



## Personal factors of creativity: A second order meta-analysis



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### ABSTRACT

This article integrates seven meta-analyses of individual factors associated with creativity and innovation and reports effects based on one ( $r$ ) or two or more ( $\bar{r}$ ) meta-analyses. Emotional intelligence ( $r = .31$ ), divergent thinking ( $\bar{r} = .27$ ), openness to experience ( $\bar{r} = .22$ ), creative personality ( $\bar{r} = .21$ ), intrinsic motivation ( $\bar{r} = .20$ ), positive affect ( $\bar{r} = .19$ ), and androgyny ( $r = .19$ ) are related to creativity. Age ( $r = .17$ ), intelligence ( $\bar{r} = .17$ ), extraversion ( $\bar{r} = .13$ ), self-efficacy ( $\bar{r} = .13$ ), and extrinsic motivation ( $r = .11$ ) were also moderately associated with innovation. Pro-risk attitudes ( $r = .08$ ) and being female ( $r = .07$ ) were weakly associated with creativity. Results are discussed, explanatory processes described, and practical implications for organizations examined.

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### Factores personales y personalidad: metaanálisis de segundo orden

#### RESUMEN

Este artículo integra siete meta-análisis sobre factores individuales asociados a la creatividad e innovación y estima el efecto en base a uno ( $r$ ) o varios ( $\bar{r}$ ) de ellos. Entre los rasgos que se asocian positivamente a la creatividad se encuentran la inteligencia emocional ( $r = .31$ ), el pensamiento divergente ( $\bar{r} = .27$ ), la apertura a la experiencia ( $\bar{r} = .22$ ), la personalidad creativa ( $\bar{r} = .21$ ), la motivación intrínseca ( $\bar{r} = .20$ ), la afectividad positiva ( $\bar{r} = .19$ ) y la androginia ( $r = .19$ ). La edad ( $r = .17$ ), la inteligencia ( $\bar{r} = .17$ ), la extraversión ( $\bar{r} = .13$ ), la auto-eficacia ( $\bar{r} = .13$ ) y la motivación extrínseca ( $r = .11$ ) se asociaron con menor fuerza a la innovación. Una actitud favorable al riesgo ( $r = .08$ ) y ser mujer ( $r = .07$ ) se han asociado débilmente a la creatividad. Se discuten los resultados y posibles procesos explicativos y las implicaciones prácticas para el ámbito organizacional.

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Numerous studies and interventions exist on the topic of creativity in the domains of education, work, art, science, and in society in general (Artola et al., 2012; Garaigordobil & Pérez, 2004). This thriving development exists side by side with an open debate on how to measure, apply, and develop creativity (Garaigordobil, 2003). While it has been shown that creativity is a basic human trait

(Artola et al., 2012), research has allowed us to understand that it does not depend exclusively on stable characteristics (Averill, 2004), but that it is the result of individual, cognitive, affective, behavioral, and contextual processes (Amabile, Barsade, Mueller, & Staw, 2005; Csikszentmihalyi, 2011; Sternberg & Lubart, 1995). Creativity may be understood as a human resource to deal with the challenges of life, supporting psychological and social adaptation (Artola et al., 2012; da Costa & Páez, 2015). The relationship between creativity and intelligence has been widely debated, and while there is agreement that very creative people are also intelligent, a high IQ it is not a necessary nor a sufficient precondition for high creativity (Garaigordobil, 2003; Gardner, 2010). Those

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studying creativity agree that there are two principal aspects that define creativity: a) novelty – creative work has to be original and different in some way from previous work (Amabile, 1996; Feldman, Csikszentmihalyi, & Gardner, 1994; Runco, 2014), and b) quality – the new product must be deemed suitable, even useful, by a reference group with respect to a problem or situation (Sternberg & Kaufman, 2010). Creativity can be analyzed as a personal attribute, a process, a product, and as the context which enables it (Baer, 2010).

In this study, we review personal factors of creativity and innovation. To this end, the available meta-analyses on the subject (see Table 1) are synthesized and the impact of the results is discussed in terms of the work domain. Before this, we will review the relationship between creativity and innovation, given that the latter is the application of the former in organizations. We will also investigate the creative context and process in order to highlight the role of personal factors in creativity.

### Creativity and innovation

Both concepts share the generation of new ideas and practices. Innovation is the successful implementation of creative ideas (Hennessey & Amabile, 2010) and in this sense is understood as a broad process which includes the generation of ideas or creativity but also the application of these in real environments (at work, in education, etc.). Creativity is about absolute novelty, while in innovation relative newness may include the application in a new or different way of products, procedures, or processes which have already been used in a different place (Anderson, De Drew, & Nijstad, 2004).

