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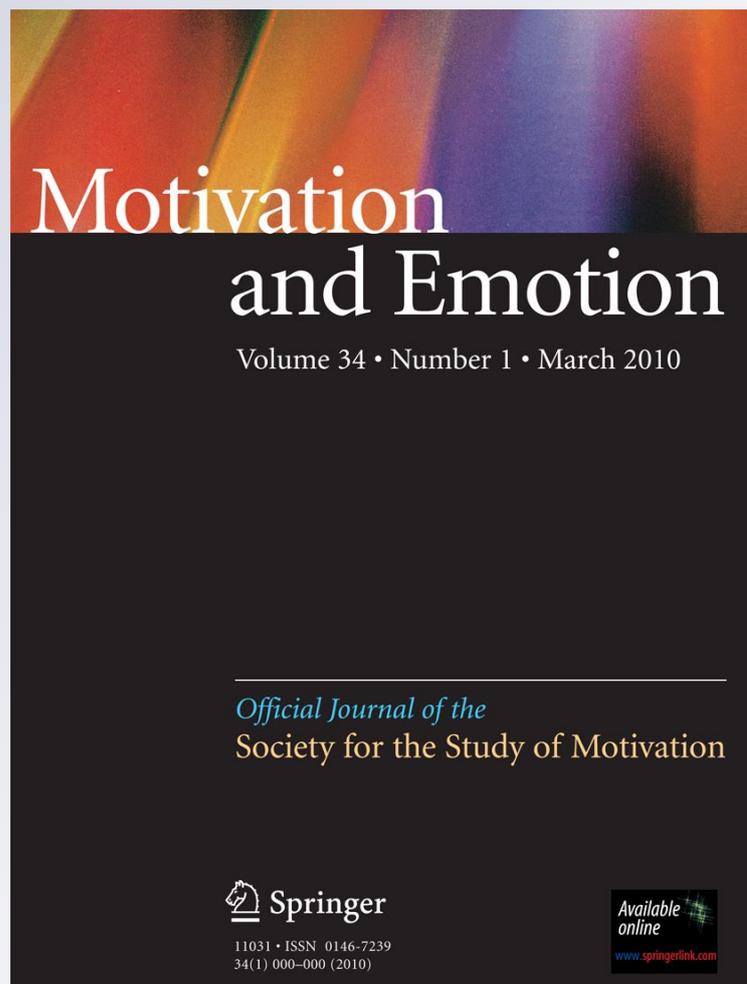
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# The relationship between trait emotional intelligence and creativity across subject domains

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**Abstract** This study investigated the association between two creativity indicators: Divergent Thinking (DT) and Creative Personality (CP), and key aspects of cognitive ability, personality (Big Five), and trait emotional intelligence (trait EI or trait emotional self-efficacy). The sample consisted of 175 Spanish undergraduates and recent graduates from three university subject domains: Technical & Natural Sciences, Social Sciences, and Arts. Cognitive ability was found to bear little relationship to either index of creativity. In contrast, strong relationships were demonstrated between personality traits, including trait EI, and creativity, some of which varied significantly across subject domains. Results suggest that future research will have to pay particular attention to individual differences in the affective parts of the personality realm that are comprehensively captured by the construct of trait EI.

**Keywords** Trait emotional self-efficacy · TEIQue · Divergent thinking · Creative personality · Big Five · Domain-specificity

## Introduction

The study of creativity has drawn the attention of professionals and researchers in a variety of disciplines, as the concept is considered to be of central importance in many contexts (Runco 2004). There have been recent integrative efforts to describe and delineate the field of creativity research (Batey and Furnham 2006; Plucker et al. 2004). With regards to definitions, many researchers have adopted the “new and useful” definition of creativity (Mumford 2003), which suggests that a creative product is that which is deemed to be novel or original as well as useful or adaptive. Although creativity can be defined relatively succinctly, the examination of the underlying causes and the mechanisms by which it operates has led to greater conceptual diversity. Creativity’s multifaceted nature has been expressed as a constellation of factors such as personality traits, cognitive abilities, cognitive styles, and motivation (Amabile 1996; Eysenck 1993; Mumford and Gustafson 1988).

There is a clear need to consider cognitive as well as non-cognitive variables in the study of creativity. Within the latter variables, personality and emotional aspects seem to play a central role (Batey and Furnham 2006; Sánchez-Ruiz, in press). The main aim of this study is to investigate the association between creativity and emotion-related personality traits within the context of the trait emotional intelligence (trait EI or trait emotional self-efficacy) framework. We also seek to explore the possible

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moderating role of university subject domains in these associations.

#### Divergent thinking and creative personality as indicators of creative potential

In this study, we focus on the individual-oriented approach and, in particular, two important indicators of creativity potential that have been proposed in previous literature: Divergent Thinking (DT; Guilford 1967) and Creative Personality (CP; Gough 1979). We explore the relationships of these two constructs with: cognitive ability, the Big Five personality dimensions, and trait EI (Petrides et al. 2007c) in the total sample, but also within the three different university subject domains; Technical and Natural Sciences (T&N Sciences), Social Sciences, and Arts.

DT tests “require individuals to produce several responses to a specific prompt, in sharp contrast to most standardized tests of achievement or ability that require one correct answer” (Plucker and Renzulli 1999, p. 38). DT tests can be considered as idea-generation measures, which, in addition to covering the traditional aspect of fluency (quantity of ideas), often capture other factors related to creativity, such as flexibility, originality, and elaboration (e.g., Torrance 1990). However, DT should not be considered as synonymous with creativity. DT is generally considered to be a necessary, but not sufficient, condition for creativity, mainly because creativity requires not only novel ideas, but also convergent and evaluative processes to achieve usefulness (Clapham 2001; Runco 2008).

