Received 20 December 2013
Revised 11 October 2014
Accepted 27 December 2014

Managerial creative problem solving and the Big Five personality traits

Distinguishing divergent and convergent abilities

Nils Myszkowski and Martin Storme
ESCE – International Business School, Paris, France and Laboratoire Adaptations Travail-Individu, Université Paris Descartes, Paris, France
Andrés Davila
ESCE – International Business School, Paris, France, and
Todd Lubart
Laboratoire Adaptations Travail Individu, Université Paris Descartes, Paris, France

Abstract

Purpose – The purpose of this paper is to provide new elements to understand, measure and predict managerial creativity. More specifically, based on new approaches to creative potential (Lubart *et al.*, 2011), this study proposes to distinguish two aspects of managerial creative problem solving: divergent-exploratory thinking, in which managers try to generate several new solutions to a problem; and convergent-integrative thinking, in which managers select and elaborate one creative solution.

Design/methodology/approach – In this study, personality is examined as a predictor of managerial creative problem solving: On one hand, based on previous research on general divergent thinking (e.g. Ma, 2009), it is hypothesized that managerial divergent thinking is predicted by high openness to experience and low agreeableness. On the other hand, because efficient people management involves generating satisfying and trustful social interactions, it is hypothesized that convergent-integrative thinking ability is predicted by high agreeableness. In all, 137 adult participants completed two divergent-exploratory thinking managerial tasks and two convergent-integrative thinking managerial task and the Big Five Inventory (John and Srivastava, 1999).

Findings – As expected, divergent-exploratory thinking was predicted by openness to experience ($r = 0.21$; $p < 0.05$) and agreeableness ($r = -0.22$; $p < 0.05$) and the convergent-integrative thinking part of managerial creative problem solving was predicted by agreeableness ($r = 0.28$; $p < 0.001$).

Originality/value – Contrary to most research on managerial creativity (e.g. Scratchley and Hakstian, 2001), the study focuses (and provides measure guidelines) on both divergent and convergent thinking dimensions of creative potential. This study replicates and extends previous results regarding the link between personality (especially agreeableness) and managerial creativity.

Keywords Creativity, Creative thinking, Management skills

Paper type Research paper

Introduction

In a context of increasingly rapid change and increased competition due to globalization, leaders have to face relentless unpredictability. As their ability to cope with new and open-ended problems is constantly challenged, it is crucial for managers to be capable of imagining applicable and creative solutions. With such problems,

Journal of Management Development
Vol. 34 No. 6, 2015
pp. 674-684

0262-1711
DOI 10.1108/JMD-12-2013-0160

general intelligence, however essential, cannot be the only required ability for managers to succeed in their tasks (Sternberg, 1997).

Creativity is the ability to produce work that is both original and useful (Sternberg and Lubart, 1999). It became an important subject of research in the 1950s, after the decisive works of Joy Paul Guilford (1950, 1956). At that time, creativity was largely considered as a unidimensional cognitive ability: divergent thinking, which is the ability to explore in order to generate as many original solutions as possible to a problem. Following this definition, divergent thinking is mostly measured using fluency (the number of solutions that one can find in a definite amount of time) (Kim, 2006; Torrance, 1966).

However, creativity does not only involve exploring many ideas, but also involves a converging process (Kim, 2006), called convergent-integrative thinking (Lubart *et al.*, 2011), which is the ability to integrate and combine elements in order to elaborate the best and most creative idea possible for implementation. The convergent-integrative aspect of creative problem solving allows "a synthesis of various heterogeneous elements to converge into a unique, original production" (Barbot *et al.*, 2011, p. 63). Although divergent thinking tests, such as the well-known Torrance Tests of Creative Thinking (Kim, 2006; Torrance, 1966) and Wallach and Kogan Creativity Tests (Wallach and Kogan, 1965), are far more widely used (Baer, 1993) than convergent-integrative thinking tests, some test batteries combine both divergent-exploratory and convergent-integrative tests, such as Evaluation of Potential Creativity (EPoC, Lubart *et al.*, 2011), aimed at assessing various forms (e.g. musical, figurative, verbal, social) of children's creative potential.

