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# Vulnerability to Psychopathology and Creativity: The Role of Approach-Avoidance Motivation and Novelty Seeking

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Existing findings on the intriguing link between vulnerability to psychopathology and creativity are scattered and inconclusive. Here we report 3 studies (total  $N = 826$ ) that tested a 2-step solution to the possible relationship between vulnerability to psychopathology and creativity. First, we propose that inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) can be clustered and distinguished from another cluster of psychopathologies that are linked to the approach system (hypomania, positive schizotypy). Second, we propose that inclinations toward avoidance-related (approach-related) psychopathologies associate with reduced (increased) creativity. Consistent with our first step, confirmatory factor analyses showed that trait anxiety, depressive mood, and negative schizotypy load on an avoidance-based vulnerability factor, whereas hypomania and positive schizotypy load on an approach-based vulnerability factor. Partial support for the second step was obtained: Whereas avoidance-based vulnerability to psychopathology was not related to creativity, approach-based vulnerability was associated with increased creativity. Finally, results showed that approach rather than avoidance-based vulnerability to psychopathology positively predicts creativity because it associates with stronger approach sensitivity toward novelty. However, based on the cross-sectional nature of our research design no conclusions regarding causality can be drawn.

*Keywords:* psychopathology, creativity, mental disorder, motivation, personality

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Many people are intrigued by the possibility that Vincent van Gogh, Virginia Woolf, Ernest Hemingway, and Robert Schumann

were creative geniuses because of their proclivity toward schizophrenia and depressive, anxiety, and bipolar disorder. More generally, many of us wonder whether creativity is, at least to some extent, linked to a vulnerability to psychopathology. Indeed, this idea continues to attract attention in popular media, will always make for conversation at dinner parties, and it is one of the most extensively studied topics in creativity research (Abraham, 2014; Acar, Chen, & Cayirdag, 2018; Baas, Nijstad, Boot, & De Dreu, 2016; Boot, Nevicka, & Baas, 2017; Johnson et al., 2012; Kaufman, 2014; Kyaga et al., 2013, 2011; Simonton, 2014; Zabelina, Condon, & Beeman, 2014). Many studies have correlated creativity indicators with the degree to which people experience symptoms of commonly occurring psychopathologies, including depressive, anxiety, psychotic, and bipolar disorders.

Recent meta-analyses synthesizing this research have revealed that the size and sign of the relation between vulnerability to psychopathology and creativity crucially depends on the specific psychopathology under investigation. Specifically, creativity is positively related to symptoms associated with bipolar disorder, such as hypomanic symptoms, and the positive symptoms associated with psychotic disorders, including hallucinations and delu-

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sions (Acar & Sen, 2013; Baas et al., 2016). Conversely, creativity is negatively related to vulnerability to depressive and anxiety disorders and the negative symptoms associated with schizophrenia, such as anhedonia (Acar & Sen, 2013; Baas et al., 2016; Byron & Khazanchi, 2011). These results led Baas et al. (2016) to propose that symptoms associated with psychopathologies may be differentially related to motivational approach and avoidance systems that are known to affect the cognitive and behavioral processes that support creativity. The approach system deals with appetitive motivation and approach behavior toward rewarding and novel stimuli (Carver, Sutton, & Scheier, 2000; Elliot, 2008) and chronic approach sensitivity, especially toward novel stimuli, is associated with increased creativity (Baas, De Dreu, & Nijstad, 2008, 2011; Chavez-Eakle, Lara, & Cruz-Fuentes, 2006; Friedman & Förster, 2010; Gocłowska, Ritter, Elliot, & Baas, 2018). The avoidance system deals with withdrawal motivation and avoidance behavior away from aversive stimuli and threatening circumstances (Carver et al., 2000; Elliot, 2008), and is associated with stronger rejection of creative experiences (Chavez-Eakle, Eakle, & Cruz-Fuentes, 2012; Neff, Rude, & Kirkpatrick, 2007) and reduced creativity (Baas et al., 2008; Friedman & Förster, 2010).

The evidence for the link between the type of vulnerability to psychopathology, motivational system, and creativity, however, is scattered and inconclusive. First, although research on the structure of psychopathology has sometimes supported the proposed clustering of approach- and avoidance-based inclinations toward psychopathologies (Markon, Krueger, & Watson, 2005), other structures with one, three, four, or five factors have also been observed (Markon et al., 2005; Widiger, 1998; see Kotov et al., 2017 for an overview). For instance, because many psychopathological symptoms are connected, it has been argued that the structure of psychopathology can best be explained by one general psychopathology factor (Caspi et al., 2014; Tackett et al., 2013). Moreover, although the link between the avoidance system and inclinations toward psychopathology, such as depressive mood and anxiety, has been well-established, the link between the approach system with hypomania and positive schizotypy is less clear: There is some overlap in the genes that predict both bipolar disorder and schizophrenia (International Schizophrenia Consortium, 2009), but the association between hypomania and positive schizotypy is inconsistent across studies (Horan, Blanchard, Clark, & Green, 2008; Hori et al., 2012; Watson, Stasik, Ellickson-Larew, & Stanton, 2015). Thus, it is desirable to test the assumed clustering of different types of psychopathologies along the approach-avoidance dimensions.

Second, although meta-analytic results show that anxiety, depressive moods, and negative schizotypy negatively relate to creativity, and hypomania and positive schizotypy positively, no primary evidence is available that shows that indeed avoidance or approach motivation underlies this connection. In other words, motivation remains untested as a mediator in the link between vulnerability to psychopathology and creativity. These two issues are disconcerting because of the high co-occurrence of symptoms of psychopathologies within one and the same individual (i.e., comorbidity; Borsboom & Cramer, 2013; Krueger, 1999). This obscures clear links between inclinations toward psychopathologies and creativity. For instance, depressive mood is often positively correlated with hypomania (Meads & Bentall, 2008), and this may not only muddy relationships with creativity, but also the

interpretation of such relationships. Addressing the possible effects of comorbidity in the relation between psychopathologies and creativity requires the assessment of multiple inclinations toward psychopathologies in one study, something few studies do.

Here we address these issues in three studies (total  $N = 826$ ). We used factor analysis and a latent variables approach (cf. Krueger & Markon, 2006; Lonigan, Phillips, & Hooe, 2003) to test whether inclinations toward psychopathologies that are linked to the approach system (e.g., hypomania, positive schizotypy) form a cluster and predict enhanced creativity, whereas inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, and negative schizotypy) form another cluster and predict reduced creativity. Finally, we directly test approach motivation toward novelty as a possible mediating variable that may explain the differential relationships between inclinations toward psychopathologies and creativity.

### Creativity and Biobehavioral Approach/Avoidance

An outcome is considered creative when it is novel and potentially useful (Runco & Jaeger, 2012). Creative outcomes can be generated through novel and appropriate combinations of existing knowledge. For example, novel experiences enrich existing knowledge, which in turn facilitates the generation of creative ideas (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; Carson, Peterson, & Higgins, 2005; Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012). Creativity also benefits from a facilitated access to distant semantic concepts in memory (Eysenck, 1993; Friedman & Förster, 2010) and the flexible switching between task approaches or by considering different problem perspectives (Carson, 2011; Nijstad, De Dreu, Rietzschel, & Baas, 2010; Sio & Ormerod, 2009).

Converging evidence from social neuroscience, and cognitive and social psychology shows that the activation of the approach (avoidance) system stimulates (stifles) flexible thinking and the engagement in creative experiences, and thus promotes (prevents) creativity (e.g., Ashby, Isen, & Turken, 1999; Baas et al., 2008, 2011, 2013; Boot, Baas, Van Gaal, Cools, & De Dreu, 2017; De Dreu, Nijstad, & Baas, 2011; Flaherty, 2005; Friedman & Förster, 2010; McCrae, 1987). The approach system regulates appetitive motivation and approach behavior toward rewarding and novel stimuli (Carver et al., 2000; De Fruyt, Van de Wiele, & Van Heeringen, 2000; Elliot, 2008). It associates with euphoric feelings when there is good progress toward, and successful attainment of, desired end states (Baas, De Dreu, & Nijstad, 2011; Idson, Liberman, & Higgins, 2000). The approach system can be temporarily activated with situational factors, such as the promise of rewards (Ashby et al., 1999) or operating tasks under a gain (as opposed to loss) frame (Roskes, De Dreu, & Nijstad, 2012). In addition, individuals vary in their sensitivity for the presence and prospect of positive and desired stimuli (approach sensitivity; Savine, Beck, Edwards, Chiew, & Braver, 2010), which can be measured by, for example, Carver and White's (1994) Behavioral Activation Scales. Chronic sensitivity of the approach system is reflected in stronger novelty seeking, extraversion, positive affectivity, openness to experience, and approach temperament (Baas et al., 2013; De Fruyt et al., 2000; Depue & Collins, 1999; Elliot & Thrash, 2002; Robinson, Moeller, & Ode, 2010). Individual differences in approach sensitivity and incidental manipulations of approach moti-

vation associate with enhanced flexibility, engagement in creative experiences, and creative performance (Ashby et al., 1999; Baas et al., 2011, 2013; De Dreu et al., 2011; Flaherty, 2005; Friedman & Förster, 2010; McCrae, 1987).

The opposite seems to apply to the avoidance system. The avoidance system regulates withdrawal motivation and avoidance behavior away from aversive and threatening stimuli (Elliot, 2008), and associates with agitated feelings and vigilance (Baas et al., 2011; Idson et al., 2000). As is the case for the approach system, the avoidance system can be temporarily activated with situational factors, such as the presence of threats (e.g., Cheng, Baas, & De Dreu, 2018; Elliot, 2008). In addition, individuals vary in their sensitivity for the presence and prospect of negative and harmful stimuli (avoidance sensitivity; Savine et al., 2010). Chronic sensitivity of the avoidance system is reflected in stronger neuroticism, negative affectivity, and avoidance temperament (Elliot & Thrash, 2002; Robinson et al., 2010), and can also be measured by Carver and White's (1994) Behavioral Inhibition Scale. Because it constrains the breadth of attention (Derryberry & Tucker, 1994; Friedman & Förster, 2010), and leads to reduced shifting among, and use of, perspectives and task approaches (De Dreu, Baas, & Nijstad, 2008; Roskes et al., 2012), avoidance-related traits and states are associated with reduced flexibility (Baas et al., 2008; Friedman & Förster, 2010). Because chronic avoidance sensitivity also associates with a reduced preference for things novel and creative, it generally predicts decreased creativity (Baas et al., 2016; Friedman & Förster, 2010).