Despite methodological concerns regarding DT tests, including lack of ecological validity (Lubart 2003; Sternberg 2005; see also Kim 2006), the most widely used tests tend to be successful in the identification of creative individuals (Plucker 1999), and DT abilities have, therefore, become well established as indicators of creative potential (Batey et al. 2009b; Furnham et al. 2008; Kaufman et al. 2008).

The second indicator of creativity in our study is Creative Personality (CP). The study of the personality traits of creative people has been very popular in creativity research (see Batey and Furnham 2006 for a review). CP operationalises creativity by capturing potentially creative attributes of the individual, rather than by measuring performance. Its roots lie in the idea that creative people share certain personality traits (Cattell and Drevdahl 1955; Eysenck 1993, 1995; Feist 1998). In a salient empirical attempt to operationalize CP, Gough (1979) developed the Creative Personality Scale (CPS), which has been used in psychometric research (e.g., Carson et al. 2005). The items of this scale are consistent with the personality characteristics repeatedly identified in the literature as correlates of creativity, such as independence of judgment, tolerance of

ambiguity, broad interests, and non-conformity (Batey and Furnham 2008; Barron and Harrington 1981; Feist 1998; McCrae 1987).

#### The role of cognitive ability and personality in DT and CP

The study of the relationship between creativity and cognitive ability has a long tradition (e.g., Sternberg and O'Hara 1999). Empirically, the correlation between DT and IQ is in the range of .20–.40, as has been shown in many studies and meta-analyses (Kim 2005).

In contrast, not many studies have considered the relationships between CP and cognitive ability. This is possibly because they are located at a greater conceptual distance from one another (Cattell 1987), one in the field of personality and the other in the field of intelligence.

Both DT and CP have been related to personality traits. Research based on the Big Five (Costa and McCrae 1985) has shown large correlations between DT and Openness (Chamorro-Premuzic 2006; Furnham et al. 2008; King et al. 1996; McCrae and Costa 1997; Wuthrich and Bates 2001). A positive association between DT and Extraversion has also been reported in various studies (Batey et al. 2009a; Chamorro-Premuzic 2006; Furnham et al. 2008; King et al. 1996; Martindale and Dailey 1996; Wuthrich and Bates 2001).

Less clear are the relations between DT and the other Big Five personality dimensions. Although Conscientiousness has been found to be negatively related (Chamorro-Premuzic 2006), other studies have failed to find this correlation (Furnham et al. 2009). The same has occurred with Neuroticism, as this trait has been positively correlated with DT in some studies (Batey et al. 2009b; Wuthrich and Bates 2001), but not in others (e.g., Martindale and Dailey 1996). Numerous studies have failed to show any correlation between Agreeableness and DT (Furnham et al. 2008; Wuthrich and Bates 2001).

The relationship between CP and personality has also been explored, with positive correlations emerging with Openness and Extraversion (Dollinger et al. 2004; McCrae 1987; Woldfradt and Pretz 2001), and negative correlations emerging with Neuroticism (Dollinger et al. 2004; McCrae 1987).

#### Creativity and affect

Some of the aforementioned findings, in particular those referring to the influence of traits like Neuroticism or Extraversion on DT and CP, suggest that affect-related processes may play an important role in creativity. Research on affect and creativity has taken two main directions. On the one hand, there has been work on mood

induction and creativity (Ashby et al. 1999; Baas et al. 2008; De Dreu et al. 2008; Mumford 2003); on the other hand, researchers have been trying to clarify the role of affect-related normal and psychopathological personality traits in facilitating creativity (Batey and Furnham 2008; Csikszentmihalyi 1990; Feist and Runco 1993; Furnham et al. 2008; Shaw and Runco 1994). In her attempt to develop an integrated theoretical model of affect and creativity, Russ (1993, 1998) argued that traits relating to affective processes may facilitate creative abilities. For example, receptiveness and comfort with intense affect may be linked to increased DT abilities.

Yet there is a methodological and theoretical challenge in addressing not only how creativity is measured, but also how affect-related traits are assessed (Russ 1993). It is important to consider specific traits, like emotion expression, emotion regulation, and self-esteem (Russ 2003) that can be directly linked to creativity. These traits, along with some others conventionally associated with creative individuals, like low self-control, emotionality, impulsivity, and self-motivation (Feist 1998) are efficiently integrated into the trait EI framework.

The construct of trait EI refers to a constellation of emotion-related self-perceptions located at the lower levels of the Eysenckian and Big Five personality hierarchies (e.g., Petrides et al. 2007c). Essentially, trait EI concerns people's self-perceptions of their emotional abilities. An alternative label for the same construct is trait emotional self-efficacy. Trait EI provides a comprehensive operationalization of the affect-related aspects of personality (see Table 1 for the sampling domain). Its roots lie in the distinction between two EI constructs, viz., trait EI and ability EI (see Austin 2009; Petrides and Furnham 2000; Warwick and Nettelbeck 2004). The conceptualization of EI as a personality trait leads to a construct that lies wholly outside the taxonomy of human cognitive ability (Carroll 1993).

Trait EI has been used the main reference framework in areas as diverse as ballet dancing (Petrides et al. 2006), behavioral genetics (Vernon et al. 2008), nursing (Quoidbach and Hansenne 2009), psychoneuroendocrinology (Mikolajczak et al. 2007b), relationships (Smith et al. 2008), work locus of control (Johnson et al. 2009), and forgiveness (Carvalho et al. 2010), among many others.

