrantes-Vidal, N., & Kwapil, T. R. (2014). A three-year longitudinal study of affective temperaments and risk for psychopathology. *Journal of Affective Disorders*, *164*, 94-100.

Degnan, K. A., & Fox, N. A. (2007). Behavioral inhibition and anxiety disorders: Multiple levels of a resilience process. *Development and Psychopathology*, *19*(3), 729-746.

*DeMoss, K., Milich, R., & DeMers, S. (1993). Gender, creativity, depression, and attributional style in adolescents with high academic ability. *Journal of Abnormal Child Psychology*, *21*, 455-467.

Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality:

Dopamine, facilitation of incentive motivation and extraversion. *Behavioral and Brain Sciences, 22,* 491–569.

Depue, R. A., Krauss, S., Spoont, M. R., & Arbisi, P. (1989). General behavior inventory: Identification of unipolar and bipolar affective conditions in a nonclinical university population. *Journal of Abnormal Psychology*, *98*(2), 117-126.

Derryberry, D., & Tucker, D. M. (1994). Motivating the focus of attention. In P. M. Niedenthal & S. Kitayama (Eds.), *The heart's eye: Emotional influences in perception and attention* (pp. 167–196). San Diego, CA: Academic Press.

*Drapeau, C. W., & DeBrule, D. S. (2013). The relationship of hypomania, creativity, and suicidal ideation in undergraduates. *Creativity Research Journal*, *25*, 75-79.

Dreisbach, G., & Goschke, T. (2004). How positive affect modulates cognitive control: Reduced perseveration at the cost of increased distractibility. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*(2), 343-353.

Durstewitz, D., & Seamans, J. K. (2008). The dual-state theory of prefrontal cortex dopamine function with relevance to catechol-o-methyltransferase genotypes and schizophrenia. *Biological Psychiatry*, *64*(9), 739-749.

Duval, S. J., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot- based method of testing and adjusting for publication bias in meta- analysis. *Biometrics, 56,* 455–463.

Eckblad, M., & Chapman, L. J. (1986). Development and validation of a scale for hypomanic personality. *Journal of Abnormal Psychology*, *95*(3), 214-222.

Edmundson, M., Lynam, D. R., Miller, J. D., Gore, W. L., & Widiger, T. A. (2011). A five-factor measure of schizotypal personality traits. *Assessment, 18*, 321-334.

Elliot, A. J. (Ed.). (2008). *Handbook of approach and avoidance motivation*. Mahwah, NJ: Erlbaum.

Elliot, A. J., & Thrash, T. M. (2002). Approach–avoidance motivation in personality:

Approach and avoidance temperaments and goals. *Journal of Personality and Social Psychology, 82,* 804–818.

*Erdman, A. M. (2009). *Relationship between hypomania, creativity and creative achievement in a non-clinical population*. Unpublished Doctoral Dissertation. Alliant International University, Los Angeles.

Eysenck, H. J. (1993). Creativity and personality: Suggestions for a theory. *Psychological Inquiry, 4*, 147-178.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7,* 336–353.

Feist, G. J. (1998). A meta-analysis of the impact of personality on scientific and artistic creativity. *Personality and Social Psychology Review, 2*, 290-309.

*Fialkoff, L.M. (2011). Depression and creative intelligence. Thesis in partial Fulfillment of the requirements for the degree of Bachelor of Arts with honors in psychology, University of Michigan, 1-35.

Flaherty, A. W. (2005). Frontotemporal and dopaminergic control of idea generation and creative drive. *Journal of Comparative Neurology*, *493*, 147-153.

Fletcher, P. C., & Frith, C. D. (2009). Perceiving is believing: a Bayesian approach to explaining the positive symptoms of schizophrenia. *Nature Reviews Neuroscience*, *10*(1), 48-58.

*Flood, M. (2007). Exploring the relationships between creativity, depression, and successful aging. *Activities, Adaptation & Aging*, *31*, 55-71.

*Fodor, E. M. (1999). Subclinical inclination toward manic-depression and creative performance on the Remote Associates Test. *Personality and Individual Differences*, *27*, 1273-1283.

*Fodor, E. M., & Laird, B. A. (2004). Therapeutic intervention, bipolar inclination, and

literary creativity. *Creativity Research Journal*, *16*(2-3), 149-161.

*Forgeard, M. J. (2011). Happy people thrive on adversity: Pre-existing mood moderates the effect of emotion inductions on creative thinking. *Personality and Individual Differences*, *51*(8), 904-909.

Franke, P., Maier, W., Hardt, J., Hain, C., & Cornblatt, B. A. (1994). Attentional abilities and measures of schizotypy: Their variation and covariation in schizophrenic patients, their siblings, and normal control subjects. *Psychiatry Research*, *54*(3), 259-272.

*Frantom, C., & Sherman, M. F. (1999). At what price art? Affective instability within a visual art population. *Creativity Research Journal*, *12*, 15-23.

Friedman, R. S., & Förster, J. (2010). Implicit affective cues and attentional tuning: An integrative review. *Psychological Bulletin, 136,* 875–893.

Fulford, D., Feldman, G., Tabak, B. A., McGillicuddy, M., & Johnson, S. L. (2013). Positive affect enhances the association of hypomanic personality and cognitive flexibility. *International Journal of Cognitive Therapy*, *6*(1), 1-16.

*Furnham, A., Batey, M., Anand, K., & Manfield, J. (2008). Personality, hypomania, intelligence and creativity. *Personality and Individual Differences*, *44*, 1060-1069.

Furnham, A., Crump, J., Batey, M., & Chamorro-Premuzic, T. (2009). Personality and ability predictors of the "Consequences" Test of divergent thinking in a large non-student sample. *Personality and Individual Differences*, *46*, 536-540.

Fusar-Poli, P., & Meyer-Lindenberg, A. (2013). Striatal presynaptic dopamine in schizophrenia, part I: meta-analysis of dopamine active transporter (DAT) density. *Schizophrenia Bulletin*, *39*(1), 22-32.

Gard, D. E., Kring, A. M., Gard, M. G., Horan, W. P., & Green, M. F. (2007). Anhedonia in schizophrenia: Distinctions between anticipatory and consummatory pleasure. *Schizophrenia Research*, *93*(1), 253-260.

Gillan, C. M., Morein-Zamir, S., Urcelay, G. P., Sule, A., Voon, V., Apergis-Schoute, A. M., ... & Robbins, T. W. (2014). Enhanced avoidance habits in obsessive-compulsive disorder. *Biological Psychiatry, 75*, 631-638.

Gold, J. M., Waltz, J. A., Prentice, K. J., Morris, S. E., & Heerey, E. A. (2008). Reward processing in schizophrenia: A deficit in the representation of value. *Schizophrenia Bulletin*, *34*(5), 835-847.

Goodwin, D.W. & Jamison, K. R. (1990) *Manic depressive illness*. NewYork: Oxford University Press.

Gore, W. L., & Widiger, T. A. (2013). The DSM-5 dimensional trait model and five-factor models of general personality. *Journal of Abnormal Psychology*, *122*(3), 816-821.

Gough, H.G. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology*, *37*, 1398–1405.

Grace, A. A. (2012). Dopamine system dysregulation by the hippocampus: Implications for the pathophysiology and treatment of schizophrenia. *Neuropharmacology*, *62*(3), 1342-1348.

Gray, J. A. (1990). Brain systems that mediate both emotion and cognition. *Cognition and Emotion, 4,* 269–288.

*Grigorenko, E. L., & Sternberg, R. J. (2001). Analytical, creative, and practical intelligence as predictors of self-reported adaptive functioning: A case study in Russia. *Intelligence*, *29*, 57-73.