### Social context and creativity

The context in which creativity is developed is a further factor to take into account in its analysis (Baas, De Drew, & Nijstad, 2008; Davis, 2009; Hammond, Neff, Farr, Schwall, & Zhao, 2011; Hülsheger, Anderson, & Salgado, 2009b; Hunter, Bedell, & Mumford, 2007; Kozbelt, Beghetto, & Runco, 2010; Ma, 2009). We propose an interactional model which suggests that in order to analyze innovation in organizations it is necessary to consider different levels: individual, group, and organizational (Amabile, 1996; Csikszentmihalyi, 2011; Hülsheger et al., 2009b; Sternberg & Lubart, 1995). An organizational context rich in resources and with complex and autonomous roles reinforces creativity (Costa, Páez, Sánchez, Gondim, & Rodríguez, 2014), while it is in the interaction with the personal factors of creativity (see Table 2) that innovation is reinforced.

### Creativity as a process

Different authors (see for example Amabile, 1996; Basadur, Basadur, & Licina, 2012; Csikszentmihalyi, 2011; Ma, 2009) have proposed models of stages in the creative process, such as: 1) preparation stage, with immersion in the problems inherent in a task and/or in something that arouses curiosity; 2) incubation stage, with formulation of problems or conceptualization of hypothesis; 3) generation of solutions or assembling the pieces of a puzzle (Csikszentmihalyi, 2011); 4) generation of criteria to evaluate appropriate solutions, involving communication, evaluation, modification and/or validation of ideas for the solution of the problem; and 5) selection, solution, and application, involving decision making or implementation of the proposed solution (product, ideas and practices) or innovation (Amabile, 2013; Basadur et al., 2012; Hammond et al., 2011). This last stage can be included in a process

of combining the categories or reorganizing knowledge depending on the complexity of the problem.

Prior knowledge will be decisive in the first and second stages, with divergent thinking (DT) playing an important role in stages three and four, and convergent thinking being essential for the final stage (Csikszentmihalyi, 2011; Ma, 2009; Simonton, 2012). The meta-analyses have revealed that personality traits influence the generation of ideas more strongly, while the contexts in which they are developed have greater influence on the application stage (Hammond et al., 2011).

### Individual characteristics of creativity favoring the process and product of creativity

Sternberg and Lubart (1995) propose that personality, intelligence, knowledge, thinking style, motivation, and environment are factors associated with creativity. While the first five are individual factors corresponding to the creative person, we also need to consider given characteristics such as age and gender, acquired characteristics such as education, and other individual attributes such as attitude, affect, and emotional intelligence (Garaigordobil, 2003, p. 151; see Table 2 for definition and examples of items).

With respect to given characteristics, like gender and age, previous reviews suggest a positive relationship between being a woman and creativity. Narrative reviews (Baer & Kaufman, 2008) find many results with no difference between genders, although some slightly favor being female as opposed to male. The results of one study of gender identity and creativity found that subjects who were both “feminine” or expressive and instrumental or “masculine” (androgynous) were more creative than people who scored low on both dimensions. Highlighting the importance of instrumentality, the participants who reported strongly instrumental or masculine gender characteristics showed greater creativity (Stoltzfus, Nibbelink, Vredenburg, & Thyrum, 2011). In terms of the development of creativity related to age, some studies suggest a curvilinear progression, peaking between 30 and 40 year of age and declining after 40. Regarding acquired characteristics like education, it has been suggested that the level of education is associated with creativity, although it is not a determining factor beyond a certain level (Artola et al., 2012).

With regard to individual traits associated with creativity, it has been proposed that favorable personality traits are creative self-concept (CSC) or creative personality and openness to experience (OE). The relationship with creativity is less clear than with other traits such as extraversion, agreeableness, neuroticism, and being conscientious (see for example Feist, 1998; Hülsheger, Anderson, & Salgado, 2009a). Continuing with cognitive individual traits, intelligence is linked to creativity and, since it is not decisive beyond a certain level, there is an asymptotic relationship between intelligence and creativity (Kim, 2005). As well as the role of general mental ability, some authors posit the existence of thinking styles and attitudes associated specifically with creativity, such as field independence, tolerance of ambiguity, perseverance in the face of frustration, relative disinterest in social approval, and a pro-risk attitude (see Feist, 1998; Hülsheger et al., 2009a). It is specifically thought that creativity correlates positively with DT and weakly or negatively with convergent thinking. The former allows tasks with multiple solutions to be completed, and is characterized by high ideation, intuition, tolerance of ambiguity, and low evaluation, while the latter is found in the area of logical deduction, and is defined by evaluation, reasoning, adaptation, and intolerance of ambiguity (Guilford, 1968; Ma, 2009). A further important skill is to distance thinking from the procedures normally applied in dealing with problems (for example making the unusual normal and the normal unusual), or when all else fails to try something

