Brief Report

Effects of personality and threat of evaluation on divergent and convergent thinking

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Abstract

This study explores the effects of the Big Five personality traits and threat of evaluation on divergent and convergent thinking in a sample of 82 UK students. Results showed that Openness and Extraversion predicted divergent thinking under both threat of evaluation and no evaluation, whilst Neuroticism correlated significantly with divergent thinking (negatively) only under threat of evaluation. However, mediational analysis showed that the effects of Neuroticism on divergent thinking under threat of evaluation were fully accounted for by Extraversion. Thus neurotics’ divergent thinking was significantly more impaired because they were more introverted. Theoretical and practical implications are discussed. © 2008 Elsevier Inc. All rights reserved.

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1. Introduction

More than 50 years ago, Guilford (1956) provided a key foundation for the study of creativity postulating that, unlike intelligence, which refers to individual differences in the ability to identify the correct solution to a problem, creativity is better understood in terms of the ability to generate numerous answers to a problem. In that sense, intelligence requires convergent thinking, whilst creativity requires divergent thinking. Although correlations between creativity and intelligence measures suggest that divergent and convergent thinking are positively related (Sternberg & O’Hara, 2000), the fact that ability tests account for only a small percentage of variance in divergent thinking (Runco, 2004) encouraged a wave of research into the non-ability correlates of creativity, notably personality (Chamorro-Premuzic, 2007).

The most important personality correlate of creativity is Openness, which assesses intellectual curiosity, imagination, artistic interests, liberal attitudes, and originality (McCrae, 1987). Indeed, some conceptualized Openness as a proxy of creativity (Chamorro-Premuzic, 2007). Accordingly, a number of studies reported positive links between Openness and divergent thinking (George & Zhou, 2001; King, Walker, & Broyles, 1996; McCrae, 1987).

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The association between creativity and other Big Five traits appears to be less consistent. There is some evidence for the positive link between creativity and Extraversion (King et al., 1996), a trait that assesses sociability, activity, assertiveness and the tendency to experience positive affect. However, Eysenck (1995) argued that Introversion—rather than Extraversion—enhances creative interests and achievement. With regards to Neuroticism, a trait that assesses an individual’s level of emotional stability, self-concept, and tendency to experience negative affect, positive (Martindale, 1999) as well as non-significant (King et al., 1996) links with creativity have been reported. Agreeableness and Conscientiousness seem largely unrelated to divergent thinking (Chamorro-Premuzic & Furnham, 2005).

The above results may be explained in terms of situational factors that moderate the effects of personality on creativity. Accordingly, Chamorro-Premuzic and Furnham’s (2005) model of intellectual competence distinguishes between dispositional effects on tested versus actual abilities. Traits such as Openness to Experience and Conscientiousness would affect actual intellectual development, whereas traits such as Neuroticism and Extraversion would correlate with ability measures primarily because they affect test performance. Thus intellectual competence offers an interpretative framework to understand correlations between non-ability and ability traits at the level of latent and measured constructs.

Although intellectual competence focuses on convergent thinking, its principles can also be applied to the non-ability determinants of divergent thinking. For instance, Openness may be hypothesized to relate to “actual” creativity (e.g. interests, abilities, attitudes), whereas Neuroticism and Extraversion may correlate with creativity primarily because they affect test performance. Accordingly, classic experimental manipulations of arousal (Eysenck, 1967) would reveal significant differences in the creative performance of more and less neurotic and extraverted individuals. In fact, Martindale (1999) posited that heightened arousal reduces the range of task cues used during creative performance, consuming attention in self-evaluation (one’s examination and concerns about his or her performance), constricting the range of thoughts, and reducing ideational fluency (Russ, 1993; Silvia & Phillips, 2004).