Grijalva, E., Newman, D. A., Tay, L., Donnellan, M. B., Harms, P. D., Robins, R. W., & Yan, T. (2015). Gender differences in narcissism: A meta-analytic review. *Psychological Bulletin, 141*, 261-310.

Gruber, J., Johnson, S. L., Oveis, C., & Keltner, D. (2008). Risk for mania and positive emotional responding: too much of a good thing?. *Emotion*, *8*(1), 23-33.

Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw Hill.

Hathaway, S. R., & McKinley, J. C. (1951). *Manual for the Minnesota Multiphasic Personality Inventory*. Minneapolis, MN: University of Minnesota Press.

*Healey, D., & Rucklidge, J. J. (2006). An investigation into the psychosocial functioning of creative children: The impact of ADHD symptomatology. *The Journal of Creative Behavior*, *40*(4), 243-264.

Hedges, L. V., & Olkin, I. (2014). *Statistical method for meta-analysis*. New York: Academic press.

Hirshfeld-Becker, D. R., Biederman, J., Calltharp, S., Rosenbaum, E. D., Faraone, S. V., & Rosenbaum, J. F. (2003). Behavioral inhibition and disinhibition as hypothesized precursors to psychopathology: Implications for pediatric bipolar disorder. *Biological Psychiatry*, *53*(11), 985-999.

Hirt, E. R., Devers, E. E., & McCrea, S. M. (2008). 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*, *94*(2), 214-230.

Hocevar, D., & Bachelor, P. (1989). A taxonomy and critique of measurements used in the study of creativity. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), *Handbook of creativity* (pp. 53–75). New York: Plenum Press.

Hollon, S. D., & Kendall, P. C. (1980). Cognitive self-statements in depression: Development of an automatic thoughts questionnaire. *Cognitive Therapy and Research*, *4*(4), 383-395.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, *11*, 213-218.

Horan, W. P., Blanchard, J. J., Clark, L. A., & Green, M. F. (2008). Affective traits in schizophrenia and schizotypy. *Schizophrenia Bulletin*, *34*(5), 856-874.

Hori, H., Teraishi, T., Sasayama, D., Matsuo, J., Kawamoto, Y., Kinoshita, Y., & Kunugi, H. (2012). Relationships between season of birth, schizotypy, temperament, character and neurocognition in a non-clinical population. *Psychiatry Research*, *195*(1), 69-75.

Howes, O., Bose, S., Turkheimer, F., Valli, I., Egerton, A., Stahl, D., ... & McGuire, P. (2011). Progressive increase in striatal dopamine synthesis capacity as patients develop psychosis: A PET study. *Molecular Psychiatry*, *16*(9), 885-886.

Hyde, J. S., & Linn, M. C. (2006). Gender similarities in mathematics and science. *Science, 314*(5799), 599–600.

Idson, L. C., Liberman, N., & Higgins, E. T. (2000). Distinguishing gains from non-losses and losses from non-gains: A regulatory focus perspective on hedonic intensity. *Journal of Experimental Social Psychology, 36,* 252–274.

Ivcevic, Z. (2007). Artistic and everyday creativity: An act-frequency approach. *The Journal of Creative Behavior*, *41*(4), 271-290.

Janssen, O. (2001). Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction. *The Academy of Management Journal*, *44*, 1039-1050.

Johnson, S. L., Cueller, A. K., Ruggero, C., Winett-Perlman, C., Goodnick, P., White, R., & Miller, I. (2008). Life events as predictors of mania and depression in bipolar I disorder. *Journal of Abnormal Psychology*, *117*(2), 268-277.

Johnson, S. L., Murray, G., Fredrickson, B., Youngstrom, E. A., Hinshaw, S., Bass, J. M., ... & Salloum, I. (2012). Creativity and bipolar disorder: Touched by fire or burning with questions?. *Clinical Psychology Review*, *32*(1), 1-12.

Johnson, S. L., Murray, G., Hou, S., Staudenmaier, P. J., Freeman, M. A., & Michalak, E. E. (2015a). Creativity is linked to ambition across the bipolar spectrum. *Journal of Affective Disorders*, *178*, 160-164.

*Johnson, S. L., Tharp, J. A., Holmes, M. K. (2015b). Understanding creativity in bipolar I disorder. *Psychology of Aesthetics, Creativity, and the Arts, 9*, 319-327.

Johnson, S. L., Turner, R. J., & Iwata, N. (2003). BIS/BAS levels and psychiatric disorder: An epidemiological study. *Journal of Psychopathology and Behavioral Assessment*, *25*(1), 25-36.

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology*, *35*, 835-847.

Kaufman, J. C. (Ed.). (2014). *Creativity and mental illness*. New York: Cambridge University Press.

Kaufman, J. C., Waterstreet, M. A., Ailabouni, H. S., Whitcomb, H. J., Roe, A. K., & Riggs, M. (2009). Personality and self-perceptions of creativity across domains. *Imagination, Cognition and Personality*, *29*, 193-209.

*Kelly, W. E. (2014). Correlates of the Ausburg Multidimensional Personality Instrument (AMPI) among college students: The Big Five, vocational interests, approach to the academic environment, and creativity. *Journal of Instructional Psychology*, *41*, 10-15.

Kendler, K. S., Neale, M. C., Kessler, R. C., Heath, A. C., & Eaves, L. J. (1992). Major depression and generalized anxiety disorder: Same genes, (partly) different environments? *Archives of General Psychiatry*, *49*(9), 716-722.

Kéri, S. (2009). Genes for psychosis and creativity A promoter polymorphism of the Neuregulin 1 Gene is related to creativity in people with high intellectual achievement. *Psychological Science*, *20*(9), 1070-1073.

Kessler, R. C., Demler, O., Frank, R. G., Olfson, M., Pincus, H. A., Walters, E. E., ... &

Zaslavsky, A. M. (2005). Prevalence and treatment of mental disorders, 1990 to 2003. *New England Journal of Medicine*, *352*(24), 2515-2523.

Kim, S. H., Vincent, L. C., & Goncalo, J. A. (2013). Outside advantage: Can social rejection fuel creative thought?. *Journal of Experimental Psychology: General*, *142*(3), 605-611.

*Klco, S. E. (2010). *A neuropsychological examination of the effects of mindfulness meditation in elementary school children*. Unpublished master's thesis. Florida Atlantic University.

Klein, D. N., Kotov, R., & Bufferd, S. J. (2011). Personality and depression: Explanatory models and review of the evidence. *Annual Review of Clinical Psychology*, *7*, 269.

Korte, S. M. (2001). Corticosteroids in relation to fear, anxiety and psychopathology. *Neuroscience & Biobehavioral Reviews*, *25*(2), 117-142.

Kotov, R., Gamez, W., Schmidt, F. L., & Watson, D. (2010). Linking "Big" personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin, 136*, 768–821.

Kray, J., & Lindenberger, U. (2000). Adult age differences in task switching. *Psychology and Aging*, *15*(1), 126.

Krueger, R. F. (1999). The structure of common mental disorders. *Archives of General Psychiatry*, *56*(10), 921-926.

Kurzban, R., & Leary, M. R. (2001). Evolutionary origins of stigmatization: The functions of social exclusion. *Psychological Bulletin*, *127*(2), 187-208.

Kwapil, T. R., Barrantes-Vidal, N., & Silvia, P. J. (2008). The dimensional structure of the Wisconsin schizotypy scales: Factor identification and construct validity. *Schizophrenia Bulletin*, *34*(3), 444-457.