**Table 1**  
Personal creativity and innovation factors by meta-analysis statistics.

Study Author/year/Publication	Statistical sample			Participants	Factors	Most relevant results
	K	Design	N			
Feist (1998). <i>Personality and Social Psychology Review</i>	83	Comparative/descriptive	a) 4,852 (men vs. women) b) 3,918 (men vs. women) c) 4,397 (men vs. women)	a) Scientists vs. non-scientists b) Creative people vs. less creative scientists c) Artists vs. non-artists	Big five personality traits	Creative personality: openness to experience, unconventionality, conscientiousness, self-confidence, self-acceptance, impulsiveness, ambitious, dominant, hostility and impulsiveness Intra- and interdisciplinary vision required in research into creativity as a complex behavior Importance of longitudinal studies Positive emotional states, high activation and positive contexts (e.g. of happiness), high motivation (vs. low) and relaxed context produce more creativity than neutral (emotional, motivational, context of sadness) and negative states (low motivation, context of fear and anxiety), which above all undermined cognitive flexibility
Baas et al. (2008). <i>Psychological Bulletin</i>	102	Experimental and correlational	C1- Positive vs. neutral affect = 5,165 C2- Negative vs. neutral affect = 4,435 C3- Positive vs. negative affect = 3,559	Students and adult population	Positive and negative affect.	Positive states of mind improve creativity. Effect strength depends on state of mind when comparing and the type of creative task involved A curvilinear relation is suggested between affect intensity and creative performance. The influence of context is accepted for relations established between state of mind and creativity
Davis (2009). <i>Organizational Behavior and Human Decision Processes</i>	72	Experimental and correlational	1) Positive vs. neutral = 2,794 2) Positive vs. negative = 3,409 3) Neutral vs. negative = 1,204	Adult population and some children mostly mixed groups, some only women	Positive and negative affect.	Individual factors, workplace characteristics and contextual factors are moderately associated with phases of the innovation process Innovation defined as generation and application of ideas
Hammond et al. (2011). <i>Psychology of Aesthetics, Creativity and Arts</i>	88	Correlational	7,092	Employees and students	Creative personality. Education, stability (permanent job). Motivation. Creative self-efficacy Personality traits. Other personality attributes	OE is associated with innovation (being open to new ideas, curiosity, non-conformism, questioning norms, and independent thinking) Neuroticism correlates negatively with innovation (n/s). Extraversion could be important in the work domain. Agreeableness is not shown to be relevant. Being conscientious has an ambivalent link with innovation Relations between creativity and other traits like creative self-concept, proactive personality, propensity to innovate and internal locus of control or self-efficacy are strong and generalizable to other samples. There are few primary studies of personality and innovation in work or organizational domains
Hülsheger et al. (2009a) <i>14th Congress of the European Association of Work and Organizational Psychology</i>	97	Correlational	Between 1,522 and 4,164 (Big five) Between 908 and 5,148 (other attributes)	Adult employees	IQ levels above and below the threshold Socio-demographic variables: gender, age	Relations between creativity tests and IQ scores are low (IQ tests contribute in second place) Age contributes strongly to the relation between intelligence and creativity. This study does not support the threshold theory
Kim (2005). <i>The Journal of Secondary Gifted Education</i>	21	Correlational	45,880	Children, military cadets and university students (adults)	Personality, motivation, thinking, attitude	Conceptual knowledge of a specific domain may be a pre-requisite for creative problem solving
Ma (2009). <i>Creativity Research Journal</i>	111	Correlational	Not registered	Students and teachers		$\bar{r}$ for problem solving and verbal creativity were significantly higher than those for emotional creativity and non-verbal creativity. Variable with highest $\bar{r}$ were: recognition = rewards, work environment favorable to creativity, problem definition and accessing knowledge in solving them

Note: k = number of studies; N = number of participants = a, b, c participating groups; C1, C2, C3 comparisons made; 1, 2, 3 participating groups;  $\bar{r}$  = mean r.

**Table 2**  
Personal factors of creativity (adapted from Ma, 2009) and items which relate to them on the scale of Innovation Factors in Organization (F.I.N.O) (da Costa, Páez, Oriol, & Unzueta, 2014).