### Approach/Avoidance and Vulnerability to Psychopathology

Importantly, creativity-enhancing approach sensitivity and creativity-reducing avoidance sensitivity differentially associate with specific sets of (inclinations toward) common psychopathologies. We focus our analyses on inclinations toward anxiety, depressive, bipolar, and psychotic disorders. These psychopathologies have been linked to creativity (Baas et al., 2016) and are also quite common (cf. Kessler et al., 2005; Krueger, 1999). Whereas the dysfunctional symptoms develop in a relatively small subset of the general population, many otherwise healthy individuals have tractable tendencies toward one or more of these psychopathologies (Brown & Barlow, 2009; Crow, 1990; Gore & Widiger, 2013; Nelson, Seal, Pantelis, & Phillips, 2013; Saulsman & Page, 2004). For example, whereas some people may have a weak inclination toward depression and experience few depressive symptoms, others may experience mild or severe symptoms of depression, including suicidal thoughts and feelings of sadness and guilt. As noted, there is reason to assume that symptoms associated with anxiety and depressive disorders as well as the negative symptoms of schizophrenia are all linked to increased sensitivity in the avoidance system. In contrast, symptoms associated with bipolar disorders and, to a lesser extent, the positive symptoms associated with psychotic disorders have been linked to increased sensitivity in the approach system.

### Anxiety and Depressive Mood

Anxiety refers to an unpleasant arousing state that is often accompanied by nervous behavior, rumination, and worries about

future events (Lang, Davis, & Öhman, 2000). It is grounded in the avoidance system. For instance, trait anxiety is related to high neuroticism, negative emotionality, and avoidance temperament (Degnan & Fox, 2007; Elliot, 2008; Klein, Kotov, & Bufferd, 2011; Kotov, Gamez, Schmidt, & Watson, 2010; Suzuki, Samuel, Pahlen, & Krueger, 2015). Likewise, depressive mood is an unpleasant state characterized by high levels of negative emotionality and low levels of energy and positive emotionality (Clark & Watson, 1991). Depressive mood is negatively related to positive emotionality and positively related to anxiety, neuroticism, negative emotionality, and avoidance temperament (Alloy et al., 2006; Beck, Steer, & Carbin, 1988; Klein et al., 2011; Kotov et al., 2010; Naragon-Gainey, 2010; Suzuki et al., 2015).

### Schizotypy

Schizotypy refers to four subtypes of cognitive, affective, and behavioral eccentricities that constitute the foundation of psychotic disorders (Laruelle, Kegeles, & Abi-Dargham, 2003; Larøi, De Fruyt, van Os, Aleman, & Van der Linden, 2005; Mason, Linney, & Claridge, 2005; Nelson et al., 2013). First, unusual experiences refer to the tendency to have aberrant perceptual and cognitive experiences, such as hallucinations and magical interpretation of events. Second, impulsive nonconformity refers to unstable behavior and mood with regard to rules and social conventions. Third, anhedonia refers to the tendency toward introverted, emotionally flat and socially withdrawn behavior, and the reduced ability to derive pleasure from social and physical stimulation. Fourth, cognitive disorganization is the tendency to have derailed and disorganized thoughts. Of these four subtypes, unusual experiences (also referred to as "positive" schizotypy) and anhedonia (also referred to as "negative" schizotypy) are most often linked to creativity (Acar & Sen, 2013).

Studies 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. Negative symptoms were positively related to neuroticism and social anxiety (Miller & Tal, 2007), and were either negatively related or unrelated to extraversion and openness to experience (Edmundson, Lynam, Miller, Gore, & Widiger, 2011; Kwapil, Barrantes-Vidal, & Silvia, 2008; Larøi et al., 2005; Miller & Tal, 2007; Vollema & Van den Bosch, 1995). On the other hand, positive symptoms were positively correlated with extraversion (Claridge et al., 1996; Muntaner, Garcia-Sevilla, Fernandez, & Torrubia, 1988; Zuckerman, Bone, Neary, Mangelsdorff, & Brustman, 1972), novelty seeking (Daneluzzo, Stratta, & Rossi, 2005), and openness to experience (Edmundson et al., 2011; Kwapil et al., 2008; Larøi et al., 2005; Miller & Tal, 2007; Suzuki et al., 2015). However, other studies challenge the link between positive schizotypy and approach sensitivity (Horan et al., 2008; Hori et al., 2012; Larøi et al., 2005; Watson et al., 2015). Thus, although preliminary evidence suggests that negative and positive schizotypy would differentially link with chronic avoidance and approach sensitivity, additional empirical support is desirable.

### Hypomania

Hypomania is characterized by pervasive elevated or irritable moods, and thoughts and behaviors that are consistent with such

moods (Johnson et al., 2012; Mansell & Pedley, 2008). In a hypomanic state, people are very energetic, outgoing and confident, and have a decreased need for sleep. Hypomania is characterized by positive emotionality (Gruber, Johnson, Oveis, & Keltner, 2008), reward sensitivity (Mason, O'Sullivan, Blackburn, Bentall, & El-Deredy, 2012), high openness to experience and extraversion (Meyer, 2002; Walsh, Royal, Brown, Barrantes-Vidal, & Kwapił, 2012), approach temperament (Alloy et al., 2006; Carver & Johnson, 2009), and novelty seeking (Carson, 2011; Furnham, Batey, Anand, & Manfield, 2008; Savitz, Van der Merwe, Stein, Solms, & Ramesar, 2008).

### Vulnerability to Psychopathology, Motivation, and Creativity: The Current Study

On the basis of the previously discussed associations, we expect that inclinations toward psychopathologies that are grounded in the avoidance system (anxiety, depressive mood, negative schizotypy) will negatively predict creativity, whereas inclinations toward psychopathologies that are grounded in the approach system (hypomania, positive schizotypy) will positively predict creativity. Indeed, although effect sizes are generally small, recent meta-analytic findings show that creativity is negatively related to anxiety ( $r = -.17$ ; Byron & Khazanchi, 2011), depressive mood ( $r = -.06$ ; Baas et al., 2016), and negative schizotypy ( $r = -.09$ ; Acar & Sen, 2013). Conversely, creativity is positively related to hypomania and mania ( $r = .22$ ; Baas et al., 2016), and positive schizotypy ( $r = .14$ ; Acar & Sen, 2013).

The proposition that psychopathologies and their inclinations are orchestrated by two motivational systems that alter creativity thus fits meta-analytic findings concerning the relation between inclinations toward specific psychopathologies and creativity. It also fits the findings linking common mental disorders and their precursors to approach and avoidance sensitivity. At the same time, however, the evidence is indirect and a full model-test is missing: No primary studies have directly measured the different inclinations toward psychopathology and have linked them, as a set, to creative functioning.

In three studies, we fill this void, and address four different issues. First, our analysis implies that different inclinations toward psychopathology will cluster into an approach-based (hypomania, positive schizotypy) and avoidance-based (anxiety, depressive mood, negative schizotypy) cluster, and testing this possibility empirically was our first goal. Second, our analysis implies that creativity will relate negatively to the avoidance cluster and positively to the approach cluster. Testing this overall prediction is our second goal. Third, we address effects of comorbidity (Borsboom & Cramer, 2013; Krueger, 1999). For example, depressive mood is often positively correlated with hypomania (Meads & Bentall, 2008), and this may not only obscure relationships with creative performance, but also the interpretation of (absence of such) relationships. Fourth, and finally, motivation as a potential mediating variable that explains the differential relationship between vulnerability to psychopathology and creativity has not been empirically addressed. Here, using mediated path models, we test novelty approach as a possible mediator of this relation (Study 3). This mediator will be introduced in more detail in Study 3's introduction.

### Study 1a and 1b

In Study 1a and 1b, we measured anxiety, depressive mood, hypomania, and schizotypy and had participants generate creative uses for a brick to assess creative performance (Study 1a) or report creative achievements in different domains (Study 1b). With exploratory and confirmatory factor analyses and model testing, we tested the prediction that inclinations toward psychopathologies that are linked to the approach system (e.g., hypomania, positive schizotypy) would form an approach cluster and positively associate with creativity, whereas inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) would form an avoidance cluster and negatively associate with creativity.

### Method

**Design, participants, and procedure.** In Study 1a, 147 undergraduate students (68% female) with a mean age of 21.73 years ( $SD = 2.66$ ) participated for money or partial fulfillment of a course requirement. On the basis of earlier work (Baas et al., 2016), we expected to obtain a small to medium effect size. Using the G\*Power software (Faul, Erdfelder, Lang, & Buchner, 2007), we calculated that to obtain this effect, would require at least 159 participants (at power of at least .80,  $\alpha = .05$ ). Originally, 161 students participated. However, for 13 of these cases data regarding participants' inclination toward psychopathologies were not recorded due to a programming error. These participants were excluded from analyses. In addition, one participant was identified as an outlier in the regression line between independent and dependent variables ( $>3 SD$ ) and was excluded from further analyses. The study was conducted in the laboratory where the hypomania, schizotypy, trait anxiety, and depressive mood scales, and creativity task were administered. Participants were seated in individual cubicles behind a personal computer, which displayed all materials and recorded all responses.