Although arousal has been found to impair creativity (Chamorro-Premuzic, 2007), interactive effects of dispositions/traits × arousal/affect on divergent thinking have rarely been examined. Indeed, our review of the literature revealed only one study that focused on the interactive effects of Extraversion, Neuroticism, and arousal (noise) on creative performance (Matthews, 1986). Results showed no further noise impairments on neurotic introverts, though “floor effects could have prevented the anxious introvert group from declining further in performance in noise” (Matthews et al., 1986, p. 759). In regards to convergent thinking, a recent study found that the effects of Neuroticism on IQ test performance were fully accounted for by test anxiety (Tsaouisis, Moutafi & Furnham, 2006), but did not examine other Big Five traits. Thus the present study will assess the interactive effects of negative affect and personality on divergent and convergent thinking. To this end, we will induce heightened arousal via threat of evaluation (Keogh & French, 1997) and assess whether personality traits affect participants’ performance differently under stressful and calm conditions.

2. Method

2.1. Participants

Eighty-two UK psychology students – 23 males (age $M = 20.6$, $SD = 3.1$ years) and 59 females (age $M = 21.7$, $SD = 5.1$ years) - took part in this study in exchange of course credits.

2.2. Measures

2.2.1. Personality

Personality traits were assessed through the English Big Five Inventory (BFI, John, Donahue, & Kentle, 1991). This 44-item self-report scale assesses Neuroticism (low Emotional Stability), Extraversion, Openness to Experience, Agreeableness and Conscientiousness. Responses are recorded on a 5-point Likert-type scale ranging from 1 (disagree strongly) to 5 (agree strongly). The BFI is well validated and has internal consistencies ranging from .75 to .90 and test-retest reliabilities ranging from .80 to .90.
2.2.2. Negative affect

Negative affect was assessed with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), which consists of 20 emotional adjectives (ten for negative affect). Participants are asked to report the degree to which they feel or experience each state “right now” on a 1 (very slightly or not at all) to 5 (extremely) point scale. Previous studies report good internal consistencies (Cronbach’s in the mid to high .80’s).

2.2.3. Divergent thinking

Divergent thinking was operationalized and assessed in terms of verbal fluency and creative problem solving.

Verbal fluency is a central domain of divergent thinking and was measured with an adaptation of the Alternate Uses Test (Christensen, Guilford, Merrifield, & Wilson, 1960), which required participants to name “as many possible uses” for a brick, paper-clip, pen, pillow, tin and shoe box. They were given 1 minute per object. Three objects were used for each condition (calm and stressful), and the order of objects was counterbalanced. Responses were coded for (1) fluency or the total number of uses per item (regardless of quality or appropriateness); (2) elaboration or the level of detail provided for each use; and (3) originality or the number of responses provided by fewer than 1% (5 points), 10% (2 points), or 15% (0 points) of participants in the sample.

Creative problem solving was measured using four insight and four utopian situation/consequences tasks (Fink, Grabner, Benedek, & Neubauer, 2006) (order was counterbalanced as above). In the insight task the experimenter described specific situations to the participants (e.g. “A light in the darkness”) asking participants to provide as many different causes as they could. In the utopian situation task participants were instructed to produce as many consequences to scenarios defined by the experimenter (e.g. “What would happen if nobody could speak anymore?”). Responses were rated blindly by four independent raters on a 1–10 (average inter-rater reliability = .86).

2.2.4. Convergent thinking

The Baddeley Reasoning Test (Baddeley, 1968) was administered to measure convergent thinking under both calm and stressful conditions. Items present participants with grammatical transformations of a logical proposition that is answered with either true or false, e.g. “A precedes B: AB” (true) or “A does not follow B: BA” (false). The original 60 items of the test were administered in 2 × 30-item sessions, lasting 1’ 30” each (the normal time for full test administration is 3 min). Participants received 1 point for each correct answer (A “harsh” score—adjusting for attempted responses—was also computed but not retained for further analyses as it correlated r = .91 with the unadjusted score).

2.3. Procedure

Participants were tested individually in 45-min sessions. The first mood measure was administered at the start of the experiment to record participants’ baseline negative affect. Participants were then asked to complete the Big Five Inventory. Next, they performed the two divergent thinking tasks under both calm and stressful conditions. Testing order was counterbalanced among participants to avoid order and/or practice effects. In the calm condition participants were tested in a quiet and soundproof cubicle. In the stressful condition participants were seated in front of a video camera (Sony MD GR-SX22E) and told that their performance would be filmed and compared to fellow students.