Given or ascribed variables	Sex		F.I.N.O. scale items
	Gender		
	Age		
Acquired subject variables or individual attributes	Education y academic achievement	Includes grades, among others	Mark what applies to your specific situation . . . 22.- I believe I am competent at teamwork (my knowledge, techniques, personal skills equip me for it)
	A. Creative personality	Includes test scores measuring, e.g., creative personality, interests, attitude and self-perception	
	B. Openness to experience	Such as opposed to being satisfied with the known and familiar, inconformity with imposed discipline	
	C. Neuroticism or emotional stability	Includes low hostility, depression, self-conscience, impulsiveness, vulnerability and anxiety	
	D. Extraversion	Includes high scores of openness (being socially open) and low introversion, searching for social support to deal with stressful situations	
	E. Agreeableness	Includes being compassionate, kind-hearted, cooperative as opposed to hostile (proud, skeptical and competitive)	
	F. Conscientiousness	Includes being an organized, disciplined and goal-oriented person	
	Cognitive abilities	Includes IQ test scores	
	Attitude	Pro-risk tendency	19.- Workplace characteristics in this organization mean that people: c.- Take on challenges in the realization of their work d.- Decide how to do their work 19.- Workplace characteristics in this organization mean that people: a.- Come up with and consider alternative possible solutions to a problem at work b.- Know that they have to apply original solutions to carry out their job efficiently
	Tendency to divergent thinking	Includes preference for high ideation; low evaluation; high intuition; low reasoning; high innovation; low adaptation; more exploration than assimilation; high tolerance for ambiguity	
	Tendency to convergent thinking	Includes preference for evaluation, reasoning and adaptation, low tolerance and ambiguity	
	Motivation	Intrinsic  and extrinsic	18.- People who work in this organization are motivated by: a.- The work itself that they do b.- The pleasure they derive from a job well done c.- Their salary d.- The security of having a job e.- The possibility of promotion in the organization
	Self-efficacy	Includes having confidence in one's own abilities; self-esteem; self-determination; internal locus of control	16.- People who work in this organization: a.- Believe in their ability to do the job efficiently b.- Believe in their ability to carry out their work by applying original solutions c.- Believe they can generate new ideas in connection with their work d.- Believe they are able to apply new products or processes in their job
	Affective sensitivity	Includes low alexithymia and high empathy	17.- People who work in this organization: a.- Express their emotions b.- Talk to their colleagues about their emotions c.- Are sensitive to the feelings and emotions of their colleagues and put themselves in their situation/respond in a suitable way to their colleagues' emotional reactions
	Positive vs. neutral and negative affect, induced or personal trait		21.- The atmosphere among employees of this organization is characterized by: c.- A positive work atmosphere (good-humoured, enthusiastic, understanding . . .)
	Induced affective trait and state		

counter-intuitive (Amabile, 1996; Baas et al., 2008; Davis, 2009; Ma, 2009). Nevertheless, some authors submit that there are no cognitive styles generic to creativity and that these are specific to the area in question (Hennessey & Amabile, 2010).

In addition to intelligence, personality traits, attitudes, and cognitive styles, motivation is a further individual factor which is important in creativity. It has been claimed that there is a positive relation between creativity, intrinsic motivation, and self-efficacy (Artola et al., 2012; Guilford, 1968; Runco, 2014). It is expected that people are more likely to be creative when they are intrinsically motivated, i.e., by interest, pleasure, satisfaction, and the challenge of the task itself, more than by external pressure and reward (Amabile, 1996). Self-efficacy refers to the perception that one has the capacity to behave in a way required to attain a goal and the beliefs about one's personal competences to be proactive in the generation of new ideas and the application of innovations. It is expected that high self-efficacy is associated with greater creativity (Hülsheger, Anderson & Salgado, 2009a; Ma, 2009). The relation between extrinsic motivation and creativity is not clear, although some authors suggest a negative link (Ma, 2009).

Finally, emotions and affectivity are individual factors relevant to creativity. In terms of the relation between affectivity and creativity, it is thought that emotions can change thinking and that knowing them can help one use them to process information in a better way, thus allowing emotional intelligence to further creativity (Mayer & Salovey, 2007). Several authors propose that positive affect facilitates creativity (Amabile et al., 2005; Fredrickson, 2009; Isen, Daubman, & Nowicki, 1987). There is also evidence to suggest a link between negative affect and psychopathology, given the fact that the percentage of disorders is high among some creative groups such as artists, although this association has also been questioned (Feist, 1998; Ivcevic, Brackett, & Mayer, 2007; Ma, 2009).

On the basis of our review, the hypothesis is put forward in this study that creativity is associated with the female gender and androgyny, in a curvilinear form by age, and asymptotically with intelligence and education; with openness to experience, creative self-concept and to a lesser degree with other personality traits; with cognitive/attitudinal variables (DT and pro-risk), intrinsic motivation and self-efficacy, low extrinsic motivation, emotional intelligence (EI), and positive affect. It is also expected that the association with negative affect is weaker or less clear. Finally, we expect that there will be a stronger association between creativity and motivation than between creativity, cognition, and attitude.

We now turn to an explanation of the method used to explore the hypothesis, the results obtained and the discussion of objectives. The limitations of the study will also be outlined before conclusions for future research are drawn.

**Method**

A search was made for all articles which included the terms meta-analysis, state of the art, review, creativity, and innovation (PsycINFO & Google Scholar), without searching exhaustively for primary articles and without imposing time limits. Meta-analyses which used creativity or innovation as a criterion variable and individual characteristics as a predictive variable were included (highlighted with an asterisk in the references). Also included were meta-analyses which had as an axis creativity and its relationship with given and acquired individual characteristics, personality traits, attitude, intelligence, and cognitive styles, motivational processes, affectivity, and emotional processes (see Table 1).

