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Research report

Temperament–creativity relationships in mood disorder patients, healthy controls and highly creative individuals

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Abstract

Objective: To investigate temperament–creativity relationships in euthymic bipolar (BP) and unipolar major depressive (MDD) patients, creative discipline controls (CC), and healthy controls (HC).
Methods: 49 BP, 25 MDD, 32 CC, and 47 HC (all euthymic) completed three self-report temperament/personality measures: the Revised NEO Personality Inventory (NEO-PI-R), the Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego Autoquestionnaire (TEMPS-A), and the Temperament and Character Inventory (TCI); and four creativity measures yielding six parameters: the Barron–Welsh Art Scale (BWAS-Total, BWAS-Like, and BWAS-Dislike), the Adjective Check List Creative Personality Scale (ACL-CPS), and the Torrance Tests of Creative Thinking – Figural (TTCT-F) and Verbal (TTCT-V) versions. Factor analysis was used to consolidate the 16 subscales from the three temperament/personality measures, and the resulting factors were assessed in relationship to the creativity parameters.
Results: Five personality/temperament factors emerged. Two of these factors had prominent relationships with creativity measures. A Neuroticism/Cyclothymia/Dysthymia Factor, comprised mostly of NEO-PI-R-Neuroticism and TEMPS-A-Cyclothymia and TEMPS-A-Dysthymia, was related to BWAS-Total scores ($r=0.36$, $p<0.0001$) and BWAS-Dislike subscale scores ($r=0.39$, $p<0.0001$). An Openness Factor, comprised mostly of NEO-PI-R-Openness, was related to BWAS-Like subscale scores ($r=0.28$, $p=0.0006$), and to ACL-CPS scores ($r=0.46$, $p<0.0001$). No significant relationship was found between temperament/personality and TTCT-F and TTCT-V scores.
Conclusions: Neuroticism/Cyclothymia/Dysthymia and Openness appear to have differential relationships with creativity. The former could provide affective (Neuroticism, i.e. access to negative affect, and Cyclothymia, i.e. changeability of affect) and the latter cognitive (flexibility) advantages to enhance creativity. Further studies are indicated to clarify mechanisms of creativity and its relationships to affective processes and bipolar disorders.

Keywords: Temperament; Personality; Mood disorders; Creativity

1. Introduction

Despite the disabling and often lethal effects of mood disorders, remarkably high numbers of eminently creative individuals appear to suffer from depression and

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related illnesses, particularly bipolar disorder (Andreasen and Glick, 1988; Jamison, 1989, 1993, 1995; Richards and Kinney, 1989; Goodwin and Jamison, 1990). This association, long embedded in Western cultural notions of mad geniuses and artistic temperaments, is well documented in eminently creative individuals (Jamison, 1993; Andreasen, 2005). Most of the literature on the subject, however, is anecdotal and retrospective, or involves examining rates of mood disorders in small populations of living or deceased, eminently creative individuals (Andreasen, 1987; Jamison, 1989). Prospective studies of non-eminent creativity in mood disorder patients are limited in size, scope, and number, but include findings complementing those in eminent creators, suggesting that some facets of bipolar disorder, but not the disorder itself, may confer advantages for creativity (Richards et al., 1988). Converging data suggest relationships between cyclothymia and creativity (Kretschmer, 1931; Andreasen, 1987; Akiskal and Akiskal, 1988; Richards et al., 1988). For example, in a study of diagnostically heterogeneous psychiatric outpatients, Akiskal and associates found that compared to control patients from similar clinical settings, architects and artists had three- and four-fold increases in rates of cyclothymia, respectively (Akiskal et al., 2005a,b). Our own group found that euthymic bipolar disorder patients, but not euthymic (unipolar) major depressive disorder patients, had increased creativity on the Barron–Welsh Art Scale (Barron, 1963; Santosa et al., 2007). This bipolar–creativity association may be related to temperamental differences, such as increased cyclothymia in bipolar disorder patients compared to major depressive disorder patients (Nowakowska et al., 2005).