In managerial problem solving, creativity is also typically measured through divergent thinking fluency tests (Scratchley and Hakstian, 2001). In such tests, such as the Innovative and Divergent Elaboration Aptitudes (IDEA, Hakstian and Scratchley, 1995), participants have to find as many original solutions as possible to management problems. Such tests have been found to predict efficiently creative managerial behaviors (Scratchley and Hakstian, 2001).

According to several authors (e.g. Amabile, 1996; Runco, 1989), creative ability is field-specific. As a result, each domain which involves creativity is best considered separately (Baer, 1993; Gardner, 1988). This study aims at providing elements to further investigate the specific field of creative managerial problem solving, taking into account convergent-integrative thinking, the often forgotten half of creative managerial problem solving. Indeed, facing managerial problems, a manager often has not only to diverge and look for every possible solution, but also to converge, decide and elaborate the most useful solution in order to implement it efficiently. Consequently, convergent-integrative thinking ability has, just like divergent-exploratory thinking ability, a highly relevant ecological validity when predicting efficient managerial problem solving, and therefore managerial success.

Managerial creativity and personality traits

Concerning the relations between general creativity and the Big Five personality traits, most empirical studies have shown a positive correlation between divergent thinking and openness (Batey and Furnham, 2006; Feist, 1998; Ma, 2009; McCrae, 1987). Furthermore, divergent thinking fluency was found to be negatively correlated with agreeableness related traits, such as altruism (Batey *et al.*, 2009) or low individualism (Goncalo and Staw, 2006).

In the field of managerial creativity, openness was also identified as a key predictor of divergent thinking. Scratchley and Hakstian (2001) notably showed that openness to experience was positively correlated with managerial divergent thinking fluency. Research focusing on other dimensions of the creative personality also showed that openness-related traits (sensation seeking, flexibility, non-dogmatism, tolerance to ambiguity, etc.) are key characteristics of innovative leaders (Goldsmith, 1986; Kirton, 1987; Zenasni *et al.*, 2008).

Additionally, agreeableness, although not a traditionally investigated correlate of managerial creativity (Scratchley and Hakstian, 2001), may be a relevant predictor of creativity in managerial problem solving. On one hand, agreeableness, as found in general creativity research (e.g. Batey *et al.*, 2009; Goncalo and Staw, 2006), could predict negatively managerial divergent-exploratory thinking ability. Indeed, being able to propose new unconventional ideas can be facilitated by being less affiliative and by searching for independence (Barbot *et al.*, 2011). On the other hand, agreeableness might be a positive predictor of managerial convergent-integrative thinking ability. Indeed, Cable and Judge (2003) showed that agreeable managers tend to motivate using less legitimization-based and pressure-based motivating strategies. Moreover, elaborating creative long term efficient solutions which integrate every aspect of a managerial problem involves the ability to considerate the importance of generating intrinsic motivation, individual consideration, autonomy and trustful social interactions with employees (Amabile *et al.*, 1996; Dionne *et al.*, 2004). Furthermore, previous research suggests that low agreeableness is linked with prosocial motivation (Graziano *et al.*, 2007), and such prosocial motivation has been identified as a key component in achieving the production and elaboration of useful ideas in the workplace (Grant and Berry, 2011). Therefore, we propose that agreeableness could provide prosocial motivation, an essential fuel in the elaboration of an efficient, wise and applicable solution to managerial problems.

This study focuses on managerial creativity as a complex process involving both divergent-exploratory thinking and convergent-integrative thinking, and aims at defining the similarities and the differences, in terms of personality, between these two aspects of creative management.