Table 3 displays individual factors of creativity which are present in two or more meta-analyses. Their effects are described by providing z and k for each. To provide the effects of all the factors, correlations r were run. When there were Cohen's ds (e.g.,

**Table 3** Meta-analytics results of personal creativity factors.

Variable	Feist (1998) creative vs. less-creative scientists and artists vs. non-artists		Davis (2009)		Baas et al. (2008)		Ma (2009)		Hülsheger et al. (2009a)		Kim (2005)		Hammond et al. (2011)		BESD effect size % high creativity in favourable factor vs. % high creativity in low factor
	z	k	z	k	z	k	z	k	z	k	z	k	r	r <sub>w</sub>	
Creative personality															
Openness to experience	.20	28	.21	29	.20	38	.24	10	.24	9	.22	9	.22	.21	60.5% vs. 39.5%
Extraversion	.17	28	.075	29	.34	24	.19	13	.19	9	.22	9	.22	.22	61% vs. 51%
Emotional Instability - Neuroticism	.055	28	.025	29	.15	24	.10	13	.10	13	.12	9	.12	.12	56% vs. 44%
Agreeableness	-.01	28	-.10	29	-.13	28	-.10	14	-.04	9	-.04	9	-.03	-.03	51.5% vs. 48.5%
Conscientiousness	.09	28	-.29	29	.08	13	-.04	9	-.04	9	-.03	9	-.03	-.05	52.5% vs. 47.5%
Intelligence (IQ)					.11	19	-.001	15	-.001	15	.15	21	.11	.17	53% vs. 47%
Divergent thinking					.20	8	.04	10	.04	10	.18	21	.11	.17	58.5% vs. 41.5%
Intrinsic motivation					.15	33	.31	15	.31	15	.25	16	.25	.27	63.5% vs. 46.5%
Self-efficacy					.11	46					.17	6	.17	.13	56% vs. 43.5%
Positive vs. neutral affect					.25	48	.15	63			.20	6	.20	.19	58.5% vs. 41.5%

Note: BESD based on weighted r; z = equivalent to z of r; r̄ = r uncorrected mean; r̄<sub>w</sub> = r mean weighted by N.

Ma, 2009, Davis, 2009), they were converted into  $r$ s. When there was only one meta-analysis, the  $r$  effect size is reported, and when there were two or more, a mean  $\bar{r}$  effect size is shown. We calculated  $\bar{r}$  on the basis of the  $r$ s not corrected for reliability to group the results together, given that it was the common indicator for all.  $N$ , or sample size, was used to weight the effects. Given that Ma's meta-analysis only reported  $k$ , or the number of studies, and not  $N$  on which these were based, the sample size was estimated on the basis of the average  $N$  in other studies. Given the large values of  $N$ , all confidence intervals exclude 0, e.g., with  $N = 15,279$  the 95% confidence interval of emotional instability was between  $-.05$  and  $-.01$  (DeCoster & Iselin, 2005).

To show the relevance of factors facilitating creativity, Rosenthal's Binomial Effect Size Display (BESD) was used. Assuming the variable creativity or innovation is normally distributed, a high level (above average) of the facilitating factor implies a probability of  $.50 + r/2$  greater creativity (e.g., the association of neuroticism with creativity is  $r = -.03$ ). This means that 51.5% ( $.50 + .03/2 = .515$ ) of people with emotional stability will display a more creative than average response, compared to 48.5% of people with high neuroticism.

## Results

The hypotheses will be examined in order of effect size (greater to smaller), taking into account whether we are dealing with an integration of two or more meta-analyses or commentary on a single one. In the first case, the estimated weighted  $\bar{r}$  is given.

The results of the meta-analyses reviewed clearly show (see Table 3) that more creative people are characterized by greater DT ( $\bar{r} = .27$ ). This ( $r = .20$ ) is associated with creativity, as is convergent thinking ( $r = .10$ ) in the meta-analysis of Ma (2009). The meta-analysis of Hülshager et al. (2009a) found that DT is associated ( $r = .30$ ) with innovation and that people with a systematic thinking style displayed lower workplace innovation ( $r = -.26$ ). Having the knowledge relevant to the task is associated with innovation ( $r = .33$ ) in the same meta-analysis. DT is the most important effect of those reviewed based on more than one meta-analysis and its BESD can be seen in Table 3.

Results indicate that creativity is associated with personality traits such as CSC,  $\bar{r} = .21$ , OE,  $\bar{r} = .22$ , and to a lesser extent with being extrovert ( $\bar{r} = .11$ ). OE is also associated with creativity ( $r = .33$ , Ma, 2009), and innovation at work ( $r = .19$  Hammond et al., 2011; Hülshager et al., 2009a). CSC is also associated with creativity in ( $r = .20$ , Ma, 2009) and workplace innovation ( $r = .24$  Hammond et al., 2011). Creativity is also associated with greater extraversion ( $r = .12$ ) and in some meta-analyses like Ma's (2009) with emotional stability ( $r = .13$ ), with conscientiousness ( $r = .11$ ) and agreeableness ( $r = .08$ ), although in others creativity is negatively related to conscientiousness and agreeableness (see Feist, 1998; Hülshager et al., 2009a). Low neuroticism ( $\bar{r} = -.03$ ) and agreeableness ( $\bar{r} = -.05$ ) and being less conscientious ( $\bar{r} = -.06$ ) are globally associated with creativity. The effects of CSC and OE are second and third in order of importance of those reviewed on the basis of two or more meta-analyses (see BESD in Table 3).