For the present study, we explored relationships between temperament (assessed with established metrics of temperament and personality) and creativity (assessed with established measures of creativity) across bipolar disorder, major depressive disorder, creative control, and healthy control groups, with the specific goal of understanding those temperamental traits most strongly related to creativity.

2. Methods

The study was conducted in the Bipolar Disorders Clinic at Stanford University and approved by the Stanford Administrative Panel on Human Subjects. Prior to the participation in this study, all subjects provided oral and written informed consent. Inclusion criteria and assessments are described in detail in the accompanying article (Santosa et al., 2007).

Mood disorder participants were euthymic for at least four weeks and had a diagnosis of Bipolar Disorder Type I, II, or Not Otherwise Specified (BP), or Major Depressive Disorder (MDD). Beck Depression Inventory (BDI) (Beck et al., 1961) was used on the day of the study to quantify the severity of any subsyndromal depressive symptoms. The BP group included a mixture of one-quarter unmedicated and three-quarters heterogeneously medicated patients.

Participants were administered self-report temperament/personality measures: the Revised NEO Personality Inventory (NEO-PI-R) (Costa and McCrae, 1992; McCrae and Costa, 1997), the Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego Autoquestionnaire (TEMPS-A) (Akiskal et al., 2005a,b), and the Temperament and Character Inventory (TCI) (Cloninger et al., 1993, 1994). Participants were also administered creativity measures: the Barron–Welsh Art Scale (BWAS) (Barron, 1963), the Adjective Checklist Creative Personality Scale (ACL-CPS) (Gough, 1979; Gough and Heilbrun, 1983), and the Torrance Tests of Creative Thinking – Figural (TTCT-F) and Verbal (TTCT-V) versions (Torrance, 1990), which are described in the accompanying article (Santosa et al., 2007).

Factor analysis, using principal components as the extraction method, was applied to the 16 subscales of the three temperament/personality measures for the HC group ($N=47$), in order to reduce the number of variables. The entire 153 subject sample was not utilized for the primary analysis due to concerns that within-group (individual) and between-group (ecological) correlations, with weights determined by the relative sample sizes in the different groups and the variances between and within each group, would undermine validity in such a diagnostically heterogeneous sample. Stepwise linear regression was used to assess how the resulting temperament/personality factors contributed to each creativity measure. For post-hoc assessments of relationships between individual temperament/personality factors and creativity measures, Bonferroni corrections were applied, using a significance threshold of $p=0.05/30=0.0017$, correcting for a total of 30 comparisons between the five temperament/personality factors resulting from the factor analysis and the six creativity parameters (BWAS-Total, BWAS-Like, BWAS-Dislike, ACL-CPS, TTCT-F, and TTCT-V). In exploratory analyses, temperament/personality factors that demonstrated relationships to creativity were compared across diagnostic groups. Means (±S.D.) are reported, unless otherwise indicated. The above analyses were also performed based on factor analysis applied to the temperament/personality measures for the entire sample

(N=153), in order to check whether the results varied with the choice of subjects for the factor analysis.

3. Results

3.1. Subjects

A total of 153 euthymic subjects participated in the study; 49 BP, 25 MDD, 32 CC and 47 HC. These groups (Santosa et al., 2007) had similar demographics to one another, with the exceptions that CC compared to BP were younger, and CC compared to BP, MDD, and HC had approximately 2 years more education. Also, subsyndromal depressive symptoms as assessed by the BDI were greater in BP, MDD, and CC than in HC.