To date, only a limited number of studies of creativity have been directly undertaken in relation to trait EI. In one of these studies, Guastello et al. (2004) administered the Schutte et al. scale (Schutte et al. 1998) and used DT and CP among other criteria to assess creativity in a sample of undergraduates. Global trait EI was uncorrelated to DT, although it correlated with CP ( $r = .32$ ). This study suggests that trait EI is unrelated to DT, but positively related to CP. However, it is important to replicate these findings

with an inventory that provides comprehensive coverage of the trait EI sampling domain and, more important, to interpret the findings from the perspective of trait EI theory, which links the construct to mainstream models of differential psychology. One of the aims of the present study is to contribute in this direction.

The domain-specific nature of creativity correlates

In a tentative domain-specificity model of creativity resulting from the review of many studies, Kaufman and Baer (2005) argued for the existence of general requirements at a global level, but also of specific requirements that may vary across different domains. This idea also exists in componential models of creativity, wherein general creativity traits are in constant interaction with specific abilities (Amabile 1996; Romo 1997).

The effects of personality traits on creativity have been shown to vary across domains in a number of studies (Batey and Furnham 2006; Feist 1998; Sheldon 1994). Two emotion-related traits have been found to vary most. The first is Sensitivity to emotions, which is related to the trait EI Emotionality factor (which includes facets like Emotion perception and Emotion expression). Artists have shown higher levels of sensitivity, and emotion expressiveness, as well as a greater interest in internal mental life (Drevdahl 1956; Feist 1998). The second domain-dependent trait is Emotional instability, which is inversely related to the trait EI Self-control factor (which includes facets like Emotion regulation and Stress management). Specifically, it has been shown that artists are more impulsive, more anxious, and less able to control their emotions than scientists (Feist 1998; Götz and Götz 1979; Sheldon 1994). However, the different definitions and criteria of creativity used in these studies makes it difficult to draw unequivocal conclusions regarding DT and CP.

Studies have typically considered two traditional domains (sciences and arts; Carson et al. 2005; Feist 1998). In the present research, we decided to widen this spectrum by investigating three domains: Technical & Natural (T&N) Sciences, Social Sciences, and Arts.

The novelty of our research concerns the study of two different creativity indicators (DT and CP) and their relationships with trait EI, as well as the exploration of university subject domain as a possible moderator variable of these relationships. The study also aims to revisit previous findings from the literature on the association of DT and CP with cognitive ability and personality.

Intelligence has been seen as a necessary precursor to developing creative ability (Mednick 1962). Cognitive ability and DT are part of the cognitive pillar of individual differences (the other pillar being personality), and tend to be positively intercorrelated (e.g., Kim 2005). CP, in

**Table 1** The trait EI sampling domain along with facet descriptions and internal consistencies

Factors and Facets	High scorers perceive themselves as...	Mean	SD	$\alpha$
Well-being				
Self-esteem	...successful and self-confident.	4.6	.83	.80
Trait happiness	...cheerful and satisfied with their lives.	5.5	.92	.83
Trait optimism	...confident and likely to “look on the bright side” of life.	4.9	1.02	.84
Self-control				
Emotion regulation	...capable of controlling their emotions.	4.1	.87	.81
Stress management	...capable of withstanding pressure and regulating stress.	4.3	1.00	.82
Impulsiveness (low)	...reflective and less likely to give into their urges.	4.4	.88	.72
Emotionality				
Emotion perception (self and others)	...clear about their own and other people’s feelings	4.6	.84	.76
Emotion expression	...capable of communicating their feelings to others.	4.3	1.21	.87
Relationships	...capable of having fulfilling personal relationships.	5.4	.66	.55
Empathy	...capable of taking someone else’s perspective.	5.1	.78	.74
Sociability				
Social awareness	...accomplished networkers with excellent social skills.	4.6	.82	.77
Emotion management (others)	...capable of influencing other people’s feelings.	4.5	.83	.72
Assertiveness	...forthright, frank, and willing to stand up for their rights.	4.6	.83	.73
Adaptability <sup>a</sup>	...flexible and willing to adapt to new conditions.	4.4	.81	.72
Self-motivation <sup>a</sup>	...driven and unlikely to give up in the face of adversity.	4.7	.86	.79
Global trait EI		4.7	.54	.95

<sup>a</sup> This facet is not used in any factor, but feeds directly into the global trait EI score

contrast, belongs to the personality realm, and there are no theoretical or empirical reasons for it to be associated with cognitive ability. Hence, we tested the following hypotheses:

H1 Cognitive ability will be positively correlated with DT.

H2 Cognitive ability will be orthogonal (uncorrelated) to CP.

We also considered whether the relationships between personality factors and creativity are the same across the two creativity indicators used in this study. Openness to experience refers to mental flexibility, intellectual curiosity, and willingness to experiment, which has theoretical and empirical links to creativity (e.g., Wuthrich and Bates 2001). Extraverts show high levels of activity, need for stimulation and excitement, and tend to be assertive. Similarly, creative individuals tend to look for new experiences and ideas, held non-conformative views and show independence of judgment. Also, as Sternberg and Lubart (1995) pointed out, creative individuals put effort into convincing others about the quality of their ideas, and that requires networking skills, which is an aspect of Extraversion. In sum, we can hypothesize a positive association between creativity and the personality traits of Openness

and Extraversion (e.g., Batey, Chamorro-Premuzic, et al. 2009). The following hypotheses were advanced:

H3 Openness will be positively correlated to both DT and CP.

H4 Extraversion will be positively correlated to both DT and CP.