3. Results

Means and standard deviations for the Big Five personality traits were in line with manual norms (John et al., 1991). All zs were higher than .77 showing good internal reliabilities. Principal components analysis was used to compute an overall divergent thinking score (49.58% variance explained) and an overall negative
affect score (variance explained = 41.70% variance explained). Two paired-samples t-tests revealed that threat of evaluation significantly affected divergent thinking ($t(82) = 2.96$, $p < .01$), but narrowly missed to have a significant effect on convergent thinking ($t(82) = 1.86$, $p = .06$). There were no significant correlations between negative affect and either divergent (no evaluation $r = -.06$, evaluation $r = -.11$) or convergent (no evaluation $r = -.08$, evaluation $r = -.18$) thinking.

Table 1 reports bivariate correlations between personality and divergent and convergent thinking, as well as four hierarchical regressions where divergent and convergent thinking scores were regressed onto the Big Five traits and two personality × negative affect interactions (chosen on the basis of the previous literature). As seen, Extraversion and Openness were significantly correlated with divergent thinking in both conditions, whereas Neuroticism correlated significantly—negatively—with divergent thinking only under threat of evaluation. Personality traits were much stronger predictors of divergent than of convergent thinking, accounting for over 30% and 6% of the variance, respectively. In fact, there were no significant personality correlates of convergent thinking in either condition. No Extraversion or Neuroticism × negative affect interactions were found for any of the criteria.

Interestingly, the regression of divergent thinking under threat of evaluation revealed that Neuroticism was no longer significantly associated with the criterion when other predictors were included in the model. Thus, a test of mediation (Baron & Kenny, 1986) was conducted to examine whether the effects of Neuroticism on divergent thinking under threat of evaluation could be accounted for by Extraversion (which was moderately correlated with Neuroticism). These results are presented in Fig. 1.

As seen, Extraversion fully accounted for the link between Neuroticism and divergent thinking performance. Thus neurotic individuals’ divergent thinking was significantly more impaired by the threat of evaluation only because of their lower Extraversion scores, meaning that if these individuals had been higher in Extraversion their divergent thinking would have not differed from that of their more emotionally stable counterparts.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Regressing divergent and convergent thinking onto personality and personality and personality × negative affect</th>
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<tbody>
<tr>
<td>Divergent thinking calm</td>
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<td>.53**</td>
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<tr>
<td>Adj. R²</td>
<td>.33</td>
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<td>F(5, 76)</td>
<td>8.98**</td>
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| 2 | N | .19 | .66 | -.02 | .08 | .13 | .39 | .02 | .11 |
| E | .14 | .35 | .20 | .55 | -.13 | .28 | .03 | .15 |
| A | -.15 | 1.52 | -.16 | 1.72 | -.30 | 2.65* | -.23 | 2.00 |
| C | .06 | .60 | .07 | .84 | .14 | 1.25 | .06 | .60 |
| O | .46 | 4.79** | .45 | 4.89** | -.17 | 1.53 | -.16 | 1.45 |
| N x NA | -.05 | -.17 | .33 | -.13 | -.09 | .19 | -.02 | -.36 | .58 | -.21* | .24 | .82 |
| E x NA | .25* | .21 | .50 | .14 | .15 | .39 | .12 | .39 | .81 | -.04 | -.41 | 1.00 |
| Adj. R² | .32 | .37 | .04 | .05 |
| F(7, 74) | 6.35** | 7.82** | 1.08 | 1.02 |

Note. r, Pearson’s Bivariate correlation coefficient; N, Neuroticism; E, Extraversion; A, Agreeableness; C, Conscientiousness; O, Openness to Experience; NA, negative affect; For N × NA and E × NA interactions NA represents NA calm if the predicted criterion is Divergent or Convergent Thinking under calm condition, and NA stressful if the criterion is Divergent or Convergent Thinking under stressful condition.

* $p < .05$.