3.2. Factor analysis of temperament measures

Analysis yielded five principal factors (Table 1), all with eigenvalues greater than 1. These factors had primary or secondary loadings for each of the NEO-PI-R subscales, but also contained prominent (greater than 0.60) loadings for seven additional variables, two from the TEMPS-A, and five from the TCI. Factors 1 and 2 were predominant. Factor 1 had a primary loading for TCI-Cooperativeness, and secondary loadings for NEO-PI-R-Extroversion, TCI-Directedness, and TCI-Reward Dependence. Factor 2 had a primary loading for NEO-PI-R-Neuroticism, but also contained substantial loadings for TEMPS-A-Cyclothymia and TEMPS-A-Dysthymia, and is referred to hereafter as the Neuroticism/Cyclothymia/Dysthymia Factor. Factors 3, 4 and 5 had primary loadings for NEO-PI-R-Conscientiousness, -Agreeableness, and -Openness, respectively. Among the NEO-PI-R subscales, Openness was of particular interest in view of the well-documented relationship between Openness and creativity, and Factor 5 is referred to hereafter as the Openness Factor. Finally, in view of the emergence of relationships with creativity described below, we assessed the correlation between the Neuroticism/Cyclothymia/Dysthymia Factor and the Openness Factor ($r(148)=0.20$, $p<0.05$), compared to a 0.02 correlation between the NEO-Neuroticism and NEO-Openness scales in normative samples (Costa and McCrae, 1992; McCrae and Costa, 1997).

3.3. Relationships between creativity and temperament factors

Stepwise linear regression yielded two temperament/personality factors contributing to BWAS-Total scores, ($F(2,148)=14.2$, $p<0.0001$), accounting for 16% of the total variance, with a predicted BWAS-Total score formula of (2.1 × Neuroticism/Cyclothymia/Dysthymia Factor) + (2.0 × Openness Factor) + 19.9. In post-hoc analysis, BWAS-Total scores correlated significantly with the Neuroticism/Cyclothymia/Dysthymia Factor ($r(150)=0.36$, $p<0.0001$), but not with other factors. This pattern

Table 1
Unrotated Temperament Factors based on Healthy Controls

	Factor 1	**Neuroticism/ Cyclothymia/Dysthymia**	Factor 3	Factor 4	**Openness**
NEO-Neuroticism	−0.36	**0.82**	−0.03	0.12	0.18
NEO-Openness	0.38	0.24	−0.08	−0.29	**0.69**
NEO-Extroversion	**0.68**	0.13	−0.23	−0.38	0.25
NEO-Agreeableness	0.56	−0.13	<0.005	**0.61**	0.13
NEO-Conscientiousness	0.21	−0.02	**0.79**	−0.37	<0.005
TEMPS-A-Cyclothymia	0.22	**0.77**	−0.15	0.29	−0.11
TEMPS-A-Dysthymia	−0.12	**0.70**	0.24	0.15	−0.25
TEMPS-A-Hyperthymia	0.51	0.34	−0.07	−0.36	−0.40
TEMPS-A-Irritability	−0.44	0.58	−0.28	−0.30	−0.21
TCI-Novelty seeking	0.39	<0.005	**−0.64**	−0.37	0.01
TCI-Reward dependence	**0.64**	0.32	0.03	0.16	0.29
TCI-Persistence	0.15	0.50	**0.66**	−0.27	−0.04
TCI-Self-directedness	**0.66**	−0.25	0.25	−0.02	−0.09
TCI-Cooperativeness	**0.79**	−0.07	0.24	0.19	−0.13
TCI-Harm avoidance	−0.52	0.27	0.23	0.11	0.52
TCI-Self-transcendence	0.58	0.47	−0.21	0.25	−0.13

Two temperament/personality factors (top row, indicated by bold face) correlated with creativity measures. Twelve temperament/personality subscales (left column, indicated by bold face) had at least one factor loading greater than 0.60.
NEO-PI-R = Revised NEO Personality Inventory, TEMPS-A = Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego Autoquestionnaire, TCI = Temperament and Character Inventory.

of findings was not altered when partial correlations including age, gender, education, and BDI were assessed. The Neuroticism/Cyclothymia/Dysthymia Factor had a significant correlation with BDI ($r(150)=0.49$ $p<0.0001$), but not with age, gender, or education.