In Study 1b, 419 undergraduate students (68% female) with a mean age of 20.15 years ( $SD = 2.61$ ) participated for partial fulfillment of a course requirement. Again, we expected to obtain small to medium effect sizes. Using the G\*Power software (Faul et al., 2007), we calculated that to obtain this effect, would require at least 159 participants (at power of at least .80,  $\alpha = .05$ ). We oversampled because we anticipated that some participants would not complete all questionnaires that were administered across several weeks in different sessions (also see Study 2 and 3). This study was part of several mass testing sessions, with the scales measuring vulnerability to psychopathology and creative achievements administered weeks apart in different sessions. Participants were seated in large lecture halls behind a personal computer, which displayed all materials and recorded all responses. Experimenters supervised testing sessions in which participants were not allowed to talk and were required to work individually, at their own pace, and without consulting others. Because variables were measured across several weeks in different sessions, in a number of cases participants did not complete all questionnaires. When data from the three testing sessions were combined, 10 cases were missing for creative achievements, seven for schizotypy and hypomania, nine for depressive mood, and 116 for trait anxiety. Trait anxiety was among the final measures of the testing sessions. This may explain the relatively large drop-out of participants. The

resulting dataset consisted of 290 participants (68% female) with a mean age of 19.84 years ( $SD = 2.27$ ). Both studies had ethics approval, participants signed informed-consent forms, and received a debriefing upon completion of the studies.

#### Vulnerability to psychopathology.

**Schizotypy.** Schizotypal personality traits were measured with the shortened Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al., 2005). Participants indicated whether a statement is applicable to them (0 = *no*; 1 = *yes*). The O-LIFE contains four subscales. The unusual experiences scale (“positive schizotypy”) contains 12 items describing perceptual aberrations, magical thinking, and hallucinations; a sample item is “Are your thoughts sometimes so strong that you can almost hear them?” Reliability was acceptable (Study 1a:  $\alpha = .70$ ,  $M = 3.59$ ,  $SD = 2.53$ , range: 0 to 11; Study 1b:  $\alpha = .70$ ,  $M = 3.00$ ,  $SD = 2.31$ , range: 0 to 11). The introverted anhedonia scale (“negative schizotypy”) contains 10 items that describe a lack of enjoyment from social and physical sources of pleasure, as well as avoidance of intimacy; a sample item is “Are there very few things that you have ever enjoyed doing?” The reliability was substandard (Study 1a:  $\alpha = .52$  after the exclusion of 1 item that contributed negatively to reliability,  $M = 1.43$ ,  $SD = 1.48$ , range: 0 to 6; Study 1b:  $\alpha = .50$  after the exclusion of 1 item that contributed negatively to reliability,  $M = 1.80$ ,  $SD = 1.19$ , range: 0 to 8). The impulsive nonconformity scale (10 items; e.g., “Do you at times have an urge to do something harmful or shocking?”) and the cognitive disorganization scale (11 items; e.g., “Are you easily confused if too much happens at the same time?”) were also measured but not analyzed.

**Hypomania.** Hypomania was assessed with the 20-item hypomanic personality scale (Meads & Bentall, 2008). Participants indicated whether a statement was applicable to them (0 = *not true*; 1 = *true*). Sample items are “I am considered to be a kind of ‘hyper’ person,” “In unfamiliar surroundings I am often so assertive and sociable that I surprise myself,” and “I am usually in an average sort of mood, not too high and not too low” (reversed). Reliability was satisfactory (Study 1a:  $\alpha = .78$ ,  $M = 7.95$ ,  $SD = 4.13$ , range: 0 to 18; Study 1b:  $\alpha = .78$ ,  $M = 6.93$ ,  $SD = 3.92$ , range: 0 to 18).

**Depressive mood.** Participants completed the 21-item Beck Depression Inventory (BDI) that measures cognitive and vegetative symptoms of depression (Beck et al., 1988). Individuals were asked to report the extent to which they have been experiencing symptoms (e.g., sadness, guilt, suicidal thoughts) in the past week (0 = *never* to 3 = *always*). Reliability was good (Study 1a:  $\alpha = .86$ ,  $M = 7.01$ ,  $SD = 6.41$ , range: 0 to 31; Study 1b:  $\alpha = .83$ ,  $M = 6.27$ ,  $SD = 5.43$ , range: 0 to 33).

**Trait anxiety.** Trait anxiety was measured using the Spielberger Trait Anxiety Inventory (STAI; Spielberger, 1983). This scale consisted of 20 items assessed on a 4-point Likert scale (1 = *never* to 7 = *always* in Study 1a; 1 = *never* to 4 = *always* in Study 1b). Sample items are “I worry too much over something that really doesn’t matter” and “I am a steady person” (reverse coded). Higher scores indicate greater trait anxiety. Reliability was excellent (Study 1a:  $\alpha = .94$ ,  $M = 3.17$ ,  $SD = 1.00$ , range: 1.20 to 6.40; Study 1b:  $\alpha = .93$ ,  $M = 1.98$ ,  $SD = 0.49$ , range: 1.00 to 3.60).

#### Creative outcomes.

**Creative ideation (Study 1a).** During 3 min, participants keyed in as many creative ways to use a brick as possible (Baas et

al., 2011; Guilford, 1967). In accordance with previous work on creative ideation, ideas were scored for fluency, flexibility, originality, and infrequency (Baas et al., 2008, 2011; Guilford, 1967; Torrance, 1966). One trained and independent coder counted the number of nonredundant ideas generated per participant (henceforth fluency). The same coder assigned each idea a semantic category (examples of categories are: “to build something,” “to play with,” “to hurt someone”). The number of categories per participant was our measure of conceptual flexibility (Baas et al., 2011; Guilford, 1967; Torrance, 1966). A second coder rated 120 ideas to obtain an interrater reliability assessment. Interrater reliability was excellent (Cohen’s  $K = .90$ ,  $p < .001$ ).

In addition, ideas were rated for originality (1 = *not original at all*, to 5 = *very original*). A second coder rated 120 ideas for each topic to get reliability assessments. Interrater agreement was excellent ( $ICC = .81$ ,  $p < .001$ ). We averaged originality ratings across all ideas an individual generated to correct for the number of ideas someone generated. To validate and triangulate this measure of originality we also derived a measure of infrequency by assessing how often ideas were mentioned by other participants in this study (Baas, Nevicka, & Ten Velden, 2014; De Dreu et al., 2014; Plucker, Qian, & Wang, 2011). We assigned a percentage score to each idea (e.g., if an idea was mentioned by 4% of the participants, it received percentage score 4; if it was mentioned by 71%, it received a score of 71)—the higher the number assigned to an idea, the more frequent (i.e., less original) it is. Therefore, we subtracted percentage scores from 100 to get infrequency scores—the higher the number assigned to an idea, the less frequent (i.e., more original) it is. Finally, we calculated the mean infrequency score per participant as a second score for originality.

Finally, to reduce the number of statistical tests (and thus capitalization on chance), fluency, flexibility, originality, and infrequency indicators for each topic were z-transformed and averaged in a reliable composite index of creative ideation for the correlational analyses ( $\alpha = .81$ ;  $M = 0.00$ ,  $SD = 0.80$ , range:  $-2.10$  to  $2.24$ ). For the interested reader, correlations for fluency, flexibility, originality, and infrequency, for this and following studies, can be found in the [online supplemental materials](#). For our path analysis, creative ideation was modeled as a latent factor of divergent ideation (fluency and flexibility,  $r = .69$ ,  $p < .001$ ) and original ideation (originality and infrequency,  $r = .66$ ,  $p < .001$ ; also see below). This model produced a better fit than any other clustering of the four creative ideation indicators.

**Creative achievements (Study 1b).** Creative achievements were measured with the Creative Achievement Questionnaire (Carson et al., 2005), a self-report assessment of recognized creative achievements in 10 domains (e.g., visual arts, sciences, music) with good test–retest reliability. For each domain, eight rank-ordered statements are presented ranging from 0 (*I have no training or recognized talent in this area*) to 7 (*I have won a national prize in this field*) and participants mark which statement applies to them. Rank scores of marked statements for each domain are summed together and log-transformed to yield a creative achievement score ( $M = 1.93$ ,  $SD = 0.77$ , range: 0.00 to 4.26; Silvia et al., 2012).

**Results**

**Descriptive statistics.** Table 1 shows the zero-order correlations for all study variables. Positive schizotypy and hypomania were associated with increased creative ideation (Study 1a) and creative achievements (Study 1b). Both studies also showed mainly positive correlations among the different inclinations toward psychopathology, suggesting substantial comorbidity.

**Factor structure of vulnerability to psychopathology.** We first conducted a principal component analysis with varimax rotation to examine how participants' schizotypy, hypomania, depression, and trait anxiety scores would cluster. We included the z-transformed ratings on the positive and negative schizotypy subscales, hypomania, BDI, and STAI scales. In both studies, we obtained a two-factor solution, explaining a total of 74.38% of the variance in Study 1a and 68.57% of the variance in Study 1b (see Table 2). The first factor groups inclinations toward avoidance-related psychopathology (negative schizotypy, depression, and trait anxiety). The second factor groups inclinations toward approach-related psychopathology (positive schizotypy and hypomania). Although not reported in the article, the same principal component analyses in subsequent studies produced identical two-factor solutions.