** $p < .01$. 
4. Discussion

The present study set out to explore the personality correlates of divergent and convergent thinking under threat of evaluation and no evaluation. Two personality traits, namely Openness and Extraversion, were found to be significantly associated with divergent thinking under both conditions. Thus these traits can be hypothesized to facilitate divergent thinking production and relate to “actual” rather than measured creativity. The fact that Openness was found to be the strongest personality correlate of divergent thinking is not surprising, as previous studies have even suggested that Openness be interpreted as a proxy of creativity (Chamorro-Premuzic et al., 2005; George & Zhou, 2001; King et al., 1996). Although Openness conceptualizes individual differences in facets other than creativity—tapping into aspects of intellect, political attitudes, and aesthetic interests (McCrae, 1987)—the high correlation between Openness and divergent thinking may at least in part be indicative of two different ways of measuring (and assessing) the same aspects of creativity. Thus Openness is a self-report of, among other things, people’s likelihood of or preference for “thinking outside the box”, whereas divergent thinking tests would represent a performance-based measure of such differences.

The association found between divergent thinking and Extraversion is slightly more surprising as previous studies had yielded more conflicting results on the Extraversion-creativity link (Chamorro-Premuzic, 2005). The present results suggest that extraverts, like open individuals, have an intrinsic advantage in divergent thinking tasks and outperformed their introverted counterparts in both conditions, especially under threat of evaluation. This questions the argument that Extraversion may only relate to “tested” divergent thinking, such that its effects on the latter are a function of arousal or test taking styles. However, the larger correlation between Extraversion and divergent thinking under threat of evaluation (compared to the no evaluation condition) is consistent with the idea that the arousing effects of evaluation should impair introverted individuals more than their extraverted counterparts (Eysenck, 1967).

On the other hand, Neuroticism was found to relate to divergent thinking only under threat of evaluation. Interestingly, this effect was fully explained by Extraversion, suggesting that neurotic individuals were more impaired in their divergent thinking performance only because of their lower Extraversion scores. This highlights a complex association between these two personality traits and divergent thinking, as well as the differential effects of arousal. First, they support the hypothesis that Neuroticism is only related to divergent thinking under arousing conditions, thus supporting the idea that Neuroticism relates to “tested” rather than actual creativity (Chamorro-Premuzic et al., 2005). Second, the fact that if neurotic individuals had been matched on Extraversion their performance would not have differed significantly from their emotionally stable counterparts indicates that the detrimental effects of threat of evaluation on the divergent thinking of neurotic individuals depend on whether they are introverted or extraverted.
No personality effects on convergent thinking were found, suggesting that the Big Five are more related to divergent than convergent thinking. Furthermore, the fact that there were no significant Neuroticism or Extraversion × negative affect interactions indicates that negative affect does not moderate the effects of personality on divergent or convergent thinking. Indeed, even when threat of evaluation moderated the effects of personality on divergent thinking, this was due to factors other than negative affect.

There were some limitations to the present study, such as the small student sample and short measures used (especially for convergent thinking), as well as the omission of further levels of experimental manipulation. However, despite the simplicity of our design and unrepresentativeness of our sample, our results provide interesting information in regards to the personality – creativity interface, highlighting the differential effects of personality (as a whole and in terms of specific traits) on divergent and convergent thinking, and identifying a novel moderation-mediation effect between Neuroticism, threat of evaluation, divergent thinking and Extraversion.

In all, the results show modest support to the application of the intellectual competence framework (Chamorro-Premuzic et al., 2005) to the understanding of the non-ability determinants of divergent thinking. As the model would predict, Openness can be regarded as an investment trait and driving force underlying individual differences in creativity and therefore related to actual rather than tested divergent thinking. Also in accordance with the intellectual competence model, Neuroticism is related only to “tested” divergent thinking, meaning that, under non-arousing conditions, there are no significant divergent thinking differences between more and less neurotic individuals. However, differences in Extraversion explain the attenuation by threat of evaluation of the effects of Neuroticism on divergent thinking, such that only a combination of high Neuroticism and low Extraversion would make individuals’ divergent thinking performance more vulnerable to threat of evaluation.

References