Kwapil, T. R., Gross, G. M., Silvia, P. J., & Barrantes-Vidal, N. (2013). Prediction of

psychopathology and functional impairment by positive and negative schizotypy in the Chapmans' ten-year longitudinal study. *Journal of Abnormal Psychology*, *122*(3), 807-815.

Kwapil, T. R., Miller, M. B., Zinser, M. C., Chapman, L. J., Chapman, J., & Eckblad, M. (2000). A longitudinal study of high scorers on the Hypomanic Personality Scale. *Journal of Abnormal Psychology, 109*, 222–226.

Kyllonen, P., Walters, A. M., & Kaufman, J. C. (2005). Noncognitive constructs and their assessment in graduate education: A review. *Educational Assessment*, *10*(3), 153-184.

Lang, P. J., Davis, M., & Öhman, A. (2000). Fear and anxiety: Animal models and human cognitive psychophysiology. *Journal of Affective Disorders*, *61*(3), 137-159.

Larøi, F., DeFruyt, F., van Os, J., Aleman, A., & Van der Linden, M. (2005). Associations between hallucinations and personality structure in a non-clinical sample: Comparison between young and elderly samples. *Personality and Individual Differences*, *39*(1), 189-200.

Laruelle, M., Abi-Dargham, A., Van Dyck, C. H., Gil, R., D'Souza, C. D., Erdos, J., ... & Innis, R. B. (1996). Single photon emission computerized tomography imaging of amphetamine-induced dopamine release in drug-free schizophrenic subjects. *Proceedings of the National Academy of Sciences*, *93*(17), 9235-9240.

Laruelle, M., Kegeles, L. S., & Abi-Dargham, A. (2003). Glutamate, dopamine, and schizophrenia. *Annals of the New York Academy of Sciences, 1003*, 138–158.

Lauronen, E., Veijola, J., Isohanni, I., Jones, P. B., Nieminen, P., & Isohanni, M. (2004). Links between creativity and mental disorder. *Psychiatry*, *67*(1), 81-98.

Lee, H. J., Cougle, J. R., & Telch, M. J. (2005). Thought–action fusion and its relationship to schizotypy and OCD symptoms. *Behaviour Research and Therapy*, *43*(1), 29-41.

Lubin, B. (1965). Adjective checklists for measurement of depression. *Archives of General*

Psychiatry, *12*(1), 57-62.

*Loughry, N. (2013). The functionality of creativity and its relationship to hypomania and associated factors. *Psychology Honors Papers*. Paper 35.

Ludwig, A. M. (1992). Creative achievement and psychopathology —Comparison among professions. *American Journal of Psychotherapy, 46*, 330—356.

Mansell, W., & Pedley, R. (2008). The ascent into mania: A review of psychological processes associated with the development of manic symptoms. *Clinical Psychology Review*, *28*(3), 494-520.

Mason, O., Claridge, G., & Jackson, M. (1995). New scales for the assessment of schizotypy. *Personality and Individual differences*, *18*(1), 7-13.

Mason, L., O'Sullivan, N., Blackburn, M., Bentall, R., & El-Deredy, W. (2012). I want it now! Neural correlates of hypersensitivity to immediate reward in hypomania. *Biological Psychiatry*, *71*(6), 530-537.

Matthews, G., & Gilliland, K. (1999). The personality theories of H. J. Eysenck and J. A. Gray: A comparative review. *Personality and Individual Differences*, *26*(4), 583-626.

McGrath, R. E., & Meyer, G. J. (2006). When effect sizes disagree: The case of r and d. *Psychological Methods*, *11*(4), 386-401.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review, 69*, 220-232.

Meyer, T. D. (2002). The Hypomanic Personality Scale, the Big Five, and their relationship to depression and mania. *Personality and Individual Differences*, *32*(4), 649-660.

Meyer-Lindenberg, A., Miletich, R. S., Kohn, P. D., Esposito, G., Carson, R. E., Quarantelli, M., ... & Berman, K. F. (2002). Reduced prefrontal activity predicts exaggerated striatal dopaminergic function in schizophrenia. *Nature Neuroscience*, *5*(3), 267-271.

Miller, G. F., & Tal, I. R. (2007). Schizotypy versus openness and intelligence as predictors

of creativity. *Schizophrenia Research*, *93*(1), 317-324.

Millon, T. (1994). *The Millon Clinical Multiaxial Inventory-Ill manual*. Minneapolis, MN: National Computer Systems

Mitchell, J. T., Robertson, C. D., Kimbrel, N. A., & Nelson-Gray, R. O. (2011). An evaluation of behavioral approach in adults with ADHD. *Journal of Psychopathology and Behavioral Assessment, 33*, 430–437.

*Moraes, A. L., Guimarães, L. S., Joanette, Y., Parente, M. A. D. M. P., Fonseca, R. P., & Almeida, R. M. M. D. (2013). Effect of aging, education, reading and writing, semantic processing and depression symptoms on verbal fluency. *Psicologia: Reflexão e Crítica*, *26*, 680-690.

Moritz, S., Birkner, C., Kloss, M., Jahn, H., Hand, I., Haasen, C., & Krausz, M. (2002). Executive functioning in obsessive–compulsive disorder, unipolar depression, and schizophrenia. *Archives of Clinical Neuropsychology*, *17*(5), 477-483.

Mueller, J. S., Melwani, S., & Goncalo, J. A. (2011). The bias against creativity why people desire but reject creative ideas. *Psychological Science*, *23*, 13-17.

Muntaner, C., Garcia-Sevilla, L., Fernandez, A., & Torrubia, R. (1988). Personality dimensions, schizotypal and borderline personality traits and psychosis proneness. *Personality and Individual differences*, *9*(2), 257-268.

Murray, G., & Johnson, S. L. (2010). The clinical significance of creativity in bipolar disorder. *Clinical Psychology Review*, *30*(6), 721-732.

*Nadasi, C. (1997). The relationship between creativity, self-actualization, and hypomania. Unpublished master's thesis, University of Montana, Missoula.

Naragon-Gainey, K. (2010). Meta-analysis of the relations of anxiety sensitivity to the depressive and anxiety disorders. *Psychological Bulletin*, *136*(1), 128.

Nelson, M. T., Seal, M. L., Pantelis, C., & Phillips, L. J. (2013). Evidence of a dimensional

relationship between schizotypy and schizophrenia: A systematic review. *Neuroscience & Biobehavioral Reviews*, *37*(3), 317-327.

Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist*, *61*(6), 622-631.

Nettle, D., & Clegg, H. (2006). Schizotypy, creativity and mating success in humans. *Proceedings of the Royal Society B: Biological Sciences*, *273*, 611-615.

Nijstad, B. A., De Dreu., C. K. W., Rietzschel, E. F., & Baas, M. (2010). Towards a dual-pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology, 21,* 34–77.

O'Sullivan, N., Szczepanowski, R., El-Deredy, W., Mason, L., & Bentall, R. P. (2011). fMRI evidence of a relationship between hypomania and both increased goal-sensitivity and positive outcome-expectancy bias. *Neuropsychologia*, *49*(10), 2825-2835.

Ormel, J., Jeronimus, B. F., Kotov, R., Riese, H., Bos, E. H., Hankin, B., ... & Oldehinkel, A. J. (2013). Neuroticism and common mental disorders: Meaning and utility of a complex relationship. *Clinical Psychology Review*, *33*(5), 686-697.

Ormel, J., Raven, D., van Oort, F., Hartman, C. A., Reijneveld, S. A., Veenstra, R., ... & Oldehinkel, A. J. (2014). Mental health in Dutch adolescents: A TRAILS report on prevalence, severity, age of onset, continuity and co-morbidity of DSM disorders. *Psychological Medicine, 45*, 345–360.