In an exploratory analysis, individual correlations between BWAS-Total scores and the main raw subscales contributing to the Neuroticism/Cyclothymia/Dysthymia Factor were assessed. Thus, BWAS-Total scores had significant correlations with NEO-PI-R-Neuroticism ($r(150)=0.38$, $p<0.0001$) and TEMPS-A-Cyclothymia ($r(150)=0.38$, $p<0.0001$), but not TEMPS-A-Dysthymia ($r(150)=0.11$, $p=$NS), and these correlations were 0.25, 0.24, and −0.20, respectively, when partial correlations including all three of these temperament/personality measures were assessed. When partial correlations were assessed between BWAS-Total scores and TEMPS-A subscales, only TEMPS-A Cyclothymia (and not TEMPS-A-Dysthymia, TEMPS-A-Hyperthymia, or TEMPS-A-Irritability) had a significant relationship. Further analysis revealed that BWAS-Dislike (but not BWAS-Like) subscale scores correlated with the Neuroticism/Cyclothymia/Dysthymia Factor ($r(150)=0.39$, $p<0.0001$) and Factor 1 ($r(150)=-0.28$, $p=0.0006$), but not with other factors. However, when partial correlations were considered, only the correlation with the Neuroticism/Cyclothymia/Dysthymia Factor ($r(150)=0.27$, $p=0.0007$) retained significance, as the correlation with the Factor 1 attenuated markedly ($r(150)=-0.16$, $p=$NS). This pattern of findings was not altered when partial correlations including age, gender, education, and BDI were assessed. BWAS-Like (but not BWAS-Dislike) subscale scores correlated with the Openness Factor ($r(150)=0.28$, $p=0.0006$), but not with other factors (Fig. 1). This pattern of findings was not altered when partial correlations including age, gender, education, and BDI were assessed. The Openness Factor did not have significant correlations with age, gender, education, or BDI.

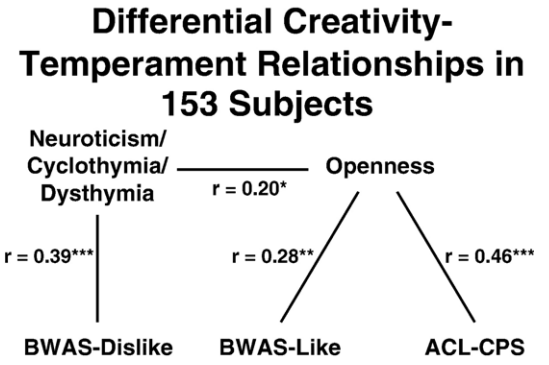

Fig. 1. Differential creativity–temperament relationships in 153 subjects. Only two (Neuroticism/Cyclothymia/Dysthymia and Openness) of five temperament/personality factors had significant correlations with creativity measures. BWAS=Barron–Welsh Art Scale. ACL-CPS=Adjective Check List Creative Personality Scale. *$p<0.5$; **$p<0.001$, ***$p<0.0001$.

Stepwise linear regression yielded two temperament/personality factors contributing to ACL-CPS scores ($F(2,148)=30.8$, $p<0.0001$), accounting for 28% of the total variance, with a predicted ACL-CPS score formula of (4.6 × Openness Factor) + (−1.5 × Neuroticism/Cyclothymia/Dysthymia Factor) + 58.2. In post-hoc analysis, ACL-CPS scores correlated significantly with the Openness Factor ($r(150)=0.46$, $p<0.0001$), but not with other factors. This pattern of findings was not altered when partial correlations including age, gender, education, and BDI were assessed.

In contrast to the above, stepwise linear regression failed to yield significant relationships between temperament/personality factors and TTCT-F and TTCT-V scores.