We subsequently conducted confirmatory factor analyses using AMOS 17.x (Arbuckle, 2003). Because of the high ratio of indicators ( $k = 82$ ) to the number of factors ( $l = 5$ ) and sample size ( $N = 147$  in Study 1a;  $N = 290$  in Study 1b), we followed the practice to parcel items belonging to the same factor and test measurement models with the resulting item-parcels. This procedure leads to a more accurate fit of the measurement models when the number of indicators per factor is high and the sample size is relatively small (Hall, Snell, & Foust, 1999). Before parceling we scrutinized our items on content and with exploratory factor analyses in order to minimize possible parceling bias and create smaller, more unidimensional subscales (Hall et al., 1999; Little, Cunningham, Shahar, & Widaman, 2002). For trait anxiety (depressive mood), we established four (three) parcels by combining the original items per construct into four (three) groups of items, using the averages of each item-group as the measured indicators of the respective factor (cf. Hall et al., 1999). Following a similar

Table 2  
Factor Solution and Loadings From Principal Component Analyses for Study 1a and 1b

Risk of psychopathology	Factor I	Factor II
Study 1a		
Trait anxiety	.83	.30
Depressive mood	.81	.34
Hypomania	.02	.87
Positive schizotypy	.21	.84
Negative schizotypy	.79	-.18
Eigenvalue (% Variance)	2.02 (40.35)	1.70 (34.03)
Study 1b		
Trait anxiety	.73	.34
Depressive mood	.77	.32
Hypomania	.04	.88
Positive schizotypy	.24	.84
Negative schizotypy	.73	-.11
Eigenvalue (% Variance)	1.71 (34.28)	1.71 (34.29)

Note. Numbers are factor loadings.

procedure, we established two parcels per construct for hypomania, negative schizotypy, and positive schizotypy.

We first tested our measurement model in which the parcels that represented the different inclinations toward psychopathology were each defined as a separate factor (five-factor model, Model 1 in Table 3 and 4). All factors were defined to covary and error terms were not allowed to covary. To test how well this model and following models fitted the data, we used the  $\chi^2/df$  ratio, which should be as low as possible and preferably below 3 (Byrne, 1998). Model fit is further indicated by a root mean square error of approximation (RMSEA) of at most .10 and by a normed fit index (NFI), an incremental fit index (IFI), a Tucker-Lewis index (TLI), and a comparative fit index (CFI), all of which should be at least .90 (Byrne, 1998; MacCallum, Browne, & Sugawara, 1996). Models were compared using the  $\chi^2$  difference test. We considered models with CFI values < .90 and RMSEA values  $\geq$  .10 as deficient, models with CFI  $\geq$  .90 to .95 and RMSEA > .06 and < .10 as acceptable, and models with CFI  $\geq$  .95 and RMSEA < .06 as good (Hu & Bentler, 1999; Mathieu & Taylor, 2006).

We tested our measurement model against a model in which parcels representing the inclinations toward psychopathology would load on one factor (common factor model, Model 2 in Table 3 and 4). The five-factor model showed an acceptable fit to the data and a better fit than the common factor model for both Study 1a (Model 1 vs. 2, Table 3) and Study 1b (Model 1 vs. 2, Table 4). These findings support the distinct nature of the variables we assessed.

To test our prediction that hypomania and positive schizotypy would form an approach cluster, whereas anxiety, depressive mood, and negative schizotypy would form an avoidance cluster, we tested the fit of a latent approach-avoidance model (Model 3, Table 3 and 4). This model builds on the five-factor model by adding two latent higher-order factors, in which avoidance-based vulnerability to psychopathology comprised of trait anxiety, depressive mood, and negative schizotypy and approach-based vulnerability to psychopathology comprised of hypomania and positive schizotypy. However, all (inclinations toward) psychopathologies are positively correlated (Borsboom

Table 1  
Correlations Among Study Variables for Study 1a and 1b

Study variable	1	2	3	4	5
Study 1a					
1. Creative ideation					
2. Depressive mood	.09				
3. Trait anxiety	.10	.74**			
4. Negative schizotypy	-.09	.40**	.44**		
5. Positive schizotypy	.22**	.40**	.35**	.08	
6. Hypomania	.19*	.25**	.25**	-.01	.55**
Study 1b					
1. Creative achievements					
2. Depressive mood	.06				
3. Trait anxiety	.08	.59**			
4. Negative schizotypy	-.01	.30**	.26**		
5. Positive schizotypy	.25**	.39**	.39**	.15*	
6. Hypomania	.23**	.25**	.27**	.10	.59**

\*  $p < .05$ . \*\*  $p < .01$ .

Table 3  
Model Testing for Study 1a (N = 147)

Model	$\chi^2$	df	p	$\chi^2/df$	NFI	IFI	TLI	CFI	RMSEA	Model comparison	$\Delta\chi^2$	$\Delta df$	p
1. Five-factor model	90.72	55	.002	1.65	.93	.97	.96	.97	.067				
2. Common factor model	300.19	65	<.001	4.62	.75	.79	.75	.79	.157	2 vs. 1	209.47	10	<.001
3. Approach-avoidance model	101.72	59	<.001	1.72	.92	.96	.95	.96	.070	3 vs. 1	11.00	4	.027
4. Common vulnerability model	133.81	60	<.001	2.23	.89	.94	.92	.93	.092	4 vs. 3	32.09	1	<.001
5. Hypothesized path model	10.26	11	.507	.93	.96	1.00	1.01	1.00	.000				

& Cramer, 2013; Krueger, 1999). To rule out the alternative possibility that all inclinations toward psychopathologies load on a common vulnerability to psychopathology factor, we compared the latent approach-avoidance model with a competing common vulnerability model (Model 4, Table 3 and 4). The latter model builds on the five-factor model by adding one latent higher-order factor, in which a common vulnerability to psychopathology factor is comprised of trait anxiety, depressive mood, hypomania, and positive and negative schizotypy. The latent approach-avoidance model showed an acceptable fit to the data and fitted the data significantly better than the common vulnerability model for both Study 1a (Model 3 vs. 4, Table 3) and Study 1b (Model 3 vs. 4, Table 4). In sum, results support the accuracy of modeling two higher-order latent factors, with avoidance-based vulnerability to psychopathology comprised of trait anxiety, depressive mood, and negative schizotypy and approach-based vulnerability to psychopathology comprised of hypomania and positive schizotypy. These results will inform the testing of our path model regarding creative ideation (Study 1a) and creative achievements (Study 1b).

**Prediction of creative ideation (Study 1a).** Our hypothesized path model (Table 3, Model 5) linked the two latent factors of approach-based and avoidance-based vulnerability to creative ideation. In this model, creative ideation was modeled as a latent factor of divergent ideation (fluency and flexibility) and original ideation (originality and infrequency). The approach-based and avoidance-based vulnerability factors were defined to covary. Table 3 shows that the hypothesized model had a good fit to the data. As shown in Figure 1, avoidance-based and approach-based vulnerability to psychopathology covaried (C.R. = 3.56,  $p < .001$ ). Consistent with predictions, approach-based vulnerability to psychopathology positively predicted creative ideation (C.R. = 2.10,  $p = .035$ ). However, avoidance-based vulnerability to psychopathology did not predict creative ideation (C.R. =  $-0.31$ ,  $p = .757$ ).

**Prediction of creative achievements (Study 1b).** Our hypothesized path model (Table 4, Model 5) linked the two latent factors of approach-based and avoidance-based vulnerability to creative achievements. In this model, creative achievements were

modeled as a latent factor of two creative achievement scores. Again, both vulnerability factors were defined to covary. Table 4 shows that the hypothesized model had a good fit to the data, and Figure 2 shows that avoidance-based and approach-based vulnerability to psychopathology covaried (C.R. = 4.34,  $p < .001$ ). Consistent with predictions, approach-based vulnerability to psychopathology positively predicted creative achievements (C.R. = 2.75,  $p = .006$ ). However, avoidance-based vulnerability to psychopathology did not predict creative achievements (C.R. =  $-1.14$ ,  $p = .254$ ).

## Discussion of Study 1 and Introduction to Study 2

The analyses confirm that trait anxiety, depressive mood, and negative schizotypy represent avoidance-based vulnerability to psychopathology, whereas approach-based vulnerability to psychopathology is comprised of hypomania and positive schizotypy. This is consistent with work that shows that inclinations toward psychopathologies that are associated with the same motivational system tend to covary more strongly than those that are associated with a different motivational system. For example, strong covariance estimates ranging between 31% and 61% have been observed for depressive mood and trait anxiety (Bjelland, Dahl, Haug, & Neckelmann, 2002; Hollon & Kendall, 1980), and hypomania strongly covaries with positive schizotypy (32%; Applegate, El-Dereby, & Bentall, 2009). Conversely, covariance estimates of hypomanic symptoms are considerably smaller with negative schizotypy (0%; Applegate et al., 2009), depressive mood (2%; Meyer, 2002; 7%; Walsh et al., 2012), and anxiety (1%; Preti et al., 2015), and of positive schizotypy with depressive mood (9%; Lee, Cogle, & Telch, 2005) and anxiety (7%; Lee et al., 2005). Our findings extend this work by measuring all five inclinations in one study and testing their interrelationships more formally.

Yet, the latent factors for approach-based and avoidance-based vulnerability to psychopathology were positively correlated in both Study 1a and 1b, which may appear strange at first sight. First, however, it should be kept in mind that the approach and avoidance systems are independent, and that a strong approach

Table 4  
Model Testing for Study 1b (N = 290)

Model	$\chi^2$	df	p	$\chi^2/df$	NFI	IFI	TLI	CFI	RMSEA	comparison	$\Delta\chi^2$	$\Delta df$	p
1. Five-factor model	75.55	55	.034	1.37	.96	.99	.98	.99	.036				
2. Common factor model	523.10	65	<.001	8.05	.72	.75	.70	.75	.156	2 vs. 1	447.55	10	<.001
3. Approach-avoidance model	77.01	59	.058	1.31	.96	.99	.99	.99	.032	3 vs. 1	1.46	4	.834
4. Common vulnerability model	144.45	60	<.001	2.41	.93	.96	.94	.95	.070	4 vs. 3	67.44	1	<.001
5. Hypothesized path model	8.10	11	.704	.74	.98	1.01	1.01	1.00	.000				



Study 2

Method

**Design, participants, and procedure.** In total, 339 undergraduate students (70% female) with a mean age of 20.12 years ( $SD = 2.77$ ) participated for partial fulfillment of a course requirement. Identical to Study 1b's procedure, this cross-sectional study was conducted as part of several mass testing sessions, with the vulnerability to psychopathology scales and creativity instruments administered weeks apart in different sessions. Because variables were measured across several weeks in different sessions, in a number of cases participants did not complete all questionnaires. When data from the four testing sessions were combined, 75 cases were missing for creativity indicators, 60 for schizotypy and hypomania, 52 for depressive mood, and 27 for trait anxiety. The resulting dataset with complete data consisted of 204 participants (73% female) with a mean age of 19.74 years ( $SD = 2.35$ ). The study had ethics approval, participants signed informed-consent forms, and received a debriefing upon completion of the study.