*Papworth, M. A., & James, I. A. (2003). Creativity and mood: Towards a model of cognitive mediation. *The Journal of Creative Behavior*, *37*, 1-16.

*Papworth, M. A., Jordan, G., Backhouse, C., Evans, N., Kent-Lemon, N., Morris, J., & Winchester, K. J. (2008). Artists' vulnerability to psychopathology: Towards an integrative cognitive perspective. *The Journal of Creative Behavior*, *42*, 149-163.

*Pascual-Leone, A., Gomes, K., Orr, E. S., Kaploun, K. A., & Abeare, C. A. (2011).

Affective and cognitive correlates of gambling behavior in university students. *Journal of Gambling Studies*, *27*, 401-408.

Peterson, J. B., Smith, K. W., & Carson, S. (2002). Openness and extraversion are associated with reduced latent inhibition: Replication and commentary. *Personality and Individual Differences, 33*, 1137-1147.

*Piffer, D. (2014). The personality and cognitive correlates of creative achievement. *Open Differential Psychology*. Retrieved from *http://openpsych.net/ODP/2014/04/the-personality-and-cognitive-correlates-of-creative-achievement/*

Pinto-Meza, A., Caseras, X., Soler, J., Puigdemont, D., Pérez, V., & Torrubia, R. (2006). Behavioural inhibition and behavioural activation systems in current and recovered major depression participants. *Personality and Individual Differences*, *40*, 215-226.

Porter, R. B., & Cattell, R. B. (1963). *Children's personality questionnaire*. Champaign, IL: Institute for Personality and Ability Testing.

Post F. (1994). Creativity and psychopathology. A study of 291 world-famous men. *British Journal of Psychiatry, 165*, 22—34.

Prentice, D. A., & Miller, D. T. (1992). When small effects are impressive. *Psychological Bulletin*, *112*, 160-164.

Preti, A., Corrias, I., Gabbrielli, M., Lai, V., Muratore, T., Pintus, E., ... & Carta, M. G. (2015). The independence of schizotypy from affective temperaments–A combined confirmatory factor analysis of SPQ and the short TEMPS-A. *Psychiatry Research*, *225*(1), 145-156.

Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385-401.

*Ravdin, L. D., Katzen, H. L., Agrawal, P., & Relkin, N. R. (2003). Letter and semantic

fluency in older adults: Effects of mild depressive symptoms and age-stratified normative data. *The Clinical Neuropsychologist*, *17*, 195-202.

*Rawlings, D., & Locarnini, A. (2008). Dimensional schizotypy, autism, and unusual word associations in artists and scientists. *Journal of Research in Personality*, *42*, 465-471.

Richard, F. D., Bond Jr, C. F., & Stokes-Zoota, J. J. (2003). One hundred years of social psychology quantitatively described. *Review of General Psychology*, *7*(4), 331-363.

Richards, R., Kinney, D. K., Lunde, I., Benet, M., & Merzel, A. P. (1988). Creativity in manic-depressives, cyclothymes, their normal relatives, and control subjects. *Journal of Abnormal Psychology*, *97*, 281-288.

Robinson, M. D., Moeller, S. K., & Ode, S. (2010). Extraversion and reward-related processing: Probing incentive motivation in affective priming tasks. *Emotion, 10*, 615-626.

Roskes, M., De Dreu, C. K. W., & Nijstad, B. A. (2012). Necessity is the mother of invention: Avoidance motivation stimulates creativity through cognitive effort. *Journal of Personality and Social Psychology, 103*, 242–256.

Roskes, M., Elliot, A. J., Nijstad, B. A., & De Dreu, C. K. (2013). Time pressure undermines performance more under avoidance than approach motivation. *Personality and Social Psychology Bulletin*, *39*(6), 803-813.

Rothenberg, A. (1990). Creativity, mental health, and alcoholism. *Creativity Research Journal*, *3*(3), 179-201.

*Ruiter, M., & Johnson, S. L. (2015). Mania risk and creativity: A multi-method study of the role of motivation. *Journal of Affective Disorders*, *170*, 52-58.

Runco, M. A. (2004). Creativity. *Annual Review of Psychology, 55*, 657-687.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*, 92-96.

Runco, M. A., & Johnson, D. J. (2002). Parents' and teachers' implicit theories of children's creativity: A cross-cultural perspective. *Creativity Research Journal*, *14*, 427-438.

Rybakowski, J. K., & Klonowska, P. (2011). Bipolar mood disorder, creativity and schizotypy: An experimental study. *Psychopathology*, *44*(5), 296-302.

Salthouse, T. A., Atkinson, T. M., & Berish, D. E. (2003). Executive functioning as a potential mediator of age-related cognitive decline in normal adults. *Journal of Experimental Psychology: General*, *132*(4), 566-594.

*Sánchez, Ó., Martín-Brufau, R., Méndez, F. X., Corbalán, F. J., & Limiñana, R. M. (2010). The relationship between optimism, creativity and psychopathological symptoms in university students. *Electronic Journal of Research in Educational Psychology*, *8*, 1151-1178.

Santosa, C. M., Strong, C. M., Nowakowska, C., Wang, P. W., Rennicke, C. M., & Ketter, T. A. (2007). Enhanced creativity in bipolar disorder patients: A controlled study. *Journal of Affective Disorders*, *100*, 31-39.

Saulsman, L. M., & Page, A. C. (2004). The five-factor model and personality disorder empirical literature: A meta-analytic review. *Clinical Psychology Review*, *23*(8), 1055-1085.

*Sawa, M., Yamashita, H., Fujimaki, K., Okada, G., Takahashi, T., & Yamawaki, S. (2013). Negative correlation between affective symptoms and prefrontal activation during a verbal fluency task: A near-infrared spectroscopy study. *Neuropsychobiology*, *67*, 103-110.

Schaller, M. (1997). The psychological consequences of fame: Three tests of the self-consciousness hypothesis. *Journal of Personality, 65*, 291-309.

Schlesinger, J. (2009). Creative mythconceptions: A closer look at the evidence for the" mad genius" hypothesis. *Psychology of Aesthetics, Creativity, and the Arts*, *3*(2), 62-72.

Schooler, J. W., & Melcher, J. (1995). The ineffability of insight. In S. M. Smith, M. Steven, T. B. Ward, & R. A. Finke (Eds.), *The creative cognition approach* (pp. 97-133). Cambridge, MA: The MIT Press.

*Schuldberg, D. (1990). Schizotypal and hypomanic traits, creativity, and psychological health. *Creativity Research Journal*, *3*, 218-230.

*Schuldberg, D. (2001). Six subclinical spectrum traits in normal creativity. *Creativity Research Journal*, *13*, 5-16.

*Schuldberg, D. (unpublished). Depressive mood, hypomania, and creativity in non-clinical samples. Unpublished raw data.

Schwartz, J. M., Ksir, C., Koob, G. F., & Bloom, F. E. (1982). Changes in locomotor response to beta-endorphin microinfusion during and after opiate abstinence syndrome—a proposal for a model of the onset of mania. *Psychiatry Research*, *7*(2), 153-161.

*Scobie, J. J. (2003). Epistemological style and its relationship to creativity and depression. *Electronic Theses and Dissertations*. Paper 1948.

*Shapiro, P. J., & Weisberg, R. W. (1999). Creativity and bipolar diathesis: Common behavioural and cognitive components. *Cognition & Emotion*, *13*, 741-762.