In this study, it is hypothesized that both divergent-exploratory and convergent-integrative thinking abilities can be predicted by personality traits, and that divergent-exploratory thinking fluency and convergent-integrative thinking ability are predicted by personality in two different ways: on one hand, because divergent thinking is by definition an exploratory process, it is hypothesized that managerial divergent thinking is predicted by openness; on the other hand, because the prosocial motivation of agreeable individuals could motivate them to create useful and applicable solutions in managerial contexts, it is hypothesized that managerial convergent-integrative thinking is predicted by high agreeableness.

Method

Participants

The sample was composed of 137 third-year management students (58 males, 79 females) aged from 20 to 26 years old ($M = 21.47$; $SD = 1.01$). All the participants had not had any information about personality, creativity or intelligence measures.

Materiel

Because of the lack of test batteries to evaluate both the divergent-exploratory and the convergent-integrative aspects of creativity in the field of management (Hakstian and

Scratchley, 1995), the creativity measures used in this study were specifically designed for this research.

Divergent-exploratory thinking tasks. Two divergent thinking tasks were consensually designed by three management professionals and researchers. The tasks were designed to reflect two different typical and real-life issues faced by managers, allowing various potential solutions, which could differ in both usefulness and originality. The first task was about strengthening cohesion within a team of employees, and the second one was about promoting innovation within a team of engineers. For each task, the participants were given five minutes to find as many original and interesting ideas as possible to solve the management problem. Each task was scored in terms of fluency, which was the number of ideas given by the participant in each task. The internal consistency of the two tasks was satisfying, as Cronbach's α was 0.70, allowing the use of a composite score.

Convergent-integrative thinking tasks. Two convergent-integrative thinking tasks were consensually designed by the same three management professionals and researchers. The tasks also had to be two different typical and real-life issues faced by managers, allowing various potential solutions. For each task, the participants were given five minutes to find and elaborate the best and most creative idea that they could imagine. The first task was about motivating an employee, and the second one was about having employees adopt new software.

In accordance with the Consensual Assessment Technique recommendations of Amabile (1983), the creativity of each idea was evaluated by two management researchers, using the same commonly used definition of creativity: an idea had to be both original and useful to be considered creative (Sternberg and Lubart, 1999). Each judge evaluated half of the ideas. No significant difference was observed between the judges concerning their means ($t(135) = -0.17$; $p = 0.86$) or standard deviations ($F(1,135) = 1.30$; $p = 0.30$). In order to verify the inter-rater reliability, the integrative-convergent thinking productions of a subsample of 40 randomly chosen participants were evaluated in terms of creativity by both management researchers. The evaluations of the two judges were strongly positively correlated ($r = 0.62$; $p < 0.001$), showing a satisfying inter-rater reliability. The internal consistency between the two tasks was also satisfying, as Cronbach's α was 0.78, allowing the use of a composite score.

Big Five Inventory. The Big Five Inventory (John and Srivastava, 1999; Plaisant *et al.*, 2010), a 44-item measure of the Big Five factors (Conscientiousness, Agreeableness, Neuroticism, Openness and Extraversion) was used. It has proven to have satisfying internal consistency, as well as good convergent and divergent validity with the traits measured by NEO-PI-R (Plaisant *et al.*, 2005).

Standard progressive matrices test. To control the effect of general intelligence, the Standard Progressive Matrices (SPM, Raven, 1941) were used. The SPM are widely used non-verbal general intelligence tests, which consist of a series of diagrams or designs with a part which is missing. The participant has to find the missing part and to choose among a series of proposed answers. The SPM have proven to be a concise, robust and psychometrically valid measure of general intelligence (Pind *et al.*, 2003; Raven, 1941, 2000).

Procedure

Each participant took the Standard Progressive Matrices, the Big Five Inventory, and the divergent-exploratory and convergent-integrative thinking tasks. Between each

task, the participants did not receive any feedback about their results. The whole procedure lasted approximately 45 minutes.