Creativity is associated with low alexithymia and high empathy, considered to be indicators of EI (Ma, 2009,  $r = .31$ ). Two meta-analyses found that positive affect is associated with creativity ( $\bar{r} = .19$ ) (Baas et al., 2008,  $r = .15$ ; Davis, 2009,  $r = .25$ ). However, this effect was greater in experimental rather than correlational studies, and the type of task and the context influenced the effect (see in Table 1 Baas et al., 2008; Davis, 2009). Comparing positive with negative affect groups, it was found that positive affect reinforces originality and fluidity of creative response ( $r = .11$  and  $r = .09$ ), although it does not influence flexibility or a global indicator of creativity (Baas et al., 2008). Finally, these same authors suggest

that high activation reinforces creativity, while Davis (2009) offers evidence that if positive affect is too high it inhibits it. This is the fifth most important effect of those reviewed in more than one meta-analysis (see BESD in Table 3).

Intrinsic motivation is associated with creativity,  $\bar{r} = .20$  (Ma, 2009,  $r = .15$ ; Hammond et al., 2011,  $r = .24$ ). This last meta-analysis found a positive association between rewards and pressures, or extrinsic motivation, and creativity ( $r = .11$ ). The results show that the relation between creativity and intrinsic motivation is greater than with extrinsic motivation, although it is positive in both cases. The effect on intrinsic motivation is the fourth most important of those reviewed based on more than one meta-analysis (see BESD in Table 3). Androgynous gender identity, or possessing expressive alongside instrumental characteristics is associated with creativity (Ma, 2009,  $r = .19$ )

Regarding age, a linear relation was revealed between this and creativity (Ma, 2009,  $r = .17$ ). Intelligence was associated with creativity ( $\bar{r} = .17$ ). Kim (2005) found that the relation between IQ and creativity is linear ( $r = .17$ ), while Hülshager et al. (2009a) discovered a correlation between general mental ability and innovation of  $r = .04$ .

In terms of self-efficacy and creativity, it was found that these motivation indicators were associated with creativity  $\bar{r} = .13$ . The first is linked to performance in workplace innovation,  $r = .22$  for workplace self-efficacy and  $r = .28$  for creative self-efficacy (Hülshager et al., 2009a). This association was also found in Ma's (2009) meta-analysis ( $r = .11$ ). In that of Hülshager et al. (2009a), the associations with self-efficacy were stronger than that shown by creativity with the OE ( $r = .19$ ) and CSC ( $r = .20$ ), signaling that motivation would be a better facilitator for innovation than personality. Conversely, in the meta-analysis of Ma (2009), self-efficacy was associated less strongly with creativity ( $r = .11$ ) than was CSC and OE, which were linked more intensely ( $r = .30$  &  $r = .35$  respectively).

Ma's (2009) meta-analysis confirms a significant association between an attitude favorable to taking risks and creativity ( $r = .08$ ). A further significant relation was found between being female and creativity ( $r = .07$ , Ma, 2009). The level of academic achievement was not significantly associated with innovation (Hammond et al., 2011,  $r = .14$ ). The meta-analyses of Baas et al. (2008) and Davis (2009) revealed that negative affectivity had a non-significant relation with creativity.

## Discussion

The analyses carried out provide evidence about the factors which reinforce creativity and innovation. Sixty percent of the effects found were smaller than  $.19$ , which, despite being a low correlation, are coherent with those found in social psychology, where 50% of the same effects are below this value (Richard, Bond, & Stokes-Zoota, 2003). The  $\bar{r}$  between individual variables and creativity was  $.14$ , below the average in social psychology which is  $.21$ . Individual factors reviewed explain 2% of the variance in creativity, while variance explained by role, group, and organizational factors was 7.2%, with  $\bar{r}$  at  $.27$ , higher than that explained by individual variables (da Costa, Páez, Sánchez, Gondim, & Rodriguez, 2014). This reinforces the importance of a model of person-context interaction to understand creativity.

Results confirm most of the hypotheses, with the exception of the negative association between convergent thinking and extrinsic motivation with creativity, of the curvilinear or asymptotical relation with age, intelligence, and education, and the hypothesis of a stronger association between creativity and motivation than between creativity, cognition, and attitude. These negative findings are important, because they disconfirm some assumptions shared

in the domain of creativity and innovation by relevant authors (e.g., Amabile, 1996).