Previous studies have found trait EI to be positively correlated to CP, but unrelated to DT. However, these studies were conducted with measures that overlook key aspects of the construct, including Emotionality (e.g., emotion expression and emotion perception), Self-control (e.g., stress management and low impulsiveness), and Sociability (e.g., assertiveness and social awareness), which could well be relevant to creativity. Given that the TEIQue provides comprehensive coverage of trait EI, we hypothesized that:

H5 The four trait EI factors will jointly predict both creativity criteria: DT and CP.

As noted above, there exist systematic differences in the relationship between traits and creativity across different university subject domains. Specifically, artists have shown higher levels of sensitivity to emotions and lower levels of emotional stability than others (Feist 1998). Some tentative

explanations for this refer to the emotional nature of much artistic work, which sometimes requires the artists to express hardship and adversity (Richards 1999; Russ 1993), and to the struggles that may accompany the artistic profession (Marchant-Haycox and Wilson 1992). We aimed to test whether this also applies within the Arts students in our sample. Hence, we hypothesized:

H6 The relationship between DT and the Emotionality and Self-control factors of trait EI will be different in the Arts domain than in other groups, with the associations being significantly more positive (DT-Emotionality) or negative (DT-Self-control) among Artists than among non-Artists.

## Method

### Participants

Participants were 175 (93, female) Spanish undergraduates and recent graduates, with a mean age of 25.76 years ( $SD = 7.07$ ). The sample included students from the following domains: T&N Sciences ( $n = 64$ ; comprising engineering, computer sciences, chemistry, and biology), Social Sciences ( $n = 69$ ; comprising psychology, psychopedagogy, social work, and education), and Arts ( $n = 46$ ; comprising drama, music and visual arts). Before grouping engineering and computer science students ( $n = 42$ ) together with chemistry and biology students ( $n = 22$ ), and drama and music students ( $n = 25$ ) together with visual arts students ( $n = 21$ ), we ensured that there were no significant differences in their mean scores.

### Measures

*Divergent Thinking* was assessed by the *Torrance Test of Creative Thinking* (TTCT-Figural Form B; Torrance 1974; Spanish adaptation of scoring criteria by Ferrando et al. (2007). This DT test consists of three different figurative activities (each taking 10 min). The test covers four DT dimensions: fluency (number of meaningful responses given), flexibility (number of changes of response category), originality (number of statistically infrequent responses), and elaboration (number of items to embellish the ideas). Despite criticisms pertaining to its factor structure (see Kaufman and Baer 2006), the TTCT has shown both content and predictive validity (Kim 2006). We estimated the inter-rater reliability between two raters using a two-way random intraclass correlation model, following Shrout and Fleiss (1979). The Intraclass Correlation Coefficients for the TTCT scores were ICC (3, 1) = .77, .94, .85, .48, and .79, respectively.

*Creative Personality* was assessed using the *Creative Personality Scale* (CPS; Gough 1979). This scale measures CP by means of 30 trait adjectives, of which 18 describe more creative personalities (e.g., inventive and imaginative) and 12 describe less creative personalities (e.g., conservative and submissive). It has been cross-validated in a sample of 1,700 individuals (Gough 1979) and administered to different populations (e.g., research scientists and advanced architecture students; Domino 1994). It has been found to be a reliable and valid measure for the operationalization of creative personality (Carson et al. 2005; Gough 1979; Kaduson and Schaefer 1991; McCrae 1987). A 20-item Spanish translation of the original scale was used, whose internal consistency was .66 in this sample.

*Cognitive ability* was measured using the *Primary Mental Aptitudes - Factor R "Reasoning"* (PMA; Thurstone and Thurstone 1984). This 6-minute, 30-item test requires participants to discern the pattern in a sequence of letters, and select a response option (from six alternatives) indicating the next letter that would continue the series. It is considered a good indicator of inductive reasoning (e.g., Hertzog and Bleckley 2001), which is a first-order factor (i.e., Stratum 1) in the hierarchical structure of cognitive ability, located under Gf (Carroll 1993). Since the *g* factor is closer to Gf than to Gc (crystallized cognitive ability), we used the PMA-R as a proxy of general cognitive ability, in line with previous studies (e.g., Colom et al. 2003). The internal consistency of the total score in this sample was .88.

*Personality* was assessed using the short form of *Goldberg's Bipolar Adjectives* (Goldberg 1992; Spanish adaptation by García et al. 2004). This is a 25-item questionnaire consisting of pairs of adjectives rated on a 9-point Likert scale. The factors measured are consistent with the Big Five dimensions (Smith and Snell 1996), namely Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A) and Conscientiousness (C). This questionnaire correlates strongly with the subscales of the NEO-FFI (Hong et al. 2008). In this sample, the internal consistencies of the five factors were .81, .88, .75, .74, and .77, respectively.

*Trait Emotional Intelligence* was assessed using the *Trait Emotional Intelligence Questionnaire*<sup>1</sup> (TEIQue v. 1.50; Petrides 2009; Spanish adaptation by Pérez-González 2010). The TEIQue is a 153-item questionnaire, covering 15 emotion-related facets and 4 factors. It has shown satisfactory psychometric properties in various studies (Freudenthaler et al. 2008; Mikolajczak et al. 2007a; Petrides et al. 2007b). Brief descriptions of the trait EI facets, along with descriptive statistics and internal consistencies for the present sample, are presented in Table 1.

<sup>1</sup> All forms and versions of TEIQue are available, free of charge, for research purposes, from [www.psychometriclab.com](http://www.psychometriclab.com).

Procedure

Participants completed the TTCT, the PMA-R, the TEI-Que, the CPS, and Goldberg’s questionnaire either individually or in small groups. An experimenter timed and oversaw all sessions. The testing session lasted approximately 70 min. All participants were debriefed and received an individualized feedback report.