Results

Descriptive statistics

Univariate descriptive statistics and bivariate correlation coefficients between all the tests and questionnaires are reported in Table I.

As expected, a weak correlation ($r = 0.25$; $p < 0.01$) was observed between the divergent-exploratory thinking and the convergent-integrative scores, showing that creative ability cannot be reduced to divergent-exploratory thinking, which encourages researchers to study convergent-integrative thinking and divergent-exploratory thinking separately. For these reasons, further analyses will separately focus on each of the two dimensions of creative ability that were measured: divergent thinking fluency and convergent-integrative thinking ability.

Predicting managerial creativity

First, in order to test our hypotheses, bivariate correlations between each managerial creativity measure and the predictors (intelligence and personality traits) were computed (see Table I).

Second, focusing on our hypothesis on differentiating the predictors of the dimensions of creativity, we used generalized linear modeling (GLM) in order to compare the unique contribution of each predictor to individual differences in managerial creativity. To do so, for each managerial creativity measure, all possible combinations of level 1 predictors went through a process of model selection, using the glmulti R library (Calcagno and Mazancourt, 2010). This R library allows computing, comparing, and ranking an exhaustive list of models, using information criteria[1]. Such a method has been shown to be efficient in the selection of a subset of predictors of a dependent variable (Myszkowski *et al.*, 2014; Myszkowski and Storme, 2012).

More precisely, in this study, for each managerial creativity measure, an exhaustive list of all the possible models was computed. To avoid an incomputable combinatorial explosion (Cerdeira *et al.*, 2009; Grafen and Hails, 2002), the computed models did not include interaction terms. Excluding interaction terms, the number of possible models to predict each managerial creativity measure with intelligence and the five personality

Table I. Univariate descriptive statistics and bivariate correlation coefficients

	Mean	SD	Divergent-exploratory thinking	Convergent-integrative thinking
Creativity measures				
1. Divergent-exploratory thinking	6.0	2.43	–	–
2. Convergent-integrative thinking	3.8	1.26	0.25**	–
Predictors of creativity				
3. Intelligence (SPM)	51.2	5.80	0.10	0.06
4. Conscientiousness (BFI)	30.6	5.11	0.05	0.14
5. Agreeableness (BFI)	32.0	4.54	−0.22**	0.28***
6. Neuroticism (BFI)	22.9	5.09	−0.02	−0.14
7. Openness (BFI)	35.0	5.37	0.21*	0.08
8. Extraversion (BFI)	27.9	5.36	0.07	0.09

Notes: ***,**,*Correlations significant at $p < 0.001$; $p < 0.01$; $p < 0.05$, respectively

factors was 64. The fit of all the models was subsequently ranked using each model's Bayesian Information Criterion (BIC). The BIC-based optimal model was chosen for predictor selection, and for further interpretation. Tables II and III report parameter estimates and fit indices for the full model, including all the predictors, and the BIC-based optimal model.

Divergent-exploratory thinking fluency. As shown in Table I, fluency was significantly correlated with openness ($r = 0.21$; $p < 0.05$), which shows, as expected, that participants that were open to experience were also able to find more ideas to solve managerial problems than others. As hypothesized, fluency was negatively significantly correlated with agreeableness ($r = -0.22$; $p > 0.01$). No other significant correlation was found between fluency and the other personality and intelligence measures.

The model selection procedure lead to selecting an optimal model which included only agreeableness ($\beta = -0.21$; $p < 0.05$) and openness ($\beta = 0.20$; $p < 0.05$) as predictors of managerial fluency, accounting for 9 percent ($R^2 = 0.09$; $p < 0.01$) of the variance of fluency (see Table II).