**Vulnerability to psychopathology.** Schizotypal personality traits, hypomania, depressive mood, and trait anxiety were measured as before (see Study 1). Scores on the items of the unusual experiences scale were summed to form an index of positive schizotypy ( $\alpha = .60, M = 3.75, SD = 2.19$ , range: 0 to 11). Scores on the items of the introverted anhedonia scale were summed to form an index of negative schizotypy ( $\alpha = .59, M = 1.36, SD = 1.55$ , range: 0 to 6). Reliability of the scales that measured hypomania ( $\alpha = .76, M = 6.99, SD = 3.79$ , range: 0 to 17), depressive mood ( $\alpha = .86, M = 7.48, SD = 6.37$ , range: 0 to 34), and trait anxiety ( $\alpha = .93, M = 2.04, SD = 0.51$ , range: 1.15 to 3.30) were sufficient.

**Creative behavior and outcomes.**

**Creative behavior.** Self-rated creative behavior was assessed with the Janssen Creativity Scale (Janssen, 2001). Participants rated on eight items how often they engaged in eight general

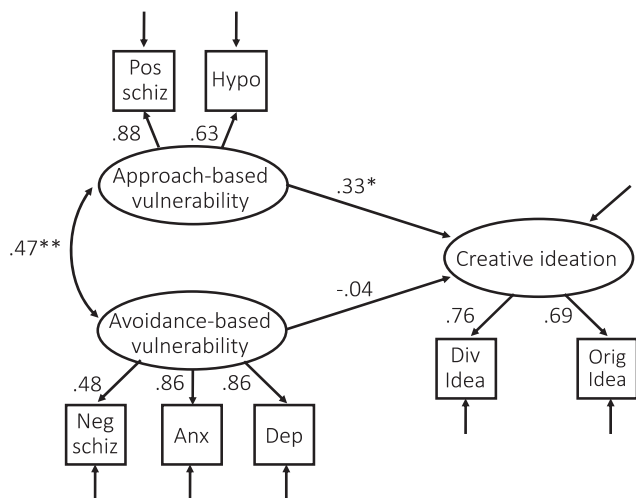


Figure 1. Hypothesized path model that links approach versus avoidance-based vulnerability to psychopathology with creative ideation (Study 1A). Div Idea = Divergent ideation (mean of flexibility and fluency); Orig Idea = Original ideation (mean of originality and infrequency). Displayed are standardized weights. \*  $p < .05$ . \*\*  $p < .01$ .

orientation does not exclude a strong avoidance orientation. For example, Carver and White (1994) report low correlations between their Behavioral Activation (approach) and Behavioral Inhibition Scales. Second, it is likely that comorbidity between (approach and avoidance-related) types of psychopathology develops as a particular symptom unfolds. For instance, when someone has (mild) hallucinations and his or her environment does not share this personal reality, someone may feel alienated and misunderstood, which opens the way for more depressive and anxious feelings and the involvement of the avoidance system.

Our findings also show that approach but not avoidance-based vulnerability to psychopathology positively predicts creative ideation (Study 1a) and creative achievements (Study 1b). It is important to note that in these relations the comorbidity between different types of psychopathology is taken into account. Thus, approach-related psychopathology uniquely predicts creativity over and above the effects of avoidance-related psychopathology whereas the reverse does not hold. Empirically observed relations between avoidance-related psychopathology and creativity in this data therefore are spurious, and are caused by comorbidity with approach-related forms of psychopathology.

One limitation of these studies, however, is that measures of ideation and creative achievements are but one way to gauge people's capacity for creativity. Other often used measures of creativity are based on people's engagement in general creative behaviors. Study 2's aim was to replicate findings of Study 1a and 1b with a more encompassing measurement of creativity, including creative achievements, and engagement in general creative behaviors. Another limitation of Study 1a is that creative ideation was established with an alternative uses task in which respondents had to generate possible uses for only one object, a brick. More objects are desirable to improve the reliability of the assessment of creative ideation (Kaufman, Plucker, & Baer, 2008). Therefore, in Study 2, respondents generated alternative uses for two objects: a tin can and a rope (Baas et al., 2014).

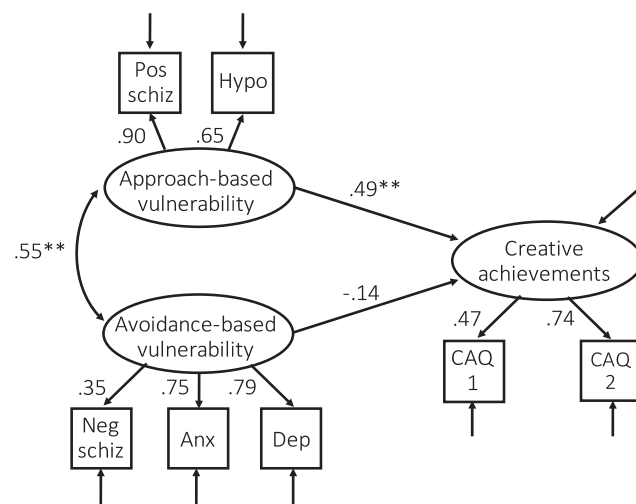


Figure 2. Hypothesized path model that links approach versus avoidance-based vulnerability to psychopathology with creative achievement (Study 1B). CAQ = Creative achievements. Displayed are standardized weights. \*  $p < .05$ . \*\*  $p < .01$ .

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creative behaviors described in the items; for example, "I often come up with original solutions for problems" (1 = *never* to 7 = *always*). Item scores for each respondent were averaged to form a creative behavior score ( $\alpha = .89$ ;  $M = 4.28$ ,  $SD = 0.99$ , range: 1.00 to 7.00).

**Creative achievements.** Creative achievements were measured with the Creative Achievement Questionnaire (Carson et al., 2005, see Study 1b;  $M = 2.00$ ,  $SD = 0.80$ , range: 0.00 to 3.74).

**Creative ideation.** Participants keyed in as many creative ways to use a tin can and a rope as possible (Baas et al., 2014; Guilford, 1967). They were given 2 min for each topic. Ideas were then scored for fluency, flexibility, originality, and infrequency (see Study 1a). For each topic, one trained and independent coder counted the number of nonredundant ideas generated per participant (fluency). Furthermore, ideas were coded in semantic categories that cover the rope topic (examples of categories are: "to attach something," "to play with," "to hurt someone") and tin can topic (examples of categories are: "as a container," "as a musical instrument," "as a weapon"). The number of categories per participant was our measure of flexibility (Baas et al., 2011; Guilford, 1967; Torrance, 1966). A second coder rated 120 ideas to obtain an interrater reliability assessment. Interrater reliability was excellent (Cohen's  $K_{tin\ can} = .80$ ,  $p < .001$ ; Cohen's  $K_{rope} = .93$ ,  $p < .001$ ).

In addition, ideas for each topic were rated for originality (1 = *not original at all* to 5 = *very original*). A second coder rated 120 ideas for each topic to get reliability assessments. Interrater agreement for both topics was excellent ( $ICC_{rope} = .86$ ,  $p < .001$ ;  $ICC_{tin\ can} = .90$ ,  $p < .001$ ). For each topic, we averaged originality ratings across all ideas an individual generated to correct for possible differences in fluency. As before, to validate and triangulate this measure of originality we also derived a measure of infrequency by assessing how often ideas were mentioned by other participants in this study (see Study 1a).

Finally, fluency, flexibility, originality, and infrequency indicators for each topic were  $z$ -transformed and averaged in a reliable composite index of creative ideation ( $\alpha = .78$ ).

## Results

**Descriptive statistics.** Table 5 shows zero-order correlations for all study variables. The creativity indicators were reliably correlated, providing evidence of convergent validity. Positive schizotypy and hypomania were associated with increased creative behavior and achievements. Finally, Table 5 shows mainly posi-

tive correlations among the different inclinations toward psychopathology.

**Factor structure of vulnerability to psychopathology.** Using the exact same procedure and modeling of Study 1, we conducted confirmatory factor analyses to compare our five-factor measurement model to a common factor model. Again, the five-factor model showed an acceptable fit to the data (Table 6, Model 1) and a better fit than the common factor model (Table 6, Model 2). These findings support the distinct nature of the scales we used. Subsequently, we tested the fit of our latent approach-avoidance model and compared it with a common vulnerability model. Table 6 shows that the latent approach-avoidance model showed an acceptable fit to the data (Model 3) and fitted the data significantly better than the common vulnerability model (Model 4). As was the case in Study 1, these results support the accuracy of modeling two higher-order latent factors, with avoidance-based vulnerability to psychopathology comprised of trait anxiety, depressive mood, and negative schizotypy and approach-based vulnerability to psychopathology comprised of hypomania and positive schizotypy. These results will inform the testing of our path model regarding creativity.

**Prediction of creativity.** In our predicted path model, we created a latent factor of creativity from the creative ideation index, creative achievement score, and self-rated creativity. The latent approach-based and avoidance-based vulnerability factors were defined to covary and to predict creativity. Table 6 shows that the model yielded an acceptable fit to the data. As can be seen in Figure 3, avoidance-based and approach-based vulnerability to psychopathology covaried ( $C.R. = 3.34$ ,  $p < .001$ ). Consistent with predictions, approach-based vulnerability to psychopathology positively predicted creativity ( $C.R. = 3.09$ ,  $p = .002$ ). Inconsistent with predictions, but consistent with the results described in Study 1, avoidance-based vulnerability to psychopathology did not predict creativity ( $C.R. = -1.77$ ,  $p = .076$ ).