Results

Descriptive statistics and reliability coefficients

The descriptive statistics and indicators of reliability are presented in Table 2.

Correlations

Total sample correlations

The correlation between CP and DT was low to moderate ( $r = .22, p < .01$ ). Table 3 shows the correlations between the creativity indicators and the other study variables.

Firstly, cognitive ability was unrelated to either CP or DT. Secondly, with respect to the Big Five dimensions, CP correlated with Openness to experience ( $r = .51, p < .001$ ) and Extraversion ( $r = .25, p < .01$ ), while DT correlated with Neuroticism ( $r = .23, p < .01$ ) and Openness ( $r = .29, p < .001$ ). Low positive correlations between the fluency and flexibility subscales of DT with Conscientiousness were also found ( $r = .16, p < .05$ ;  $r = .19, p < .05$ , respectively). Thirdly, there was a positive correlation between CP and global trait EI ( $r = .29, p < .001$ ), mainly involving the Sociability factor ( $r = .40, p < .001$ ). CP also correlated with Well-being ( $r = .19, p < .05$ ) and Self-control ( $r = .19, p < .05$ ). Only the Self-control factor was significantly correlated with the total DT score ( $r = -.10, p < .05$ ).

Domain-specific correlations

Table 4 presents the key variable intercorrelations broken down by university domain. Cognitive ability was not related to CP in any domain and only modestly related to DT in the Social Sciences ( $r = .30, p < .05$ ). Only two variables were consistently associated with at least one of the two creativity criteria across all three domains, namely

**Table 2** Means, SDs, and internal consistencies for the key variables in the total sample ( $N = 175$ ) and by subject domain (T&N sciences— $n = 64$ , social sciences— $n = 69$ , and arts— $n = 46$ )

Variable ( $\alpha$ )	Means (SDs)			
	Total	T&N sciences	Social sciences	Arts
TTCT subscales				
Fluency (.31)	19.8 (7.61)	20.8 (7.91)	19.9 (6.95)	18.2 (7.97)
Flexibility (.33)	15.0 (5.86)	15.3 (5.44)	15.7 (5.99)	13.4 (6.07)
Elaboration (.85)	61.0 (23.10)	58.2 (19.3)	59.6 (23.4)	66.9 (26.8)
Originality (.66)	41.2 (14.6)	40.6 (15.3)	41.1 (13.8)	42.2 (15.5)
Total (.83)	137.7 (35.51)	135.1 (37.8)	137.0 (391)	142.1 (42.7)
CPS (.66)	2.36 (3.09)	1.87 (2.89)	1.84 (2.91)	3.73 (3.21)
PMA-R (.88)	18.7 (5.25)	19.7 (4.99)	18.0 (5.25)	18.1 (5.48)
Big Five				
Neuroticism (.81)	27.7 (6.86)	29.1 (6.83)	27.2 (6.25)	26.9 (6.38)
Extraversion (.88)	30.4 (7.56)	30.0 (7.45)	31.8 (7.47)	28.8 (7.65)
Openness (.75)	33.3 (5.26)	32.7 (5.65)	32.4 (5.16)	35.1 (4.44)
Agreeableness (.74)	35.3 (4.88)	35.2 (4.23)	35.6 (4.83)	34.8 (5.75)
Conscientiousness (.77)	31.4 (6.63)	32.3 (6.99)	31.5 (5.95)	30.3 (6.53)
TEIQue factors				
Well-being (.84)	5.10 (.80)	5.03 (.74)	5.16 (.77)	5.09 (.80)
Self-control (.80)	4.32 (.78)	4.33 (.83)	4.28 (.71)	4.35 (.82)
Emotionality (.70)	4.89 (.65)	4.75 (.60)	5.02 (.63)	4.90 (.70)
Sociability (.74)	4.61 (.67)	4.51 (.66)	4.59 (.70)	4.77 (.63)
Global (.88)	4.73 (.54)	4.66 (.51)	4.77 (.53)	4.78 (.51)

Internal consistencies ( $\alpha$ ) are for the total sample

T&N technical and natural, TTCT Torrance Test of Creative Thinking, CPS Creative Personality Scale

**Table 3** Bivariate correlations between key variables in the total sample ( $N = 175$ )

	CP	DT subscales				Total DT
		Fluency	Flexibility	Elaboration	Originality	
PMA-R	-.07	.05	.02	.10	.01	.08
Big Five factors						
Neuroticism	-.13	.06	.22	.18*	.27**	.23**
Extraversion	.25**	.07	.11	.00	.06	.06
Openness	.51***	.12	.14	.24**	.21**	.29***
Agreeableness	.10	.07	.05	.05	-.06	.03
Conscientiousness	.07	.16*	.19*	-.04	.04	.06
TEIQue						
Well-being	.19*	.02	.03	-.09	-.08	-.08
Self-control	.19*	.00	.07	-.07	-.16*	-.10*
Emotionality	.12	.03	.12	.08	-.09	.02
Sociability	.40***	.04	.05	.08	.06	.13*
Global trait EI	.29***	.02	.07	-.02	-.09	-.03

The correlation between CP and Total DT was  $r = .22, p < .01$

DT divergent thinking, CP creative personality

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Openness and trait EI Sociability (the latter mainly through its constituent facet, Assertiveness). Trait EI Sociability was positively correlated with CP in T&N Sciences ( $r = .47, p < .001$ ) and Social Sciences ( $r = .38, p < .01$ ), and with DT in the Arts ( $r = .20, p < .05$ ).