	Full model	BIC-based optimal model
Beta estimate		
Intelligence	0.10	
Conscientiousness	0.09	
Agreeableness	−0.26**	−0.21*
Neuroticism	−0.03	
Openness	0.18*	0.20*
Extraversion	0.04	
Model fit index		
AIC	630.49	625.93
BIC	653.85	637.61
Multiple R^2	0.11*	0.09**

Notes: The reported parameters are standardized estimates. **,*Significant at $p < 0.01$; $p < 0.05$, respectively

Table II. Regression results for predicting divergent-exploratory thinking ability, using GLMULTI to exhaustively fit all possible models

	Full model	BIC-based optimal model
Beta estimate		
Intelligence	0.01	
Conscientiousness	0.08	
Agreeableness	0.25**	0.28***
Neuroticism	−0.05	
Openness	0.07	
Extraversion	0.05	
Model fit index		
AIC	452.05	445.25
BIC	475.41	454.01
Multiple R^2	0.10*	0.08***

Note: The reported parameters are standardized estimates. ***,**,*Significant at $p < 0.001$; $p < 0.01$; $p < 0.05$, respectively

Table III. Regression results for predicting convergent-integrative thinking ability, using GLMULTI to exhaustively fit all possible models

Convergent-integrative thinking ability. As shown in Table I, convergent-integrative thinking ability was significantly correlated with Agreeableness ($r = 0.28$; $p < 0.001$), which shows that, as expected, participants who were more agreeable tended to elaborate a more creative (both original and useful) solution to managerial problems than others. No other significant correlation was found between convergent-integrative thinking ability and the other personality and intelligence measures.

The model selection procedure lead to selecting an optimal model which included only agreeableness ($\beta = 0.28$; $p < 0.001$), accounting for 8 percent ($R^2 = 0.08$; $p < 0.001$) of the variance of convergent-integrative thinking ability (see Table III).

Discussion

As hypothesized, personality significantly predicted managerial creativity. More specifically, the divergent-exploratory part of the creative process was predicted by high openness to experience. Such results are consistent with both general creativity research (Batey and Furnham, 2006; Feist, 1998; Goldsmith, 1986; Kirton, 1987; Ma, 2009; Zenasni *et al.*, 2008) and managerial and leadership creativity research (Goldsmith, 1986; Kirton, 1987; Scratchley and Hakstian, 2001). This result shows that exploring for several solutions to managerial problems involves being openness to experience. Moreover, as hypothesized, and consistent with previous research on general creativity (Batey *et al.*, 2009; Goncalo and Staw, 2006), agreeableness was found to predict low divergent-exploratory fluency. This result suggests that finding many solutions to a managerial problem involves thinking without restraint, especially without thinking about how ideas might be perceived. Indeed, agreeableness might play an inhibiting or a filtering role in exploring many solutions to a managerial problem. For example, when encountering a motivation problem, an agreeable individual might not consider ruder and tougher options such as firing the unmotivated employee, lowering salaries, etc.

As hypothesized, and consistent with previous findings regarding the use of long-term efficient leadership solutions (Amabile *et al.*, 1996; Cable and Judge, 2003; Dionne *et al.*, 2004), the convergent-integrative thinking part of managerial creative problem solving was predicted by agreeableness. As agreeable individuals notably show more prosocial motivation than others (Graziano *et al.*, 2007), such a result suggests that prosocial motivation, as supported in the literature on creativity in the workplace (Grant and Berry, 2011), is a key component in the elaboration of an appropriate, applicable and original solution to a managerial problem.

Because convergent-integrative thinking was only weakly correlated with divergent-exploratory thinking fluency, one probably should not think of managerial creative problem solving as only exploring many solutions. A second aspect of the creative process should be considered, the one during which a manager converges on an elaborated solution. The two steps do not seem to involve the same underlying individual characteristics, as open but not agreeable individuals would be good explorers, whereas agreeable individuals would be better when it comes to choosing and elaborating a useful and applicable solution to people management problems. Such results may permit a better understanding of the complexity of the managerial creative process and the individual differences observed.