Restricting the above analyses to subjects no older than age 40 years retained the entire CC group, yielded HC, BP, and MDD subgroups with similar mean ages, and did not alter the above pattern of findings. Restricting the above analyses to subjects with education scores of at least 7 retained the entire CC group, yielded HC, BP, and MDD subgroups with similar mean education scores, and did not alter the above pattern of findings.

Repeating the above analyses, based on factor analysis applied to the temperament/personality measures for the entire sample ($N=153$), yielded a similar pattern of results, suggesting that basing the factor analysis on the HC group ($N=47$), had not substantively altered the findings.

3.4. Comparison of key temperament factors across diagnostic groups

In exploratory analyses, temperament/personality factors that demonstrated relationships to creativity were compared across diagnostic groups. Mean Neuroticism/Cyclothymia/Dysthymia Factor scores were increased in BP (2.5 ± 1.8, $t(94)=8.6$, $p<0.0001$), CC (1.9 ± 1.6, $t(77)=7.0$, $p<0.0001$), and MDD (1.8 ± 1.2, $t(70)=7.4$, $p<0.0001$) compared to HC (0.0004 ± 0.8), and tended to be higher in BP compared to MDD ($t(72)=1.8$, $p=0.07$). Mean Openness Factor scores were increased in BP (0.53 ± 0.97, $t(94)=2.6$, $p=0.0095$) and CC (0.74 ± 0.76, $t(77)=3.5$, $p=0.0007$), but not MDD (0.16 ± 1.3, $t(70)=0.58$, $p=$NS) compared to HC

(0.000002±1.0), and tended to be higher in CC compared to MDD ($t(55)=2.2$, $p=0.034$). Thus, between-group differences for Neuroticism/Cyclothymia/Dysthymia Factor scores resembled those previously seen with TEMPS-A-Cyclothymia, and for Openness Factor scores resembled those previously seen with NEO-PI-R-Openness (Nowakowska et al., 2005).

There were no significant differences between bipolar subgroups (29 subjects with bipolar I disorder, 16 with bipolar II disorder, and 4 with bipolar disorder not otherwise specified) with respect to Neuroticism/Cyclothymia/Dysthymia Factor scores or Openness Factor scores, which in these subgroups were significantly higher than in HC.

CC with compared to without a history of mood disorder had higher Neuroticism/Cyclothymia/Dysthymia Factor scores (2.8±1.8 vs. 1.1±0.7, $t(30)=3.4$, $p=0.0018$), but both were significantly higher than in HC and similar to scores of mood disorder subjects. Similarly, CC with compared to without a history of any psychiatric disorder had higher Neuroticism/Cyclothymia/Dysthymia Factor scores (2.4±1.8 vs. 1.1±0.8, $t(30)=2.3$, $p=0.03$), and both were significantly higher than in HC. Openness Factor scores were similar in CC with compared to without a history of mood disorder and in CC with compared to without a history of any psychiatric disorder, and in both subgroups were significantly higher than in HC.

4. Discussion

The findings of this study suggest that the Neuroticism/Cyclothymia/Dysthymia Factor (reflecting primarily NEO-PI-R-Neuroticism, TEMPS-A-Cyclothymia, and TEMPS-A-Dysthymia) and the Openness Factor (reflecting primarily NEO-PI-R-Openness), across varied groups, may differentially contribute to components of creativity captured by the BWAS and ACL-CPS. This has several potential implications.

The first implication is that Neuroticism/Cyclothymia/Dysthymia may contribute to creativity. As noted in the introduction, converging data suggest relationships between Cyclothymia and creativity (Kretschmer, 1931; Andreasen, 1987; Akiskal and Akiskal, 1988; Richards et al., 1988; Akiskal et al., 2005a,b). A correlation between NEO-Openness and creativity is well established (McCrae, 1987; King et al., 1996; Feist, 1998; Dollinger et al., 2004), but there also is evidence of a connection between Neuroticism and creativity (Kemp, 1981; Andreasen and Glick, 1988; Bakker, 1991; Hammond and Edelmann, 1991; Marchant-Haycox and Wilson, 1992). Moreover, integrative models have suggested both cognitive (e.g. Openness) and affective (e.g. Neuroticism) and components to creativity (Russ, 1993; Eysenck, 1995).