*Silvia, P. J., Beaty, R. E., Nusbaum, E. C., Eddington, K. M., & Kwapil, T. R. (2014a). Creative motivation: Creative achievement predicts cardiac autonomic markers of effort during divergent thinking. *Biological Psychology*, *102*, 30-37.

*Silvia, P. J., & Kimbrel, N. A. (2010). A dimensional analysis of creativity and mental illness: Do anxiety and depression symptoms predict creative cognition, creative accomplishments, and creative self-concepts?. *Psychology of Aesthetics, Creativity, and the Arts*, *4*, 2-10.

*Silvia, P. J., Nusbaum, E. C., Eddington, K. M., Beaty, R. E., & Kwapil, T. R. (2014b).

Effort deficits and depression: The influence of anhedonic depressive symptoms on cardiac autonomic activity during a mental challenge. *Motivation and Emotion*, *38*(6), 779-789.

Simeonova, D. I., Chang, K. D., Strong, C., & Ketter, T. A. (2005). Creativity in familial bipolar disorder. *Journal of Psychiatric Research*, *39*, 623-631.

Simonton, D. K. (2009). Varieties of (scientific) creativity: A hierarchical model of domain-specific disposition, development, and achievement. *Perspectives on Psychological Science*, *4*(5), 441-452.

Simonton, D. K. (2014a). The mad-genius paradox: Can creative people be more mentally healthy but highly creative people more mentally ill? *Perspectives on Psychological Science*, *9*(5), 470-480.

Simonton, D. K. (2014b). More method in the mad-genius controversy: A historiometric study of 204 historic creators. *Psychology of Aesthetics, Creativity, and the Arts*, *8*(1), 53-61.

*Sitton, S. C., & Hughes, R. B. (1995). Creativity, depression, and circannual variation. *Psychological Reports*, *77*(3), 907-910.

Srivastava, S., Childers, M. E., Baek, J. H., Strong, C. M., Hill, S. J., Warsett, K. S., ... & Ketter, T. A. (2010). Toward interaction of affective and cognitive contributors to creativity in bipolar disorders: A controlled study. *Journal of Affective Disorders*, *125*, 27-34.

Steel, Z., Marnane, C., Iranpour, C., Chey, T., Jackson, J. W., Patel, V., & Silove, D. (2014). The global prevalence of common mental disorders: A systematic review and meta-analysis 1980–2013. *International Journal of Epidemiology*, dyu038.

Sutin, A. R., Terracciano, A., Kitner-Triolo, M. H., Uda, M., Schlessinger, D., & Zonderman, B. (2011). Personality traits prospectively predict verbal fluency in a lifespan

sample. *Psychology and Aging*, *26*, 994.

*Sutter, C., Zöllig, J., Allemand, M., & Martin, M. (2012). Sleep quality and cognitive function in healthy old age: The moderating role of subclinical depression. *Neuropsychology*, *26*, 768.

Suzuki, T., Samuel, D. B., Pahlen, S., & Krueger, R. F. (2015). DSM-5 alternative personality disorder model traits as maladaptive extreme variants of the five-factor model: An item-response theory analysis. *Journal of Abnormal Psychology*, *124*, 343-354.

Swann, A. C, Dougherty, D. M., Pazzaglia, P. J., Pham, M., & Moeller, F. G. (2004). Impulsivity: A link between bipolar disorder and substance abuse. *Bipolar Disorder, 6*, 204–212.

*Thalbourne, M. A., Keogh, E., & Crawley, S. E. (1999). Manic-depressiveness and its correlates. *Psychological Reports*, *85*, 45-53.

Thrash, T. M., Maruskin, L. A., Cassidy, S. E., Fryer, J. W., & Ryan, R. M. (2010). Mediating between the muse and the masses: Inspiration and the actualization of creative ideas. *Journal of Personality and Social Psychology, 98,* 469–487.

Tierney, P., & Farmer, S. M. (2011). Creative self-efficacy development and creative performance over time. *Journal of Applied Psychology*, *96*, 277-293.

Toplak, M. E., Jain, U., & Tannock, R. (2005). Executive and motivational processes in adolescents with attention-deficit-hyperactivity disorder (ADHD). *Behavioral and Brain Functions, 1*, 1–12.

Torrance, E. P. (1966). *Torrance tests of creative thinking.* Princeton, NJ: Personnel Press.

Van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A

systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis proneness–persistence–impairment model of psychotic disorder. *Psychological Medicine*, *39*(02), 179-195.

*Vellante, M., Zucca, G., Preti, A., Sisti, D., Rocchi, M. B. L., Akiskal, K. K., & Akiskal, H. S. (2011). Creativity and affective temperaments in non-clinical professional artists: An empirical psychometric investigation. *Journal of Affective Disorders*, *135*, 28-36.

Verdoux, H., & van Os, J. (2002). Psychotic symptoms in non-clinical populations and the continuum of psychosis. *Schizophrenia Research*, *54*(1), 59-65.

*Verhaeghen, P., Joormann, J., & Aikman, S. N. (2014). Creativity, mood, and the examined life: Self-reflective rumination boosts creativity, brooding breeds dysphoria. *Psychology of Aesthetics, Creativity, and the Arts*, *8*, 211-218.

*Verhaeghen, P., Joorman, J., & Khan, R. (2005). Why we sing the blues: The relation between self-reflective rumination, mood, and creativity. *Emotion*, *5*, 226-232.

Vollema, M. G., & van den Bosch, R. J. (1995). The multidimensionality of schizotypy. *Schizophrenia Bulletin*, *21*(1), 19-31.

*Von Stumm, S., Chung, A., & Furnham, A. (2011). Creative ability, creative ideation and latent classes of creative achievement: What is the role of personality?. *Psychology of Aesthetics, Creativity, and the Arts*, *5*, 107-114.

Walsh, M. A., Royal, A., Brown, L. H., Barrantes-Vidal, N., & Kwapil, T. R. (2012). Looking for bipolar spectrum psychopathology: Identification and expression in daily life. *Comprehensive Psychiatry*, *53*(5), 409-421.

Watson, D., Stasik, S. M., Ellickson-Larew, S., & Stanton, K. (2015). Extraversion and psychopathology: A facet-level analysis. *Journal of Abnormal Psychology*, *124*(2), 432-446.

Watson, D., Wiese, D., Vaida, J., & Tellegen, A. (1999). The two general activation systems

of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology, 76,* 820–838.

Weisberg, R. W. (1994). Genius and madness?: A Quasi-experimental test of the hypothesis that manic-depression increases creativity. *Psychological Science*, *5*(6), 361-367.

White, H. A., & Shah, P. (2006). Uninhibited imaginations: Creativity in adults with attention-deficit/hyperactivity disorder. *Personality and Individual Differences, 40*, 1121–1131.

White, H. A., & Shah, P. (2011). Creative style and achievement in adults with attention-deficit/hyperactivity disorder. *Personality and Individual Differences, 50*, 673–677.

Whittle, S., Allen, N. B., Lubman, D. I., & Yücel, M. (2006). The neurobiological basis of temperament: Towards a better understanding of psychopathology. *Neuroscience & Biobehavioral Reviews*, *30*(4), 511-525.

Wilkinson, R. G., & Marmot, M. G. (Eds.). (2003). *Social determinants of health: The solid facts*. World Health Organization.

Wills, G. I. (2003). Forty lives in the bebop business: Mental health in a group of eminent jazz musicians. *The British Journal of Psychiatry, 183*, 255–259.

*Wohl, E. C. (2003). *Creativity and Affective Traits Across the Life Span: Developmental Influences Among Adolescents and Older Adults* (Doctoral dissertation, University of North Texas).

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1983). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research*, *17*(1), 37-49.