Neuroticism was negatively related to CP in the T&N Sciences ( $r = -.27, p < .05$ ), but positively related to DT in the Arts ( $r = .60, p < .001$ ). Self-control was positively correlated with CP in T&N Sciences ( $r = .40, p < .001$ ), but negatively related to DT in the Arts ( $r = -.51, p < .001$ ). Extraversion was positively related to CP in both T&N Sciences ( $r = .35, p < .01$ ) and Social Sciences ( $r = .26, p < .05$ ). Global trait EI was related to CP only in the T&N Sciences ( $r = .44, p < .001$ ) and unrelated to DT.

### Regressions

A two-step hierarchical regression was performed with DT as the criterion (see Table 5). At step 1, with the four trait EI factors in the equation,  $F(4, 166) = 2.44, p < .05, R^2 \text{ Adj} = .03$ ; only Sociability was a significant predictor of DT ( $\beta = .26, t = 2.65, p < .01$ ). At step 2, with the subject domains and the Arts x Self-Control and Arts x Emotionality interactions added to the equation,  $F(8, 162) = 3.71, p < .001, R^2 \text{ Adj} = .11$ ; Sociability remained a significant positive predictor ( $\beta = .23, t = 2.38, p < .05$ ). In addition, both interactions reached significance levels ( $\beta = -.37, t = 4.10, p < .001$  and  $\beta = .20, t = 2.24, p < .05$ , respectively). Figure 1 illustrates the simple slopes for the two multiplicative terms.

As can be seen in that Figure, the relationship between Self-control and DT was negative in the Arts group, but positive in the other two groups in the study. In contrast, the relationship between Emotionality and DT was positive in the Arts group, but negative in the other two groups.

### Discussion

This study explored the interrelationships between two creativity criteria (DT and CP), with cognitive ability, personality, and trait EI. Cognitive ability did not correlate with either creativity criterion. As for personality traits, Openness was positively correlated to both DT and CP in the general sample and also fairly uniformly across the different groups. Extraversion was positively correlated to CP in the general sample and in the T&N Sciences and Social Sciences, but not in the Arts group. Trait EI predicted both CP and DT, with its Sociability factor being the strongest constituent predictor. The trait EI Emotionality and Self-control factors had differential effects on DT in the Arts group than in the other two groups.

### Cognitive ability and DT/CP

Results did not support our first hypothesis [H1], since cognitive ability was unrelated to DT in the total sample, in contrast to findings in previous research (e.g. Furnham et al. 2008; Kim 2005). DT clearly involves more than just cognitive abilities (Batey and Furnham 2006), and the DT

**Table 4** Correlations between creativity indicators and study variables across subject domains (T&N sciences— $n = 64$ , social sciences— $n = 69$ , and Arts— $n = 46$ )

	T&N sciences		Social sciences		Arts	
	CP	DT	CP	DT	CP	DT
PMA-R	.08	.10	.06	.30*	-.21	-.10
Big Five factors						
Neuroticism	-.27*	.08	-.18	.06	.13	.60***
Extraversion	.35**	-.04	.26*	.01	.28	.20
Openness	.59***	.33**	.46***	.28*	.39**	.20*
Agreeableness	.10	-.18	.10	.07	.12	.18
Conscientiousness	.10	-.01	.07	.29*	.01	-.17
TEIQue						
Well-being	.31*	-.32	.12	-.07	.16	-.12
Self-control	.40***	.05	.12	.09	-.03	-.51***
Emotionality	.28*	-.12	-.03	-.02	.11	.16
Sociability	.47***	.02	.38**	.09	.25	.20*
Global trait EI	.44***	-.05	.19	.03	.17	-.06

T&N technical and natural, DT divergent thinking, CP creative personality

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

**Table 5** Hierarchical regressions of DT onto the trait EI factors, university subject domains and the arts  $\times$  self-control and arts  $\times$  emotionality interactions

	Divergent thinking	
	$\beta$	$t$
Step 1		
Well-being	-.14	1.46
Self-control	-.13	1.55
Emotionality	-.02	.19
Sociability	.26	2.65**
$F(4, 166)$	2.44*	
Adj $R^2$	.03	
Step 2		
Well-being	-.13	1.34
Self-control	.09	.91
Emotionality	-.16	1.45
Sociability	.23	2.38*
Sciences	-.09	1.06
Arts	.00	.05
Arts $\times$ self-control	-.37	4.10***
Arts $\times$ emotionality	.20	2.24*
$F(8, 162)$	3.71***	
Adj $R^2$	.11	
$\Delta F(4, 162)$	4.76 ***	
$\Delta R^2$	.10	

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

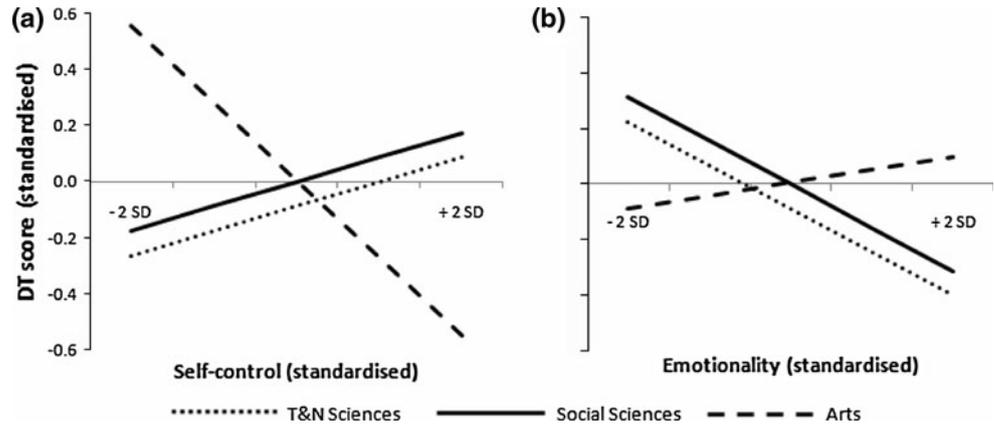
test used (TTCT) assesses not only fluency, the factor traditionally related to cognitive ability (Furnham et al. 2008; Hargreaves 1927), but also other, more personality-