## Discussion of Study 2 and Introduction to Study 3

Study 2's findings replicated those of Study 1 in showing that trait anxiety, depressive mood, and negative schizotypy represent avoidance-based vulnerability to psychopathology, whereas approach-based vulnerability to psychopathology is comprised of hypomania and positive schizotypy. As in Study 1a and 1b, approach and avoidance-based psychopathology were positively correlated, due to comorbidity among types of psychopathology

Table 5  
Correlations Among Study Variables for Study 2

Study variable	1	2	3	4	5	6	7
1. Creative ideation							
2. Creative behavior	.26**						
3. Creative achievements	.28**	.36**					
4. Depressive mood	-.01	-.05	.12				
5. Trait anxiety	-.03	-.05	.12	.65**			
6. Negative schizotypy	.10	-.14*	.08	.32**	.36**		
7. Positive schizotypy	.01	.15*	.16*	.27**	.38**	.16*	
8. Hypomania	.13	.28**	.28**	.18*	.28**	-.04	.51**

\*  $p < .05$ . \*\*  $p < .01$ .

Table 6  
Model Testing for Study 2 (N = 204)

Model	$\chi^2$	df	p	$\chi^2/df$	NFI	IFI	TLI	CFI	RMSEA	Model comparison	$\Delta\chi^2$	$\Delta df$	p
1. Five-factor model	110.13	55	<.001	2.00	.93	.96	.95	.96	.070				
2. Common factor model	464.61	65	<.001	7.15	.71	.74	.68	.73	.174	2 vs. 1	354.48	10	<.001
3. Approach-avoidance model	119.71	59	<.001	2.03	.92	.96	.95	.96	.071	3 vs. 1	9.58	4	.048
4. Common vulnerability model	150.54	60	<.001	2.51	.91	.94	.92	.94	.086	4 vs. 3	30.83	1	<.001
5. Hypothesized path model	36.05	17	.005	2.12	.89	.94	.90	.94	.074				

across different (approach and avoidance) clusters. Using a more encompassing measurement of creativity, our findings also show that whereas avoidance-based vulnerability to psychopathology is unrelated to creativity, approach-based vulnerability to psychopathology positively predicts creativity. Again, this seems to imply that relations between avoidance-related psychopathology and creativity do not hold when approach-related psychopathology is controlled for.

The assumption underlying our analysis is that certain types of psychopathology associate with creativity *because* they associate with a certain motivational orientation (i.e., approach or avoidance). However, evidence for this is so far indirect: We assume that the cluster of hypomania and positive schizotypy associates with a tendency toward approach, and that this is the reason why this cluster is positively related to creativity, but mediation of approach sensitivity in the relation between (different types of psychopathology) and creativity was not demonstrated. Likewise, we assume that trait anxiety, depressive mood, and negative schizotypy associate with an increased avoidance sensitivity, but we have not demonstrated this. However, given that the evidence for the relation between vulnerability toward avoidance-related psychopathology and creativity in Studies 1 and 2 was weak and nonsignificant, we decided to focus on approach sensitivity.

In Study 3, we therefore considered approach sensitivity as a potential mediator and focus specifically on chronic approach

sensitivity toward novel stimuli, or novelty seeking. Novelty seeking is the tendency to explore novel and unfamiliar stimuli and environments (Cloninger, Svrakic, & Przybeck, 1993; Costa, Tran, Turchi, & Averbek, 2014). Not only does this construct capture approach sensitivity, it has also been related to both psychopathology and indicators of creativity (Carson, 2011). For example, previous work has shown positive associations between hypomania and positive schizotypy with indicators of novelty seeking (e.g., Edmundson et al., 2011; Furnham et al., 2008; Kwapil et al., 2008; Savitz et al., 2008), whereas no or negative associations are obtained for depressive mood, negative schizotypy, and anxiety (e.g., Comeau, Stewart, & Loba, 2001; Farmer et al., 2003; Peirson & Heuchert, 2001). Novelty seeking, in turn, is associated with facilitated access to remote semantic concepts in memory (Eysenck, 1993; Friedman & Förster, 2010), flexible and divergent thinking (Chavez-Eakle et al., 2006), and engagement in creative experiences (McCrae, 1987; Roberti, 2004; Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009). Moreover, recent work shows that novelty seeking is the crucial aspect of openness to experience that explains why openness to experience is positively related to creativity (Gocłowska et al., 2018).

In Study 3, novelty seeking was captured by measuring the novelty seeking scales of the Personal Expansion Questionnaire (Gordon & Luo, 2011) and Adjective Checklist (Gough & Heilbrun, 1983). Trait anxiety, depressive mood, schizotypy, and hypomania were measured as before and creativity indicators were measured as was done in Study 2. We predicted that inclinations toward psychopathologies that are linked to the approach system (e.g., hypomania, positive schizotypy) would form an approach cluster that positively predicts novelty seeking as well as creativity, whereas inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) would form an avoidance cluster that negatively predicts novelty seeking as well as creativity. Finally, we predicted that variance in novelty seeking would account for the differential relationships between vulnerability to psychopathology and creativity.

Study 3

Method

**Design, participants, and procedure.** In total, 239 undergraduate students (63% female) with a mean age of 19.65 years (*SD* = 1.72) participated for partial fulfillment of a course requirement. Identical to Study 2's procedure, this cross-sectional study was conducted as part of several mass testing sessions, with the vulnerability to psychopathology scales, novelty seeking scales,

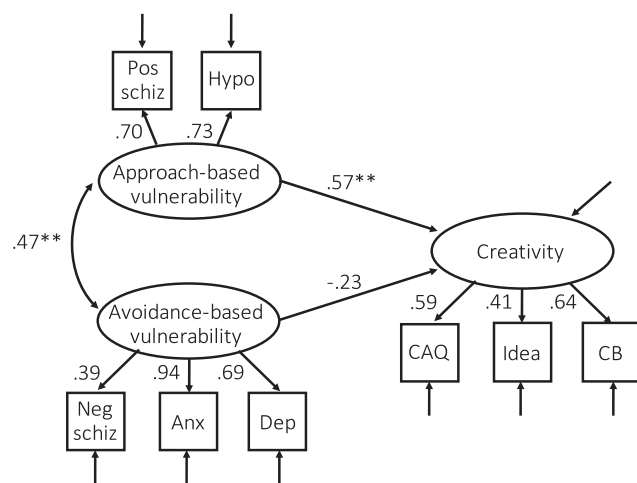


Figure 3. Hypothesized path model that links approach versus avoidance-based vulnerability to psychopathology with creativity (Study 2). CAQ = Creative achievements; Idea = Creative ideation composite; CB = Self-rated creative behavior. Displayed are standardized weights. \* *p* < .05. \*\* *p* < .01.

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and creativity instruments administered weeks apart in different sessions. When data from the four testing sessions were combined, 18 cases were missing for creativity indicators, 12 for hypomania and schizotypy, 10 for depressive mood, 46 for trait anxiety, and 11 for novelty seeking. The resulting dataset consisted of one hundred and 85 participants (65% female) with a mean age of 19.51 years ( $SD = 1.43$ ). The study had ethics approval, participants signed informed-consent forms, and received a debriefing upon completion of the study.<sup>1</sup>

**Vulnerability to psychopathology.** All inclinations toward psychopathology were measured as in Study 1 and 2. Scores on the items of the unusual experiences scale were summed to form an index of positive schizotypy ( $\alpha = .68$ ,  $M = 3.49$ ,  $SD = 2.45$ , range: 0 to 11), scores on the items of the introverted anhedonia scale were summed to form an index of negative schizotypy ( $\alpha = .56$ ,  $M = 1.17$ ,  $SD = 1.41$ , range: 0 to 8). Reliability for hypomania ( $\alpha = .75$ ,  $M = 7.45$ ,  $SD = 3.85$ , range: 0 to 19), depressive mood ( $\alpha = .87$ ,  $M = 6.13$ ,  $SD = 6.19$ , range: 0 to 47), and trait anxiety ( $\alpha = .93$ ,  $M = 1.97$ ,  $SD = 0.50$ , range: 1.05 to 3.90) were satisfactory.

**Novelty seeking scales.** Novelty seeking was measured with the novelty seeking subscales of the Personal Expansion Questionnaire (PEQ; Gordon & Luo, 2011) and Adjective Checklist (ACL; Gough & Heilbrun, 1983). The five novelty seeking items of the PEQ were scored on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). A sample item is “I place a lot of importance on experiencing new things.” Item scores for each individual were averaged to form a total novelty seeking score. Reliability was good (Cronbach’s alpha = .80,  $M = 3.51$ ,  $SD = 0.64$ , range: 1.20 to 5.00).

Novelty seeking was also measured with the 14-item change scale of the ACL (Gough & Heilbrun, 1983). Participants rated how well 14 adjectives (e.g., “adventurous,” “daring,” “having broad interests”) describe them (1 = not at all to 5 = very much). Reliability was good ( $\alpha = .81$ ,  $M = 36.06$ ,  $SD = 4.84$ , range: 14 to 47).

**Creative behavior and outcomes.** Creative behavior was assessed with the eight-item Janssen creativity scale ( $\alpha = .91$ ; see Study 2,  $M = 4.53$ ,  $SD = 1.00$ , range: 1.00 to 7.00). Creative achievements were measured with the Creative Achievement Questionnaire (Carson et al., 2005; see Study 1b,  $M = 1.91$ ,  $SD = 0.66$ , range: 0.00 to 3.64). Creative ideation was established with an alternative uses task with tin can and rope as topics (see Study 2). Using the exact same coding procedures, fluency, flexibility, originality, and infrequency indicators were derived for each topic. These were  $z$ -transformed and averaged in a reliable composite index of creative ideation ( $\alpha = .77$ ).