Young, L. N., Winner, E., & Cordes, S. (2013). Heightened incidence of depressive symptoms in adolescents involved in the arts. *Psychology of Aesthetics, Creativity, and the Arts*, *7*, 197-202.

*Zabelina, D. L., Condon, D., & Beeman, M. (2014). Do dimensional psychopathology measures relate to creative achievement or divergent thinking?. *Frontiers in Psychology*, *5*: 1029.

Zhang, G., Chan, A., Zhong, J., & Yu, X. (2015). Creativity and social alienation: The costs of being creative. *The International Journal of Human Resource Management.* doi: 10.1080/09585192.2015.1072107.

Zuckerman, M., Bone, R. N., Neary, R., Mangelsdorff, D., & Brustman, B. (1972). What is the sensation seeker? Personality trait and experience correlates of the Sensation-Seeking Scales. *Journal of Consulting and Clinical Psychology*, *39*, 308.

Zung, W. W. (1965). A self-rating depression scale. *Archives of General Psychiatry*, *12*, 63-70.

Endnotes

[1] As in our primary meta-analysis, for studies that reported multiple creativity measures, we took into consideration the correlation between these different creativity measures to estimate the overall variance for the composite *d* (Borenstein et al., 2009). This meta-analytic strategy was also performed for studies that compared the creativity of people diagnosed with bipolar disorder with control participants.

Table 1. *Inclinations Towards Mental Disorders*

Mental disorder	Bias towards biobehavioral approach/avoidance	Associated risk factor
Major depressive disorder	High avoidance sensitivity; Low approach sensitivity	Depressive mood
Generalized anxiety disorder	High avoidance sensitivity	Trait anxiety
Bipolar disorder	High approach sensitivity	(Hypo)mania, cyclothymia
Psychotic disorders	High avoidance sensitivity; High approach sensitivity	Negative schizotypy Positive schizotypy

Note. This Table presents risks of four common mental disorders. We should note that there is a high comorbidity among mental disorders and that presented inclinations may predominantly, but not exclusively, predict specific mental disorders.

Table 2. *Creativity Self-Report Measures*

Sample measure	Sample item/description	Creativity scoring	Reference
	Personality		
ACL	Respondents select characteristics indicative of creative (e.g., original) and non-creative personality (e.g., modest)	Number of non-creative characteristics are subtracted from number of creative characteristics	Gough, 1979
	Self-ratings		
CAQ	Respondents indicate recognized and concrete creative achievements in ten domains (e.g., visual arts, sciences, music).	Scores for each domain are summed together to yield a creative achievement score	Carson et al., 2005
CDQ-R	Respondents indicate their perceived level of creativity in different domains (e.g., How creative would you rate yourself in dancing?).	Scale score	Kaufman et al., 2009
JCS	Respondents rate how often they engage in nine general creative behaviors in the context of the workplace (e.g., I often think of original solutions to problems)	Scale score	Janssen, 2001
CSE	Respondents rate their perceived capacity for creativity (e.g., I have confidence in my ability to solve problems creatively)	Scale score	Tierney & Farmer, 2011

Note. ACL = Adjective Check List; CAQ = Creative Achievement Questionnaire; CDQ-R = Creativity Domain Questionnaire – Revised; JCS = Janssen Creativity Scale; CSE = Creative Self-Efficacy

Table 3. *Creativity Performance Measures*

Sample measure	Sample item/description	Creativity scoring	Reference
	Divergent thinking		
Divergent thinking	Verbal: Respondents generate as many possible uses for an object (e.g., brick, tin can); visual: Respondents draw as many possible figures using provided shapes (e.g., triangles)	Ideas and drawings are rated for originality, fluency, and flexibility by coders	Guilford, 1967; Torrance, 1976
Brainstorming	Respondents generate as many possible ideas about a given topic (e.g., improve the environment)	Ideas are rated for originality, fluency, and flexibility by coders	Nijstad et al., 2010
	Insight tasks		
Remote associates	Respondents generate a word that connects three stimulus words (e.g., black, bean, break; answer: coffee)	Correct solution: yes/no	Mednick, 1962
Candle problem	Respondents have to support a candle on the wall using a candle, matches, and a box of tacks	Correct solution: yes/no	Schooler & Melcher, 1995
	Creative product		
Collage building	Respondents make a collage with provided material	Creativity ratings of product by experts	Amabile, 1996
Poem	Respondents write a poem according to specified rules	Creativity ratings of product by experts	Amabile, 1996
	Ratings		
Supervisor ratings	Supervisors rate creativity of their subordinates	Supervisor ratings of creativity	Tierney & Farmer, 2011

Table 4. *Characteristics of Included Samples*.

	Depressive mood		Risk of bipolar disorder	
	n (studies)	% of studies	*n* (studies)	% of studies
Participant characteristics				
Gender composition				
All male	1	3	0	0
All female	0	0	0	0
Both male and female	32	82	22	79
Not specified	6	15	6	21
Age of participants in years				
Younger than 20	4	10	2	7
20-40 years	16	41	16	57
40-60 years	1	3	1	4
Older than 60	5	13	0	0
Not specified	13	33	9	32
Population type				
Children	2	5	0	0
Students	28	72	25	89
Adults	4	10	3	11
Senior citizens	5	13	0	0
Artistic profile				
Artistic	3	8	2	7
Non-artistic	36	92	26	93
Study methods				
Depressive mood measure[a]				
BDI	9	23	-	-
CES-D	8	21	-	-
Zung	5	13		
GDS	4	10	-	-
DACL	4	10		
TEMPS-D	3	8	-	-
Else	11	28	-	-

Risk of bipolar disorder measure[a]				
HPS	-	-	14	50
TEMPS-C	-	-	3	11
TEMPS-H	-	-	3	11
ARMS	-	-	3	11
Else	-	-	9	32
Risk of bipolar disorder type[a]				
Hypomania	-	-	18	64
Mania	-	-	8	29
Cyclothymia	-	-	4	14
Diffuse	-	-	2	7
Creativity measurement[a]				
Performance	30	77	18	64
Self-ratings	17	44	21	75
Study characteristics				
Publication status				
Published	31	79	19	68
Unpublished	8	21	9	32
Publication year published studies				
Before 2000	5	13	7	25
2000 and after	26	67	12	43
Location of study				
USA/Canada	18	46	18	64
Other	21	54	10	36

Note. [a] Percentages do not sum up to 100% because studies used multiple creativity measures or multiple measures of depressive mood or risk of bipolar disorder. BDI = Beck's Depression Inventory, CES-D = Center for Epidemiological Studies - Depression symptoms index, GDS = Geriatric Depression Scale, DACL = Depression Adjective Check List, TEMPS-D = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Dysthymia. ARMS = Altman Self-Rating Mania Scale, HPS = Hypomanic Personality Scale, TEMPS-C = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Cyclothymia, TEMPS-H = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Hyperthymia.