oriented components (Batey et al. 2009a; Woody and Claridge 1977). Nevertheless, a moderate-to-low relationship would still have been expected. The lack of such a relationship in our study could be due to the restricted range of cognitive ability in university students. An alternative explanation would be that, as the DT test in this study was figural, it would rely less upon traditional cognitive abilities than a verbal DT test (Carroll 1993). The extent to which verbal and figural tests of DT are equivalent has been questioned by many researchers (Carroll 1993; Plucker 1999; see also Lubart 2003). As predicted in [H2], cognitive ability did not correlate with CP.

Personality and DT/CP

Moderate-to-high correlations were found between Openness and both DT and CP, thus supporting our third hypothesis [H3]. The relationship between Openness and creativity has been established in many studies, for both DT (e.g., Chamorro-Premuzic 2006; Furnham et al. 2008) and CP measures (e.g., McCrae 1987). Creative and open individuals are more likely to be flexible and imaginative; they prefer complexity, explore new ideas, tolerate ambiguity and are able to experience a variety of thoughts and feelings at the same time (McCrae and Costa 1997). The relationship between Openness and CP may be partially attributable to item overlap between the two constructs (e.g., broad interests and independence of judgment), and to the possibility that Openness acts as a facilitator of DT (McCrae 1987). In the present study, Openness emerged as an important predictor of creativity, regardless of whether

**Fig. 1** Simple slopes data plots of the bilinear self-control  $\times$  arts interaction (a), and the bilinear emotionality  $\times$  arts interaction (b) for DT



the latter was defined in terms of personality or performance.

Hypothesis [H4] was partially supported by the results. While Extraversion was positively correlated with CP, no correlation was found with DT. A possible explanation for this is that extraverts may perform well in short tests (Furnham et al. 2008), but not in longer ones, such as that used in the present study.

With regard to other personality traits, we found correlations between Conscientiousness and aspects of DT (fluency and flexibility), which implies that a degree of responsibility and perseverance may be important in the process of creative thinking (De Dreu et al. 2008). However, the relationship between DT and Conscientiousness should be further investigated, since it has been negative in other studies (Chamorro-Premuzic 2006). Future research may investigate the extent to which Conscientiousness is positively correlated with DT in longer testing sessions.

Neuroticism was positively correlated with DT, although not with CP, a finding in line with previous work (e.g., Wuthrich and Bates 2001). In general, DT appears to be positively related to negative emotions and vulnerability to stress, with high scores also linked to affective disorders (Batey and Furnham 2008; Furnham et al. 2008) and emotional instability (Batey et al. 2009b). Mechanisms underlying these phenomena may relate to the elements of uncertainty involved in some creative work which can provoke stress and anxiety to the individual (Feist 1999). Runco (1994) suggests that highly creative individuals seek out and thrive on tension and use creativity to overcome difficulties. However, it is noteworthy that the association between Neuroticism and creativity seems to depend on how the latter is assessed (Batey et al. 2010), and that, when analyzed by university subject domains, it was restricted to the Arts group only.

#### Trait EI and DT/CP

One novel contribution of this study was the exploration of trait EI in relation to the two creativity criteria. At the

global level, there was no relationship between trait EI and DT. As can be seen in the correlations, and also in the regression analysis, this was largely due to the differential effects of the four trait EI factors. At the factor level, Self-control was negatively associated with DT, reinforcing the crucial point that high trait EI scores are not inherently adaptive in every situation (see Petrides et al. 2011; Sevdalis et al. 2007).

The Self-control factor of trait EI relates to stress management and emotion regulation. Although there is controversy about the relationship between creativity and negative emotions (see Sánchez-Ruiz, in press for a review), research indicates that activating emotional states with negative tone, such as stress, may be creativity-enhancing in terms of perseverance. Persistent hard work and thorough exploration can be conducive to the DT aspects of fluency (as the generation of many ideas within a few categories), and originality (De Dreu et al. 2008). It is important to note that this low Self-control-DT link, as in the case of Neuroticism, was only found in the Arts group.

In contrast, positive correlations were found between trait EI (at the global and factor levels) and CP. This divergence between CP and DT suggests that the links between creativity and Self-control vary across the various indicators of creativity. A negative effect of trait EI on creativity may be evident on DT, but not on CP, due to the fact that socially undesirable variables are more likely to relate to performance than to self-report measures (Petrides et al. 2007a).

Taken together, the four trait EI factors successfully predicted both CP and DT, thus supporting our fifth hypothesis [H5]. Sociability was the best predictor in both cases, a finding which seemingly contradicts the view of creative people as being introverted, cold, and asocial (Eysenck 1993, 1995; Feist 1998). However, the findings do not indicate that creative people are socially warmer or more empathic (these facets are collected in the trait EI Emotionality factor, which was unrelated to the creativity criteria in the total sample). In contrast, the Sociability

factor involves the qualitatively different aspects of Social awareness, Emotion management (in others), and Assertiveness. Social awareness and Emotion management are necessary characteristics for creative people to communicate their ideas and persuade others, while Assertiveness covers the non-conformist and autonomous element associated with creativity (Eysenck 1993). It appears that the link between trait EI Sociability and creativity has less to do with interpersonal factors than with independence of judgment, confidence and lack of repression (Barron and Harrington 1981; McCrae 1987).