Neuroticism/Cyclothymia/Dysthymia may contribute to a component of creativity captured by the BWAS. This could be related to an as yet under-appreciated affective component of the BWAS, a test that invites approval or disapproval of figures. It may be that Neuroticism/Cyclothymia/Dysthymia provides a creative advantage by increasing access to a range of affective experience, particularly negative affect (Neuroticism) and changeability of affect (Cyclothymia). Indeed, Neuroticism/Cyclothymia/Dysthymia correlated significantly with BWAS-Dislike but not BWAS-Like subscale scores. Despite its potential emotional and interpersonal complications, the ability to experience unusually intense (Neuroticism) and varied (Cyclothymia) affect might propel innovation in talented individuals dissatisfied with the current status of art, science, or industry.

In contrast, the cognitive flexibility associated with Openness may be an asset not only for creative achievement, by also for interpersonal relationships. In our study, Openness correlated with BWAS-Like subscale (but not BWAS-Dislike subscale or BWAS-Total) scores, consistent with the notion that the cognitive flexibility associated with Openness permits subjects to better appreciate complexity and asymmetry. Also, Openness correlated with ACL-CPS scores, which reflect several socially adaptive traits, consistent with Openness permitting enhanced interpersonal function. Although Openness has consistently correlated with creativity measures (Schaeffer et al., 1976; Parson et al., 1984; McCrae, 1987), it has also been related to mood swings (Velting and Liebert, 1997). Indeed, we observed a modest correlation between the Neuroticism/Cyclothymia/Dysthymia Factor and the Openness Factor, although in normative samples, the NEO-Neuroticism and NEO-Openness scales are independent (Costa and McCrae, 1992).

The nature of the Neuroticism/Cyclothymia/Dysthymia Factor and its relationship to the BWAS is of particular interest, as this creativity measure detected increased creativity in BP (but not in MDD) (Santosa et al., 2007). Overall, the NEO may account for as much as half of the variance of TEMPS-A temperaments (Bloink et al., 2005). Of the NEO subscales, Neuroticism appears to have the strongest relationships with TEMPS-A parameters, and may be particularly related to TEMPS-A-Dysthymia and TEMPS-A-Cyclothymia (Bloink et al., 2005). In contrast, Openness appears unrelated to TEMPS-A temperament subscales (Bloink et al., 2005). A similar pattern was observed in the current study.

Although Neuroticism is a prominent construct in traditional personality theory, its utility in understanding differences between patients with BP and MDD is limited, in view of its global/nonspecific sensitivity to affective disturbance. Thus, while Neuroticism varies among mood disorder patients and controls (BP type II > MDD > BP type I > controls), this appeared to be related to Cyclothymia and Dysthymia in BD type II and MDD patients, respectively (Akiskal et al., 2006). Indeed, studies with tandem use of multiple temperament measures suggest that constructs with greater affective specificity may better discriminate between such groups. For example, prominent mood lability distinguished BD type II patients from BD type I and MDD patients as well as controls (Akiskal et al., 2006). A prior article from our group utilizing the same sample as in the current report found that Cyclothymia was the only one of the 16 temperament/personality subscales to distinguish patients with BP and MDD from one another (Nowakowska et al., 2005). As noted in the Introduction, converging data suggest relationships between Cyclothymia and creativity (Kretschmer, 1931; Andreasen, 1987; Akiskal and Akiskal, 1988; Richards et al., 1988; Akiskal et al., 2005a,b). It is possible that increased Neuroticism and Dysthymia provide modest nonspecific affective (intense and frequently negative affect) creativity advantages for patients with both BP and MDD, while the combination of this with Cyclothymia in BP provides an additional or synergistic creativity advantage (intense and varied affect) that allows the creativity in the BP group to exceed that of HC. Indeed, in our sample, in BP and MDD, there were similar levels of NEO-PI-R-Neuroticism and TEMPS-A-Dysthymia that exceeded those seen in HC, while in BP compared to MDD and HC there was increased TEMPS-A-Cyclothymia (Nowakowska et al., 2005). In the current study, exploratory analyses suggested direct relationships existed between BWAS-Total scores and NEO-PI-R-Neuroticism and TEMPS-A-Cyclothymia that were at least to some degree independent from one another (partial correlations of 0.25 and 0.24, respectively).