However, this study has some limitations. In particular, it has been conducted on a sample of students, even though these students are future managers. Further study should focus on the replication of this result on a sample of positioned managers.

Moreover, predictors should be explored in a more detailed way, which was not allowed by the use of the BFI. For example, further studies may focus on facets of openness, as well as agreeableness, and on the emotional component of creativity (Botella *et al.*, 2013) for a better understanding of the complex links between individual characteristics and the different phases of managerial creative problem solving. Additionally, the research design used in this study focused on individual creative thinking ability and did not take into account possible interactions between individuals in group problem solving. Finally, the creative problem solving tasks used in this study focus primarily on people management aspects of management, and may not be generalizable to other types of managerial work.

Nevertheless, the results of this study may lead to different field applications. The main one is the selection of managers in accordance to the step or the characteristics of the task. Indeed, when brainstorming for finding lots of new management practices, managers with a high level of openness and a low level of agreeableness should be preferred. However, when it comes to developing the best creative idea and elaborating it for implementation, managers with high agreeableness may be sought. One could also use these results for building successful teams of managers. Moreover, this study could be useful in management consulting, training or teaching, as it notably suggests that, even though less agreeable individuals find a wider array of solutions, such solutions might not be helpful when converging towards a more creative solution. In other terms, less agreeable and more open individuals may have more ingredients to cook, but the extra ingredients may not be necessarily useful, and may even be counterproductive, to create a successful recipe.

Note

1. Another option that is commonly used is the use of stepwise backward or forward model selection. However, the results of stepwise model selection procedures depend on arbitrary decisions, such as the choice of the starting point and the stopping rules, may not always converge to the best model, and possibly lead to selecting different models (Grafen and Hails, 2002; Venables and Ripley, 2002). Such issues are eliminated by testing an exhaustive list of models.

References

Amabile, T.M. (1983), "The social psychology of creativity: a componential conceptualization", *Journal of Personality and Social Psychology*, Vol. 45 No. 2, pp. 357-376.

Amabile, T.M. (1996), *Creativity in Context: Update to the Social Psychology of Creativity. (Vol. xviii)*, Westview Press, Boulder, CO.

Amabile, T.M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996), "Assessing the work environment for creativity", *Academy of Management Journal*, Vol. 39 No. 5, pp. 1154-1184.

Baer, J. (1993), *Creativity and Divergent Thinking: A Task-Specific Approach (Vol. viii)*, Lawrence Erlbaum Associates Inc, Hillsdale, NJ, London.

Barbot, B., Besançon, M. and Lubart, T.I. (2011), "Assessing creativity in the classroom", *The Open Education Journal*, Vol. 4, Supplement 1, pp. 58-66, available at: http://benthamsciencepublisher.com/open/toeduj/articles/V004/SI0034TOEDUJ/58TOEDUJ.pdf

Batey, M. and Furnham, A. (2006), "Creativity, intelligence, and personality: a critical review of the scattered literature", *Genetic, Social, and General Psychology Monographs*, Vol. 132 No. 4, pp. 355-429.

Batey, M., Chamorro-Premuzic, T. and Furnham, A. (2009), "Intelligence and personality as predictors of divergent thinking: the role of general, fluid and crystallised intelligence", *Thinking Skills and Creativity*, Vol. 4 No. 1, pp. 60-69.

Botella, M., Fürst, G., Myszkowski, N., Storme, M., Costa, M.P.D. and Luminet, O. (2015), "French validation of the overexcitability questionnaire 2: psychometric properties and factorial structure", *Journal of Personality Assessment*, Vol. 97 No. 2, pp. 209-220, available at: 0.1080/00223891.2014.938750.

Cable, D.M. and Judge, T.A. (2003), "Managers' upward influence tactic strategies: the role of manager personality and supervisor leadership style", *Journal of Organizational Behavior*, Vol. 24 No. 2, pp. 197-214.