Table 5. *Meta-Regression Model for the Relationship between Depressive Mood and Creativity*

Set	Covariate	Coefficient	SE	95% Lower	95% upper	*t*	*p*	
	Intercept	.001	.039	-.078	.079	0.01	.990	
Population[a]	Population (children)	-.205	.108	-.424	.014	-1.89	.066	$F(3,40) = 3.81, p = .017$
	Population (adults)	.001	.044	-.087	.089	0.03	.979	
	Population (seniors)	-.145	.051	-.247	-.042	-2.86	.007	
	Country (USA/Canada)	.020	.030	-.040	.079	0.66	.514	
Measure[b]	BDI	-.021	.033	-.087	.046	-0.63	.535	$F(6,40) = 1.11, p = .374$
	CES-D	.010	.047	-.085	.104	0.20	.839	
	DACL	-.179	.085	-.351	-.008	-2.11	.041	
	GDS	-.022	.062	-.148	.104	-0.36	.724	
	TEMPS	.021	.053	-.086	.128	0.39	.699	
	Zung	-.108	.078	-.264	.049	-1.39	.173	
	Artistic profile (artistic)	.209	.079	.048	.369	2.63	.012	
	Creativity (ratings)	-.076	.029	-.134	-.017	-2.61	.013	

Note. Between brackets are categories that are compared to a reference category. [a] Students are set as reference category; [b] Other is set as reference category. BDI = Beck's Depression Inventory, CES-D = Center for Epidemiological Studies - Depression symptoms index, GDS = Geriatric Depression Scale, DACL = Depression Adjective Check List, TEMPS-D = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Dysthymia, Zung = Zung Self-rating Depression Scale.

Table 6. *Meta-Regression Model for the Relationship between Risk of Bipolar Disorder and Creativity*

Set	Covariate	Coefficient	SE	95% Lower	95% upper	*t*	*p*	
	Intercept	.123	.068	-.014	.260	1.82	.077	
	Population (adults)	.016	.134	-.256	.288	0.12	.905	
	Country (USA/Canada)	-.046	.046	-.138	.047	-1.00	.322	
Measure[a]	ARMS	-.063	.073	-.212	.086	-0.86	.397	$F(4,37) = 2.64$, $p = .049$
	HPS	.040	.054	-.069	.149	0.75	.458	
	TEMP-C	-.094	.084	-.264	.076	-1.13	.268	
	TEMPS-H	.155	.088	-.024	.334	1.75	.088	
	Artistic profile (artistic)	-.010	.187	-.389	.370	-0.05	.958	
	Creativity (ratings)	.172	.040	.091	.253	4.32	<.001	

Note. Between brackets are categories that are compared to a reference category. [a] Other scales are set as reference category. ARMS = Altman Self-Rating Mania Scale, HPS = Hypomanic Personality Scale, TEMPS-C = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Cyclothymia, TEMPS-H = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Hyperthymia.

Table 7. *Creativity in Major Depressive Disorder and Bipolar Disorder*

Study	Creativity measure	Patients (n)	Control (n)	Effect	Cohen's d	95% Lower	95% Upper
Major Depressive Disorder vs. Control							
Beatty et al., 1990	DT	14	42	MDD=C	0.084	-0.520	0.688
Crews et al., 1999	DT	30	30	MDD=C	0.023	-0.484	0.530
Crowe, 1996	DT	13	23	MDD<C	-0.779	-1.483	-0.075
Moritz et al., 2002	DT	25	70	MDD<C	-1.139	-1.623	-0.655
Santosa et al., 2007	DT, ACL	25	47	MDD=C	0.052	-0.359	0.463
Srivastava et al., 2010	DT, ACL	21	42	MDD=C	0.038	-0.405	0.481
Bipolar Disorder vs. Control							
Johnson et al., 2015	DT, CAQ	62	50	BP>C	0.314	0.019	0.609
Richards et al., 1988	Rated creativity	33	15	BP=C	0.200	-0.410	0.810
Rybakowski & Klonowska 2011	DT	40	48	BP>C	0.457	0.032	0.882
Santosa et al., 2007	DT, ACL	49	47	BP=C	-0.110	-0.449	0.229
Srivastava et al., 2010	DT, ACL	32	42	BP=C	-0.177	-0.564	0.210

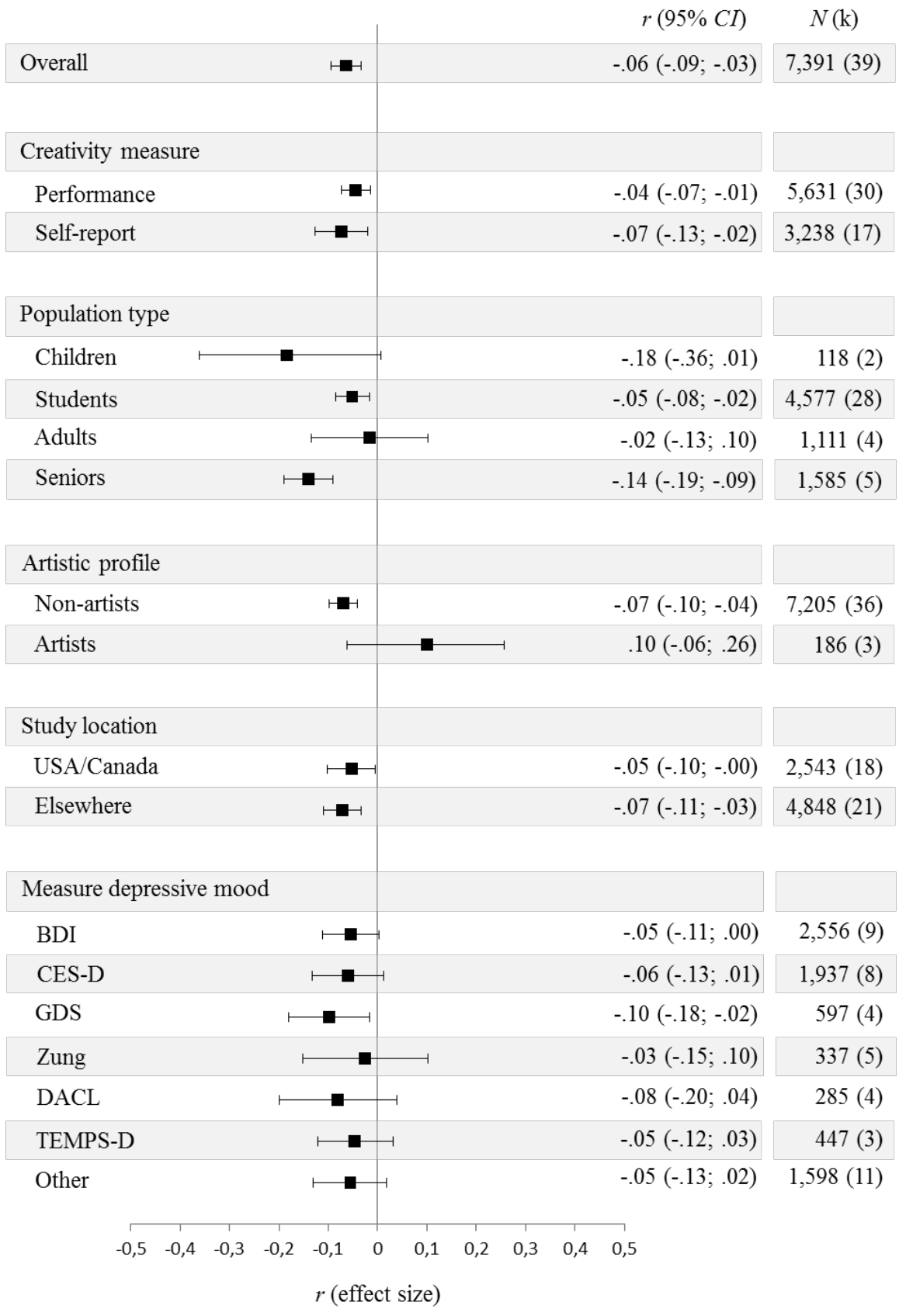
Note. ACL = Adjective Check List, CAQ = Creative Achievement Questionnaire, DT = Divergent thinking. MDD = Major Depressive Disorder, BP = Bipolar Disorder

Figure Legends

Fig. 1 Meta-analytic findings for the relation between depressive mood and creativity.