Our findings also suggest insights into the creativity measures used. For example, although the BWAS has been sensitive to differences between groups of creative individuals compared to controls, the mechanism of such separation has not been described. Our study adds to knowledge of the BWAS by providing findings consistent with the BWAS having both affective and cognitive components. Thus, the BWAS may simultaneously reflect access to intense and frequently negative affect (Neuroticism) and variability of affect (Cyclothymia) with the BWAS-Dislike subscale, and affective/cognitive flexibility (Openness) with the BWAS-Like scale. Intensity and variability of affect could permit subjects to better make the affective shifts necessary to experience and express like and dislike of different stimuli evaluated in quick succession in the BWAS.

In contrast, the ACL-CPS may reflect cognitive/personality aspects of creativity such as Openness. Finally, the lack of significant correlations between personality/temperament with the TTCT-F and TTCT-V is consistent with these creativity metrics reflecting aspects of creativity not directly related to temperament/personality.

Limitations of this study include the use of a highly educated sample and the mixture of unmedicated and heterogeneously medicated patients in the sample. The BP group consisted of subjects with bipolar I disorder, bipolar II disorder, and bipolar disorder not otherwise specified. However, there were no significant differences among these subgroups on any analysis. Our CC group was younger and more educated than other groups. However, covarying for age and education did not alter the pattern of correlational findings, and restricting the analyses to subjects not older than the age of 40 years did not alter the pattern of findings, suggesting that our correlations and comparisons involving the CC group are valid in subjects up to the age of 40 years. Additional studies are needed to confirm correlations and comparisons involving CC subjects over the age of 40 years. Also, restricting the analyses to subjects with the most education retained the entire CC group, yielded HC, BP, and MDD subgroups with similar mean education scores, and did not alter the pattern of findings. Nevertheless, additional studies are needed to confirm correlations and comparisons involving creative subjects with less education. Indeed, given the high education level of all four groups, additional studies are needed to confirm these findings in subjects with less education.

Another compromise is that our CC group was heterogeneous with respect to history of mood disorder (or any psychiatric disorder). Those with current syndromal psychiatric symptoms were not included in data analysis. However, CC with compared to without a history of mood disorder (or any psychiatric disorder) had higher Neuroticism/Cyclothymia/Dysthymia Factor scores, but scores in both groups were significantly higher than in HC. Openness Factor scores were similar in CC with compared to without a history of mood disorder (or any psychiatric disorder), and scores in both groups were significantly higher than in HC. Thus, on the crucial Neuroticism/Cyclothymia/Dysthymia Factor, CC with a history of mood disorder (or any psychiatric disorder) were similar to BP and different from CC without a history of mood disorder (or any psychiatric disorder). Although the sample included a substantial

number of participants, statistical power limitations could account for the some of our negative findings, and particularly limit our ability to understand relationships between creativity and temperament in the subgroups of the CC and BP groups. Finally, although limiting the sample to euthymic subjects removed the confound of mood state, the current study cannot inform us of the effect of mood state on relationships between temperament/personality and creativity.

In spite of the above limitations, this study is one of the first exploring temperamental/personality contributors to creativity across diverse groups (BP, UP, HC, CC), and provides preliminary insights into the importance of affect in creativity. Further studies are indicated to clarify mechanisms of creativity and their relationship to affective processes and bipolar disorders.

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