Calcagno, V. and de Mazancourt, C. (2010), "glmulti: an R package for easy automated model selection with (generalized) linear models", *Journal of Statistical Software*, Vol. 34 No. i12, available at: http://ideas.repec.org/a/jss/jstsof/34i12.html (accessed December 12, 2012).

Cerdeira, J.O., Silva, P.D., Cadima, J. and Minhoto, M. (2009), "Subselect: selecting variable subsets', R package version 0.9-9993, available at: http://CRAN.R-Project Org/package = Subselect (accessed December 12, 2012).

Dionne, S.D., Yammarino, F.J., Atwater, L.E. and Spangler, W.D. (2004), "Transformational leadership and team performance", *Journal of Organizational Change Management*, Vol. 17 No. 2, pp. 177-193.

Feist, G.J. (1998), "A meta-analysis of personality in scientific and artistic creativity", *Personality and Social Psychology Review*, Vol. 2 No. 4, pp. 290-309.

Gardner, H. (1988), "Creative lives and creative works: a synthetic scientific approach", in Sternberg, R.J. (Ed.), *The Nature of Creativity: Contemporary Psychological Perspectives*, Cambridge University Press, New York, NY, pp. 298-321.

Goldsmith, R.E. (1986), "Personality and adaptive-innovative problem solving", *Journal of Social Behavior & Personality*, Vol. 1 No. 1, pp. 95-106.

Goncalo, J.A. and Staw, B.M. (2006), "Individualism – collectivism and group creativity", *Organizational Behavior and Human Decision Processes*, Vol. 100 No. 1, pp. 96-109.

Grafen, A. and Hails, R. (2002), *Modern Statistics for the Life Sciences*, 1st ed., Oxford University Press, Oxford University Press, Oxford, New York.

Grant, A.M. and Berry, J.W. (2011), "The necessity of others is the mother of invention: intrinsic and prosocial motivations, perspective taking, and creativity", *Academy of Management Journal*, Vol. 54 No. 1, pp. 73-96.

Graziano, W.G., Habashi, M.M., Sheese, B.E. and Tobin, R.M. (2007), "Agreeableness, empathy, and helping: a person × situation perspective", *Journal of Personality and Social Psychology*, Vol. 93 No. 4, pp. 583-599.

Guilford, J.P. (1950), "Creativity", *American Psychologist*, Vol. 5 No. 9, pp. 444-454.

Guilford, J.P. (1956), "The structure of intellect", *Psychological Bulletin*, Vol. 53 No. 4, pp. 267-293.

Hakstian, A.R. and Scratchley, L.S. (1995), *The IDEA Battery: Innovative and Divergent Elaboration Aptitudes*, HR Decisions Ltd, Vancouver.

John, O.P. and Srivastava, S. (1999), "The big five trait taxonomy: history, measurement, and theoretical perspectives", in Pervin, L.A. and John, O.P. (Eds), *Handbook of Personality: Theory and Research*, 2nd ed., Guilford Press, New York, NY, pp. 102-138.

Kim, K.H. (2006), "Can we trust creativity tests? A review of the torrance tests of creative thinking (TTCT)", *Creativity Research Journal*, Vol. 18 No. 1, pp. 3-14.

Kirton, M. (1987), *Kirton Adaption-Innovation Inventory Manual*, Occupational Research Centre, Hatfield.

Lubart, T.I., Besançon, M. and Barbot, B. (2011), *EPoC: Évaluation du potentiel créatif des enfants*, Editions Hogrefe, Paris.

McCrae, R.R. (1987), "Creativity, divergent thinking, and openness to experience", *Journal of Personality and Social Psychology*, Vol. 52 No. 6, pp. 1258-1265.

Ma, H.-H. (2009), "The effect size of variables associated with creativity: a meta-analysis", *Creativity Research Journal*, Vol. 21 No. 1, pp. 30-42.