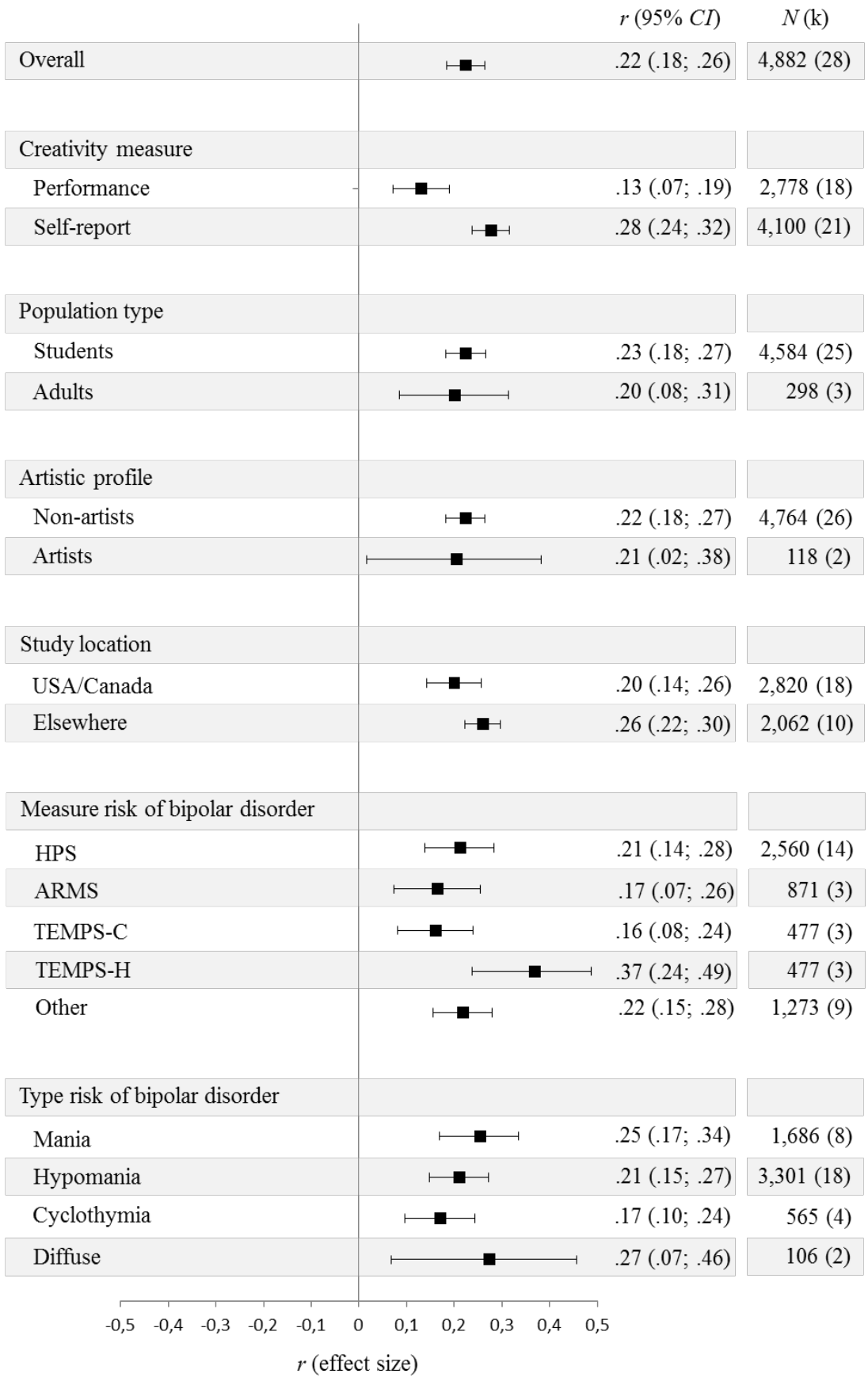
Fig. 2 Meta-analytic findings for the relation between risk of bipolar disorder and creativity.

Figure 1


r (95% CI)
N (k)
Overall
-.06 (-.09; -.03)
7,391 (39)
Creativity measure
Performance
-.04 (-.07; -.01)
5,631 (30)
Self-report
-.07 (-.13; -.02)
3,238 (17)
Population type
Children
-.18 (-.36; .01)
118 (2)
Students
-.05 (-.08; -.02)
4,577 (28)
Adults
-.02 (-.13; .10)
1,111 (4)
Seniors
-.14 (-.19; -.09)
1,585 (5)
Artistic profile
Non-artists
-.07 (-.10; -.04)
7,205 (36)
Artists
.10 (-.06; .26)
186 (3)
Study location
USA/Canada
-.05 (-.10; -.00)
2,543 (18)
Elsewhere
-.07 (-.11; -.03)
4,848 (21)
Measure depressive mood
BDI
-.05 (-.11; .00)
2,556 (9)
CES-D
-.06 (-.13; .01)
1,937 (8)
GDS
-.10 (-.18; -.02)
597 (4)
Zung
-.03 (-.15; .10)
337 (5)
DACL
-.08 (-.20; .04)
285 (4)
TEMPS-D
-.05 (-.12; .03)
447 (3)
Other
-.05 (-.13; .02)
1,598 (11)
-0,5 -0,4 -0,3 -0,2 -0,1 0 0,1 0,2 0,3 0,4 0,5
r (effect size)

Note. *CI* = Confidence Interval; k = number of studies included in the meta-analysis. BDI=Beck's Depression Inventory, CES-D= Center for Epidemiological Studies Depression symptoms index, GDS=Geriatric Depression Scale, TEMPS-D = Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Dysthymia, DACL = Depression Adjective Check List, Zung = Zung Self-rating Depression Scale. A correlation estimate greater (smaller) than zero indicates that depressive mood is positively (negatively) associated with creativity.

Figure 2.


r (95% CI)
N (k)
Overall
.22 (.18; .26)
4,882 (28)
Creativity measure
Performance
.13 (.07; .19)
2,778 (18)
Self-report
.28 (.24; .32)
4,100 (21)
Population type
Students
.23 (.18; .27)
4,584 (25)
Adults
.20 (.08; .31)
298 (3)
Artistic profile
Non-artists
.22 (.18; .27)
4,764 (26)
Artists
.21 (.02; .38)
118 (2)
Study location
USA/Canada
.20 (.14; .26)
2,820 (18)
Elsewhere
.26 (.22; .30)
2,062 (10)
Measure risk of bipolar disorder
HPS
.21 (.14; .28)
2,560 (14)
ARMS
.17 (.07; .26)
871 (3)
TEMPS-C
.16 (.08; .24)
477 (3)
TEMPS-H
.37 (.24; .49)
477 (3)
Other
.22 (.15; .28)
1,273 (9)
Type risk of bipolar disorder
Mania
.25 (.17; .34)
1,686 (8)
Hypomania
.21 (.15; .27)
3,301 (18)
Cyclothymia
.17 (.10; .24)
565 (4)
Diffuse
.27 (.07; .46)
106 (2)
-0,5 -0,4 -0,3 -0,2 -0,1 0 0,1 0,2 0,3 0,4 0,5
r (effect size)

Note. *CI* = Confidence Interval; k = number of studies included in the meta-analysis. HPS=Hypomanic Personality Scale, ARMS=Altman Self-Rating Mania Scale, TEMPS-C= Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire – Cyclothymia, TEMPS-H= Temperament Evaluation of Memphis, Pisa, Paris and San Diego-Autoquestionnaire - Hyperthymia. A correlation estimate greater (smaller) than zero indicates that risk of bipolar disorder is positively (negatively) associated with creativity.