Results show that low alexithymia and high empathy are strongly linked to creativity, confirming that knowing and using emotions is functional, both for thinking and information processing (Mayer & Salovey, 2007). To explain this, we can suppose that EI reinforces the functional use of emotions in thinking and problem solving. In terms of cognition, DT is also strongly linked to creativity and its higher scores are associated with workplace innovation, just as having knowledge relevant to the task is associated with innovation (Hülshager et al., 2009a; Ma, 2009). This may be explained by positing that the thinking style most strongly associated with creativity is thinking that diverges, disagrees, and looks for alternatives or original possibilities for solving a given problem (Ma, 2009). In one meta-analysis, convergent thinking is associated with creativity, but in another, systematic thinking was negatively linked to innovation. This discrepancy could be due to how both the dependent and independent variables are measured (Hülshager et al., 2009a; Ma, 2009). In the creative process, both styles of thinking are necessary, with the role of convergent thinking varying, depending on whether the focus is on the generation of ideas or their application. The model of person–context interaction is important for understanding this role (Csikszentmihalyi, 2011; Hammond et al., 2011; Ma, 2009; Simonton, 2012).

The strong association between CSC, OE, and creativity is due to people possessing these traits to a high degree being more flexible and being strongly attracted to new perspectives and feelings (Feist, 1998; Hülshager et al., 2009a; Ma, 2009), to the extent that they would be more likely to try changes and innovate. It has also been suggested that this association could be due to the overlap between descriptors of OE, CSC, and self-reports of creativity. However, the link between CSC, OE, and creativity and innovation is found when indicators of achievement and external judges are used, which questions whether this only arises because of the overlap of method and semantic content. The moderately strong association between extraversion and creativity can be explained by the fact that people with this character trait are more energetic, more likely to look for new stimuli (new ways of doing tasks and solving problems), resulting in greater creative achievement. Being friendly, conscientious, and emotionally unstable slightly hinders creativity (Feist, 1998; Hülshager et al., 2009a; Ma, 2009).

The relation between motivation and creativity (Ma, 2009) was confirmed both in studies of creativity, and creativity applied to organizations (Hülshager et al., 2009a). In order to explain the effect of intrinsic motivation, it is suggested that this refers to a natural tendency towards control, interest, and discovery, representing an important source of pleasure and vitality (Hammond et al., 2011). Creative performance involves high levels of energy, concentration, and willpower, which means that having high levels of intrinsic, and to a lesser extent extrinsic motivation, will drive the creative effort. A further motivational factor, self-efficacy, is associated with creativity, albeit to a lower degree than intrinsic motivation. General and creative self-efficacy act as motivational forces to raise creative performance via the perception that one possesses the capacity necessary to attain goals. Questioning the hypothesis of the general superiority of motivation, however, it has to be said that its effect is less than that of DT and similar to that of some personality traits. Regarding the relationship of these individual factors in the different stages of the creative process, we recall that Hammond et al. (2011) found that personality and motivation were associated with the generation of ideas, while the characteristics of work and the organization do so more strongly with their implementation in the workplace.

The meta-analyses confirm that, compared to a neutral state, positive affect reinforces creativity with an effect size similar to intrinsic motivation (Baas et al., 2008; Davis, 2009). To explain

this, it is suggested that positive affect reinforces creativity primarily via memory and thought. Positive affect would engender a greater flow or number of ideas because the associative network of emotional states and positive materials promotes memory and accessibility of information. It would facilitate a more flexible treatment of categories because people with a positive state of mind are more inclusive when categorizing stimuli. Furthermore, positive affect would reinforce the generation of more uncommon ideas, i.e., originality (Baas et al., 2008; Davis, 2009). Secondly, with positive feelings acting as a signal suggesting that a state of wellbeing prevails, they evoke a playful, relaxed approach to tasks (e.g. DT), whereas negative feelings would indicate danger, thereby provoking systematic thought in problem solving. A positive outlook would reinforce DT, boost attention and the repertoire of actions and ideas (Fredrickson, 2009). Finally, positive affect and associated emotions will influence creativity through the tendency towards action that they prime. Positive emotions of high levels of activation, such as happiness and interest, which involve action tendencies of an active approach, motivate creative performance (Baas et al., 2008). Mere experiencing of such states of positive valence does not reinforce creativity (da Costa, Páez, Oriol, & Unzueta, 2014); it is the high level of activation which reinforces it when it is positive and blocks it when it is negative. Furthermore, a congruency hypothesis is partially confirmed: positive affect reinforces creativity in tasks which are enjoyable and are intrinsically motivating, while undermining it in serious tasks of extrinsic reinforcement (Baas et al., 2008).

Being older is associated with creativity, demonstrating that experience provides resources for it and that it is far from being typical of young people. Rather than a curvilinear relation between the two, a linear one was found (Ma, 2009). It has been suggested that intelligence measured by IQ is associated with creativity, although it is not decisive beyond a certain level; this is known as an asymptotic relationship. Empirically, in terms of cognitive capacity and creativity, it was found that the relation between IQ and creativity is linear (Kim, 2005). These results suggest that greater intelligence means greater creativity, but permit a large amount of variability in the latter (see Kim, 2005 in Table 1), i.e., one can be creative without being very intelligent, but the greater one's cognitive resources, in general the greater one's creativity.