Myszkowski, N. and Storme, M. (2012), "How personality traits predict design-driven consumer choices", *Europe's Journal of Psychology*, Vol. 8 No. 4, pp. 641-650.

Myszkowski, N., Storme, M., Zenasni, F. and Lubart, T. (2014), Is visual aesthetic sensitivity independent from intelligence, personality and creativity?", *Personality and Individual Differences*, Vol. 59, pp. 16-20, available at: http://doi.org/10.1016/j.paid.2013.10.021

Pind, J., Gunnarsdóttir, E.K. and Jóhannesson, H.S. (2003), "Raven's standard progressive matrices: new school age norms and a study of the test's validity", *Personality and Individual Differences*, Vol. 34 No. 3, pp. 375-386.

Plaisant, O., Courtois, R., Réveillère, C., Mendelsohn, G.A. and John, O.P. (2010), "Validation par analyse factorielle du Big Five Inventory français (BFI-Fr). Analyse convergente avec le NEO-PI-R", *Annales Médico-Psychologiques, Revue Psychiatrique*, Vol. 168 No. 2, pp. 97-106.

Plaisant, O., Srivastava, S., Mendelsohn, G.A., Debray, Q. and John, O.P. (2005), "Relations entre le Big Five Inventory français et le manuel diagnostique des troubles mentaux dans un échantillon clinique français (Relations between the French version of the Big Five Inventory and the DSM classification in a French clinical sample of psychiatric disorders)", *Annales Médico-Psychologiques*, Vol. 163 No. 2, pp. 161-167.

Raven, J. (2000), "The raven's progressive matrices: change and stability over culture and time", *Cognitive Psychology*, Vol. 41 No. 1, pp. 1-48.

Raven, J.C. (1941), "Standardization of progressive matrices, 1938", *British Journal of Medical Psychology*, Vol. 19 No. 1, pp. 137-150.

Runco, M.A. (1989), "The creativity of children's art", *Child Study Journal*, Vol. 19 No. 3, pp. 177-189.

Scratchley, L.S. and Hakstian, A.R. (2001), "The measurement and prediction of managerial creativity", *Creativity Research Journal*, Vol. 13 Nos 3/4, pp. 367-384.

Sternberg, R.J. (1997), "Managerial intelligence: why IQ isn't enough", *Journal of Management*, Vol. 23 No. 3, pp. 475-493.

Sternberg, R.J. and Lubart, T.I. (1999), "The concept of creativity: prospects and paradigms", *Handbook of Creativity*, Cambridge University Press, New York, NY, pp. 3-15.

Torrance, E.P. (1966), *The Torrance Tests of Creative Thinking – Norms – Technical Manual Research Edition – Verbal Tests, Forms A and B – Figural Tests, Forms A and B*, Personnel Press, Princeton, NJ.

Venables, W.N. and Ripley, B.D. (2002), *Modern Applied Statistics With S*, Springer.

Wallach, M.A. and Kogan, N. (1965), *Modes of Thinking in Young Children*, Holt, Rinehart and Winston, New York, NY.

Zenasni, F., Besançon, M. and Lubart, T.I. (2008), "Creativity and tolerance of ambiguity: an empirical study", *The Journal of Creative Behavior*, Vol. 42 No. 1, pp. 61-73.

About the authors

Dr Nils Myszkowski has obtained his PhD at Université Paris Descartes. He is currently a management lecturer at the ESCE International Business School in Paris, France. Dr Nils Myszkowski is the corresponding author and can be contacted at: nilsmyszkowski@yahoo.fr

Dr Martin Storme has obtained his PhD at Université Paris Descartes. He is currently a management and statistics lecturer at the ESCE International Business School in Paris, France.

Dr Andrés Davila is a management professor and responsible for the International People Management specialization at the ESCE International Business School in Paris, France.

Professor Todd Lubart received his PhD from the Yale University, and is currently a professor of creativity psychology at the Institute of Psychology (Université Paris Descartes).