#### Trait EI emotionality and self-control within the arts domain

Another novel contribution of this study involved the investigation of university domain as a possible moderator variable. Significant interactions were found in the prediction of DT performance between Arts and Self-control (negative), and Arts and Emotionality (positive), thus supporting [H6]. The relationship between Self-control and DT was significantly more negative in the Arts group, than in the other two groups, whereas the relationship between Emotionality and DT was positive in the Arts group, but negative in the other two groups.

This supports the view of the creative artist as someone with particular sensitivity to emotion and difficulties in controlling stress and anxiety (Feist 1998; Götz and Götz 1979). High sensitivity has been proposed as a requirement for creative work, while low emotional stability seems to be an additional specific advantage in the Arts (Feist 1998). It may also be the case that artists have a tendency to complete creative tasks in a way that consciously accords with the stereotype of them being emotional and unstable. Studies have shown that artists tend to believe in implicit theories about the nature of their creativity, including that it represents a way to vent emotions and to resolve internal conflicts (Romo and Alfonso 2003).

#### Variable interrelationships across domains

Cognitive ability was the variable displaying the weakest associations with the creativity indicators in this study.

Trait EI was more strongly related to CP in T&N Sciences than in Social Sciences, suggesting that creative social scientists are not necessarily more emotionally confident than their creative colleagues in other disciplines. This partially contradicts the hypothesis of Baer and Kaufman (2005), that emotional intelligence would be more influential for creativity within the thematic area of empathy and communication. The composition of the T&N

subsample may account for the correlations between trait EI and CP within this group. Other studies have shown slight differences between Natural and Technical Science students in trait EI (Sánchez-Ruiz et al. 2010) and it could be the case that the relationship between trait EI and CP also differs in those groups. Future studies on the domain-specificity of creativity with sufficient sample size can benefit from splitting these subdomains of Technical and Natural Sciences.

Neuroticism and trait EI Self-control were the most domain-dependent variables in their relationships with the two creativity criteria. Arts students with higher scores on Neuroticism and lower scores on trait EI Self-control scored higher in DT. This may be a function of the emotional vulnerability and propensity to experience negative feelings associated with the artistic population (Burch et al. 2006; Feist 1998). An explanation for this may be that the emotional ambivalence and lability of creative artists can help them deal with affect-laden information and express negative emotions (Richards 1999; Russ 1993), aspects that are often intrinsically related to the artistic endeavor. Some authors have attributed the artists' emotional instability to the stressors they face, such as high competitiveness among peers, geographical mobility, and occupational criticism (e.g., Marchant-Haycox and Wilson 1992). However, in the present sample, the possible impact of such factors would be limited because participants were undergraduates and recent graduates.

In contrast, T&N Science students with creative personalities scored lower in Neuroticism and higher in Self-control, which agrees with Eysenck's (1993) view of Neuroticism as an asset in the arts and a liability in the sciences. It is, therefore, likely that the relationship between emotional instability and creativity is moderated by third variables, including the domain of application.

At the other end, Openness and trait EI Sociability were the most domain-independent variables. The former was moderately-to-highly related to both DT and CP across all domains, which suggests that it is a general requirement for creativity (see also Furnham et al. 2008; McCrae 1987). The Assertiveness facet of trait EI Sociability was positively associated with at least one of the two creativity criteria across all domains, which is explained by the independence of judgment and non-conformity that characterize creative people (Gough 1992).

#### Limitations and future research

Three limitations may be worth highlighting in relation to this study. Firstly, we used the figurative form of the TCTT. As the meta-analysis of Carroll (1993) demonstrated, figural and verbal creativity are not identical, and different conclusions might have been drawn had we used the verbal form of the TTCT. Secondly, using a long version of the Big Five

measure could have uncovered further relationships between personality traits and the two creativity indicators. Lastly, unlike in the case of DT, we have to accept the possibility that the relationships between CP and personality traits may be inflated due to common method variance.

Future research will benefit from incorporating analyses on samples drawn from a wider range of specific academic and occupational disciplines. Recent research has proposed a domain-based classification of creativity along different lines than those used in the present study (Feist 2004; Silvia et al. 2009). Furthermore, it has been established that there are different theoretical levels of domain-specificity and creativity; apart from the general thematic fields which can be identified as the domains we used in the present study (e.g., Arts), there are also specific subdomains (e.g., music), and even micro-domains (e.g., percussions; Baer and Kaufman 2005). Therefore, in future work, stratified samples should ideally be used, drawing participants from each of those different levels. This will permit more detailed investigations of the specificity of the determinants and covariates of creativity.

## Conclusions

The divergence in the patterns of correlations between personality traits and the two measures of creativity used in this study (DT and CP) has been previously reported in other studies (Furnham et al. 2008; McCrae 1987). We showed that the same divergence holds true for the four trait EI factors. Whilst it is undoubtedly true that measurement of creative potential is more reliable when it is based upon multiple tests (Batey and Furnham 2006; Dailey et al. 1997), the variation in these measures' correlates also implies that summing up scores across different indicators of creativity is unsatisfactory.

A number of studies have explicitly searched for, and found, different correlates for different measures of creativity (Batey and Furnham 2006; Woldfradt and Pretz 2001). Near-zero correlations between purportedly complementary indicators of creativity have also been reported (Clapham 2004). It is clear that creativity research should be very explicit about which indicators are used and why. Irrespective of such methodological considerations, the present study demonstrates that any comprehensive investigation of the determinants and consequences of creativity needs to pay full attention to the emotional aspects of personality, as well as to the specific domains and contexts of application.

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