## Results

**Descriptive statistics.** Table 7 shows zero-order correlations for all study variables. The creativity indicators were reliably correlated, providing evidence of convergent validity. Positive schizotypy was associated with increased creative ideation, as indexed by our composite measure, whereas hypomania was associated with increased creative behavior and achievements. Table 7 also shows mainly positive correlations among the different inclinations toward psychopathology and that our creativity indicators positively correlated with the novelty seeking scales. Fi-

nally, hypomania was associated with increased novelty seeking, but positive schizotypy was not. The comorbidity of positive schizotypy with avoidance-based inclinations toward psychopathology may explain why the association between positive schizotypy and both novelty seeking scores were small and not significant. Indeed, when controlling for inclinations toward avoidance-related psychopathology, the prediction of chronic approach sensitivity toward novel stimuli by positive schizotypy improved (novelty seeking-PEQ:  $B = 0.04$ ,  $t(180) = 1.85$ ,  $p = .066$ ; novelty seeking-ACL:  $B = 0.52$ ,  $t(180) = 3.84$ ,  $p < .001$ ).

**Factor structure of vulnerability to psychopathology.** Using similar procedures and modeling of Study 1 and 2, we conducted confirmatory factor analyses to test our five-factor measurement model against a competing common-factor model. The five-factor measurement model (Table 8, Model 1) showed a good fit to the data and a better fit than the common factor model (Table 8, Model 2). These findings support the distinct nature of the scales we used. As before, we tested the fit of our predicted latent approach-avoidance model and tested this model against the common vulnerability to psychopathology model. The approach-avoidance two-factor model showed an acceptable fit to the data and fitted the data significantly better than the common vulnerability model (see Table 8, Models 3 vs. 4).

**Prediction of creativity.** In our predicted path model and identical to Study 2’s approach, the creative behavior, creative achievements, and creative ideation scores were modeled to represent the latent factor creativity. In addition, both novelty seeking scores (defined by the respective scale’s aggregated item scores) were assumed to represent the latent construct novelty seeking. Both approach-based and avoidance-based vulnerability factors were defined to covary and to predict creativity through novelty seeking. As can be seen in Table 8, the hypothesized model showed an acceptable fit to the data. As can be seen in Figure 4, avoidance-based and approach-based vulnerability to psychopathology covaried (C.R. = 3.42,  $p < .001$ ). Consistent with predictions, approach-based vulnerability to psychopathology positively predicted novelty seeking (C.R. = 5.39,  $p < .001$ ) and avoidance-based vulnerability to psychopathology negatively predicted novelty seeking (C.R. =  $-7.75$ ,  $p < .001$ ). Novelty seeking, in turn, positively predicted creativity (C.R. = 4.08,  $p < .001$ ). Indeed, the indirect effect of both approach-based vulnerability to psychopathology (95% CI [.32, .71]) and avoidance-based vulnerability to psychopathology (95% CI [ $-.74$ ,  $-.35$ ]) on creativity via novelty seeking was significant.

## General Discussion

To better understand the link between vulnerability to psychopathology and creativity, three studies were conducted to test the prediction that inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, and negative schizotypy) form a cluster and predict reduced creativity, whereas inclinations toward psychopathologies that are linked to

<sup>1</sup> The creativity data for Study 3 were part of another project on mindfulness and creativity and the creativity variables have previously been analyzed to determine the association between mindfulness and creativity (Baas et al., 2014; Study 2). In that past work, none of the data regarding vulnerability towards psychopathology were analyzed.

Table 7  
Correlations Among Study Variables for Study 3

Study variable	1	2	3	4	5	6	7	8.	9.
1. Creative ideation									
2. Creative behavior	.36**								
3. Creative achievements	.24**	.28**							
4. Depressive mood	-.09	-.17*	-.08						
5. Trait anxiety	-.07	-.12	.01	.61**					
6. Negative schizotypy	.02	-.03	-.01	.47**	.43**				
7. Positive schizotypy	.18**	.13	.13	.32**	.36**	.20**			
8. Hypomania	.13	.31**	.23**	.04	.24**	.05	.43**		
9. Novelty seeking-PEQ	.20**	.31**	.07	-.27**	-.32**	-.29**	-.01	.31**	
10. Novelty seeking-ACL	.22**	.41**	.24**	-.42**	-.41**	-.32**	.05	.38**	.56**

Note. PEQ = Personal Expansion Questionnaire; ACL = Adjective Checklist.  
\*  $p < .05$ . \*\*  $p < .01$ .

the approach system (hypomania, positive schizotypy) form another cluster and predict enhanced creativity. Using a latent variable approach, we confirmed that trait anxiety, depressive mood, and negative schizotypy represent avoidance-based vulnerability to psychopathology, whereas approach-based vulnerability to psychopathology is comprised of hypomania and positive schizotypy. Our studies also showed that, when approach and avoidance related psychopathology were simultaneously used to predict creativity, inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) have little or no effects on creativity, whereas inclinations toward psychopathologies that are linked to the approach system (hypomania, positive schizotypy) associated with increased creativity. Finally, we uncovered that approach rather than avoidance-based vulnerability to psychopathology positively predicts various indicators of creativity because it associates with stronger individual differences in novelty seeking. It should be noted, though, that this last finding should be interpreted with caution: Given the cross-sectional nature of our research design, no conclusions regarding causality are possible. In the remainder of this General Discussion, we review the evidence for our thesis that mental disorders and their inclinations are orchestrated by two fundamental motivational systems that influence creativity and highlight avenues for future research.

**Vulnerability to Psychopathology, Approach-Avoidance, and Creativity**

Previous work is much in line with our proposed clustering of approach- and avoidance-based inclinations toward psychopathologies. Anxiety and anxiety disorders strongly predict indicators of avoidance sensitivity (Degnan & Fox, 2007; Klein et al., 2011;

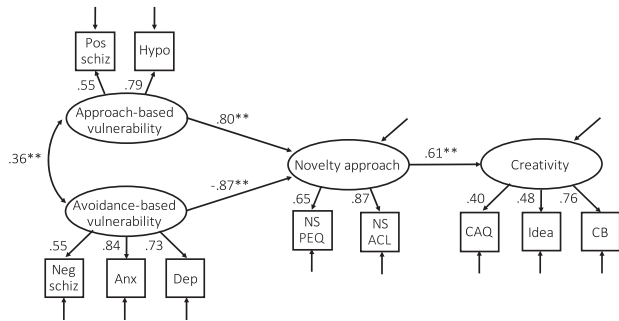
Kotov et al., 2010) and hypomania and bipolar disorders strongly predict indicators of approach sensitivity (Alloy et al., 2006; Carver & Johnson, 2009). However, the research linking sensitivity of the approach and avoidance system to depressive mood and schizotypy is less clear (Clark & Watson, 1991; Klein et al., 2011; Kotov et al., 2010; Miller & Tal, 2007). Moreover, although research on the structure of inclinations toward psychopathology has often yielded a two-factor solution (Markon et al., 2005), other factor solutions have also been proposed and established (Markon et al., 2005; Widiger, 1998). For instance, because more than half of the psychopathological symptoms are connected (Borsboom & Cramer, 2013), it has been argued that the structure of psychopathology can best be explained by one general psychopathology factor (Caspi et al., 2014; Tackett et al., 2013).

To provide a better test of our proposition that psychopathologies and their inclinations are orchestrated by two fundamental motivational systems, we assessed multiple inclinations toward psychopathologies in a single study. Using both exploratory and confirmatory factor analyses, we confirmed that trait anxiety, depressive mood, and negative schizotypy represent avoidance-based vulnerability to psychopathology, whereas approach-based vulnerability to psychopathology is comprised of hypomania and positive schizotypy. Study 3 furthermore showed that when controlling for inclinations toward avoidance-related psychopathology, inclinations toward approach-related psychopathology positively predicted chronic approach sensitivity toward novel stimuli.

Because approach and avoidance are known to differentially influence creativity and its underlying processes (Baas et al., 2008; Nijstad et al., 2010; Roskes et al., 2012), we predicted that inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) would be

Table 8  
Model Testing for Study 3 (N = 185)

Measurement model	$\chi^2$	df	p	$\chi^2/df$	NFI	IFI	TLI	CFI	RMSEA	Model comparison	$\Delta\chi^2$	$\Delta df$	p
1. Five-factor model	86.05	55	.005	1.57	.94	.98	.97	.98	.055				
2. Common factor model	379.38	65	<.001	5.84	.73	.77	.72	.76	.162	2 vs.1	293.33	10	<.001
3. Approach-avoidance model	96.96	59	.001	1.64	.93	.97	.96	.97	.059	3 vs.1	10.91	4	.028
4. Common vulnerability model	128.36	60	<.001	2.14	.91	.95	.93	.95	.079	4 vs.3	31.40	1	<.001
5. Hypothesized path model	61.43	31	.001	1.98	.88	.94	.91	.94	.073				



**Figure 4.** Hypothesized path model in which approach versus avoidance-based vulnerability to psychopathology links with creativity through novelty seeking (Study 3). NS = Novelty seeking; PEQ = Personal Expansion Questionnaire; ACL = Adjective Checklist; CAQ = Creative achievements; Idea = Creative ideation composite; CB = Self-rated creative behavior. Displayed are standardized weights. \*  $p < .05$ . \*\*  $p < .01$ .

associated with reduced creativity, whereas inclinations toward psychopathologies that are linked to the approach system (hypomania, positive schizotypy) associated with increased creativity. Previous meta-analytic findings support this proposition (Acar & Sen, 2013; Baas et al., 2016; Byron & Khazanchi, 2011) and large-scale population studies show that individuals with bipolar disorder and healthy family members of individuals with bipolar disorder and schizophrenia are overrepresented in creative professions (Kyaga et al., 2011, 2013). However, the same meta-analytic findings as well as findings from original empirical research tend to focus on a single psychopathology and can therefore not control for comorbidity effects. In addition, they did not empirically assess potential mediating variables that may explain the differential relationship between vulnerability to psychopathology and creativity.