Confirming that creativity has to do with attitude (Amabile, 1996; Hennessey & Amabile, 2010), Ma's meta-analysis (Ma, 2009) supports a slight association between pro-risk attitude and creativity. Taking risks in trying out ideas and new processes is an important part of the creative process. From the gender perspective, women displayed slightly more creativity (Ma, 2009). In terms of gender identity, it was found that having expressive traits alongside instrumental ones, i.e., androgyny, is associated with creativity more strongly than being male or female, which suggests that the psychological is more relevant than the biological sex (Ma, 2009; Stoltzfus et al., 2011). That is to say that internalization of instrumental (e.g., being assertive) and expressive attributes in one's self-concept may aid innovation.

Regarding the relation between education and creativity, it was seen that academic achievement, an education level indicator, was not associated significantly with innovation. However, this conclusion is diminished by the idea that relevant knowledge for the task in hand does associate with it (Hülshager et al., 2009a), and it is understood that to be an expert in a given field requires ten years of systematic learning (Csikszentmihalyi, 2011; Gardner, 2010).

Negative affect is in general not associated with creativity (Davis, 2009). Compared to its positive counterpart, negative affect slightly reduces the flow and originality of the creative response, although it does not affect other facets of creativity (Baas et al., 2008). Some studies have discovered positive relations between indicators of psychopathological imbalance and creativity, as in

the case of artists, but not in scientists (Feist, 1998; Ma, 2009). Nevertheless, the relation between affective disorders and creativity is essentially found in the experience of intensely affective or moderately manic states which heighten consciousness and flexibility of thought (Ivcevic et al., 2007).

Regarding limitations of the study, we acknowledge in our conclusions that they are based on correlations uncorrected for measurement error, and are thus likely to be underestimates of the real relations; for example the size effect for positive affect was larger than  $r = .20$  when corrected for reliability of measurement (Davis, 2009). Furthermore, we do not take into account the overlap between the studies of meta-analyses, although we believe that since they derive from traditions of experimental psychology on the one hand and organizational psychology on the other, any overlap will be minimal. In addition, in some cases there is only one meta-analysis, which limits generalization. In this regard, we note that results have been unified for tasks of cognitive creativity with evaluations of the application of ideas and products in organizations, although this also reinforces the generality of the conclusions.

## Conclusions

The results confirm that creativity is associated with emotional intelligence (e.g., high empathy, emotional expressiveness, and good capacities of affect regulation), divergent thinking, creative personality, openness to experience, positive affect, intrinsic motivation, and androgyny. To a lesser degree it is associated with age, intelligence, extrinsic motivation, self-efficacy, and somewhat less with pro-risk attitude and the female sex. On the basis of the evidence, we can conclude that when recruiting staff with creativity in mind, these should be emotionally intelligent, have a high degree of divergent thinking, be motivated primarily for the interest and challenge involved in the work, and be simultaneously expressive and assertive. As a practical conclusion, we emphasize that for innovation in the workplace emotional aspects such as EI and cognitive facets like DT are more important than motivational factors such as self-efficacy and intrinsic motivation. An organizational culture that boosts the EI of its workforce increases employees' capacity for understanding, using, expressing, and regulating emotions, while also reinforcing instrumental and cognitive capacities will promote innovation considerably.

In recruitment it should also be remembered that employees with openness to experience traits and a creative self-concept could strengthen organizational innovation. Furthermore, an organizational culture which includes in its occupational roles the goals of generating ideas and applying original ideas in problem solving, as well as a commitment to innovative behavior and practices may help to turn this into the norm, and, through organizational socialization, it may become internalized in the self-concept. To a lesser extent, selecting employees with high positive affect would benefit innovation. From an organizational point of view, practices and norms which reinforce a positive climate and positive emotions among the staff could have the same effect. In both emotional climate and positive emotions of the individual, it should be specifically emotions of high activation that are boosted, not those of calm, since only the former favor innovation. Recruiting people with high intrinsic motivation and high self-efficacy, or reinforcing these in existing employees by raising their decision-making and autonomous work planning capacities, as well as increasing their self-control and cognitive competences, will promote innovation moderately. Prioritizing the selection of women above men, older people and those with a pro-risk disposition would (moderately) benefit innovation. Finally, it should be remembered that organizational factors (e.g., complexity and autonomy in the work role, and structural resources of the com-

pany) are more important than those of personality in terms of increasing creativity and organizational innovation. With regard to future research, we believe it necessary to use more sophisticated statistical methods to verify theoretical models using moderation and mediation analyses. We also consider it important to broaden socially and culturally the samples of the studies, incorporating workers for different organizational areas.

## Conflict of interest

The authors of this article hereby declare no conflict of interest.

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