The evidence from our studies indicates that, when controlling for inclinations toward approach-related psychopathology, inclinations toward avoidance-related psychopathology have little or no effect on creativity. This speaks against the widely held belief that creativity requires a vulnerability to depression or anxiety disorder (Schlesinger, 2009) and is much in line with meta-analytic findings that show that the percentage of variance in creativity explained by negative schizotypy (0.8%; Acar & Sen, 2013), trait anxiety (2.9%; Byron & Khazanchi, 2011), and depressive mood (0.4%; Baas et al., 2016) is low. When controlling for inclinations toward avoidance-related psychopathology, inclinations toward approach-related psychopathology were positively associated with creativity. By implication, people that alternate between periods in which they experience mild depressive symptoms and periods in which they experience mild manic symptoms have a higher chance of being creative in the latter period (also see Weisberg, 1994). Study 3 further suggests that approach rather than avoidance-based vulnerability to psychopathology positively predicts creativity because it associates with stronger chronic approach sensitivity toward novel stimuli.

### Limitations and Avenues for Future Research

For our proposition that depressive mood, anxiety, and negative schizotypy are all grounded in the avoidance system, we found

evidence that these inclinations clustered together (Study 1 to 3). However, we could not ascertain whether this cluster would predict an independent measure of avoidance sensitivity, simply because such a measure was not administered and we focused on approach sensitivity instead. Future research should bring this evidence, making sure the chosen measure of avoidance sensitivity is truly independent from the items measuring depressive mood, anxiety, and negative schizotypy. A neuroticism questionnaire, for example, may not be the best choice, as its items show overlap in content with those measuring depressive mood and anxiety. Instead, avoidance (as opposed to approach) sensitivity may be administered by measuring people's response times to perform avoidance and approach behavior in response to negative and positive target stimuli (Eder & Rothermund, 2008).

For our proposition that hypomania and positive schizotypy are all grounded in the approach system, we found evidence that these inclinations clustered together and predicted an independent measure of approach sensitivity toward novelty. However, the association with novelty seeking seemed to be smaller for positive schizotypy than for hypomania. An important reason for this finding may be the relatively stronger comorbidity with avoidance-based inclinations toward psychopathology for positive schizotypy than for hypomania. Indeed, when controlling for inclinations toward avoidance-related psychopathology, positive schizotypy positively predicted chronic approach sensitivity toward novel stimuli. However, it is also possible that hypomania is more strongly grounded in the approach system than is positive schizotypy and that other vulnerability factors exist as well that trigger both positive schizotypy and enhanced creativity (Carson, 2011; also see below).

Our findings are correlational and causal inferences cannot be made. One possible interpretation might be that being highly creative creates the symptoms associated with hypomania (pervasive elevated or irritable moods) and positive schizotypy (hallucinations and magical interpretation of events). While we cannot exclude this possibility, it goes without saying that being highly creative could lead also to depressive symptoms and elevated levels of anxiety. After all, creative people and the unconventional products and ideas they generate are often controversial and severely criticized (Baas et al., 2016; Mueller, Melwani, & Goncalo, 2011; Runco & Johnson, 2002). Rejection, criticism, and other negative experiences associate more with anxiety and negative affect, than with hypomanic and positive schizotypal symptoms (Wilkinson & Marmot, 2003). Moreover, if this explanation were true, we should have seen not only positive relations of creativity with hypomania and positive schizotypy, but also between creativity and depression/anxiety. We did not observe this.

Another possibility reverses the causal relation: Subclinical symptoms associated with hypomania and positive schizotypy may cause enhanced creativity. According to this account, subclinical symptoms that associate with the approach system stimulate creativity, possibly through increased flexible thinking, whereas subclinical symptoms that associate with the avoidance system have no or little effects on creativity (cf. Baas et al., 2016). Earlier work has indeed shown that symptoms that are associated with approach-related psychopathologies, including elevated mood and approach motivation, cause increased flexibility and creativity (Baas et al., 2008; De Dreu et al., 2008; Friedman & Förster, 2010; Roskes et al., 2012).

A third possibility is that the motivational antecedents that put individuals at increased risk for psychopathological symptoms also influence creativity. Varying levels of approach (but not so much avoidance) sensitivity may influence the cognitive processes that affect creativity and simultaneously determine people's vulnerability to psychopathology (cf. Baas et al., 2016; Damian & Simonton, 2015). Together with the previous possibility, this interpretation points to the crucial role that the approach system plays in understanding the link between vulnerability to psychopathology and creativity, and fits our finding that approach rather than avoidance-based vulnerability to psychopathology positively predicts creativity because it associates with stronger chronic approach sensitivity toward novel stimuli (Study 3).

New empirical research on the relationship between vulnerability to psychopathology and creativity is called for to disentangle whether chronic approach sensitivity toward novel stimuli acts as a mediator or a third variable that simultaneously determines people's risk for psychopathological symptoms and their creativity. For example, both novelty seeking and positive schizotypal experiences result from hyper-responsive dopaminergic brain circuitries that are involved in reinforcement and approach motivation (Boot, Baas, et al., 2017; Durstewitz & Seamans, 2008; Ebstein et al., 1996; Laruelle et al., 2003; Roberti, 2004). Moreover, drug-induced upregulated dopamine function in the striatum is associated with activation of positive schizotypal experiences in schizophrenic participants (Laruelle et al., 1996). To establish the causal role of (approach-related) dopaminergic modulation of the relationship between positive schizotypy and creativity (taking a third variable interpretation), researchers may choose placebo controlled treatment studies with drugs that directly target dopamine functioning (e.g., De Dreu et al., 2014).

It would also be interesting if such new studies test factors other than motivation to explain the differential relationship between vulnerability to psychopathology and creativity. Carson (2011), for instance, proposed low latent inhibition (LLI) as an explanatory factor in the link between psychopathology and creativity. LLI is the lowered capability to filter out from attentional focus those stimuli that were previously experienced as irrelevant. LLI is associated with higher creativity because more seemingly irrelevant information enters working memory, which in turn increases the span of elements to create ideas. Importantly, LLI is observed in psychotic schizophrenia patients, but also in healthy people with a high number of schizotypal symptoms (Boot, Baas, et al., 2017; Carson, 2011). Neural hyperconnectivity, an abnormal neural linking of brain areas that are not typically functionally connected, is another common vulnerability factor that may explain the relatively high creativity levels in people with a high number of schizotypal symptoms (Carson, 2011).

Another important question is whether our findings generalize to the link between full-blown mental disorders and creativity. Unfortunately, there is little research that compares the creativity of people diagnosed with different mental disorders with the creativity of controls (Baas et al., 2016). A notable exception is the meta-analysis by Acar, Chen, and Cayirdag (2018) that shows an inverted-U relationship between schizophrenia and creativity. Whether declines in creativity at more severe levels of schizophrenia are due to "too much" approach motivation (cf. Boot, Baas, et al., 2017) or general impairments in cognitive functioning with increasing severity of symptoms (APA, 1994) should be answered

in new research. Such new research on the link between full-blown mental disorders and creativity should also take comorbidity between mental disorders into account (cf. Borsboom & Cramer, 2013; Krueger, 1999). To enhance the generalizability of our findings, it is also important that new research includes people of higher age groups than the student samples that were used in the current study. This has the additional benefit that the variance in some of our creativity performance indicators will increase. For instance, although the questionnaire that was used to assess creative achievements has been used in student samples before (e.g., Baas et al., 2014; Carson et al., 2005), the likelihood to achieve recognized creative feats in any domain increases with age (Silvia et al., 2012).

Controlling for comorbidity effects by measuring multiple inclinations toward psychopathology has proven to be useful in this study to better understand the relation between vulnerability to psychopathology and creativity. Individual correlations among inclinations toward psychopathology and creativity indicators tended to vary across studies. However, controlling for comorbidity, our studies consistently showed that inclinations toward psychopathologies that are linked to the avoidance system (anxiety, depressive mood, negative schizotypy) have little or no effects on creativity, whereas inclinations toward psychopathologies that are linked to the approach system (hypomania, positive schizotypy) associated with increased creativity. Research studying the link between vulnerability to psychopathology and other indicators of cognitive performance may also benefit from this approach. For example, there is rich literature on the relation of (vulnerability to) psychopathology with verbal fluency (Henry & Crawford, 2005), working memory (Nebes et al., 2000), and syllogistic reasoning (Channon & Baker, 1994). However, this research tends to focus on single mental disorders and relationships may be obscured because of the high comorbidity among symptoms of mental disorders (Borsboom & Cramer, 2013). New research endeavors into the link between vulnerability to psychopathology and cognitive performance should therefore assess multiple inclinations toward mental disorders in a single study.

Although schizotypy were measured with the well-established Oxford-Liverpool Inventory of Feelings and Experiences (Mason et al., 2005), a limitation of the current study is that the schizotypy scales suffered from weak reliability. Across studies, the positive schizotypy scale had a mean reliability of 0.67 and the negative schizotypy scale had a mean reliability of 0.54. A potential threat of low reliability is that it associates with increased error variance (Gregory, 2011). For instance, negative schizotypy consistently has the lowest loading on the latent avoidance-based vulnerability to psychopathology factor. However, despite this methodological limitation, findings were highly consistent across studies.

## Conclusion

The notion of the "mad genius" continues to attract attention, from popular discussions to sophisticated scientific research (Kaufman, 2014; Simonton, 2014). Recent meta-analyses provided mixed support for this general idea that creative people are at risk of psychopathology: Whereas anxiety and depressive mood appeared to be negatively but weakly related to creativity, hypomania and positive schizotypy were positively and moderately correlated with creativity. Across three studies, we generally replicated this

pattern of findings. More importantly, we were able to achieve two goals. First, our findings support the hypothesis that some inclinations toward psychopathology share an avoidance orientation, whereas other inclinations toward psychopathology share an approach orientation. Only the latter do positively relate to creative performance, both in self-reported achievements and in actual behavioral (idea-generation) tasks. There may be some truth to the notion of the mad genius. More generally, however, it is a chronic approach sensitivity with its associated tendency to seek novelty that contributes to creative thinking and performance.

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