JCB
Publication of the Creative Education Foundation ®

MARTIN STORME
TODD LUBART
NILS MYSZKOWSKI
PING CHUNG CHEUNG
TOBY TONG
SING LAU

A Cross-Cultural Study of Task Specificity in Creativity

ABSTRACT

This study provides new evidence concerning task specificity in creativity—examining through a cross-cultural perspective the extent to which performance in graphic versus verbal creativity tasks (domain specificity) and in divergent versus convergent creativity tasks (process specificity) are correlated. The relations between different creativity tasks in monocultural and multicultural samples of Chinese and French children were compared. Electronic versions of the Wallach and Kogan Creativity Test (WKCT, Wallach & Kogan, 1965; Lau & Cheung, 2010) and the Evaluation of Potential Creativity (EPoC; Lubart, Besançon, & Barbot, 2011; Barbot, Besançon, & Lubart, 2011) were used. Both measures showed satisfactory psychometric properties and cross-cultural structural validity. The results showed that culture has an impact on the structure of creative ability: It appeared that correlation patterns were different across Chinese and French groups and across monocultural and multicultural groups. Such results show that it is crucial to take task specificity into account when investigating the effect of culture on creativity. Indeed, our study implies that cultural differences that are found using one specific creativity task might not be automatically generalizable to all sorts of creativity tasks. Limitations are discussed and perspectives for future research on culture and task specificity in creativity are proposed.

Keywords: Creativity, Task-Specificity, Cross-cultural research, Divergent thinking.

Creativity is the ability to produce work that is both novel and appropriate (Sternberg & Lubart, 1999). A series of studies based on divergent thinking tests and/or product-oriented approaches demonstrated, based on psychometric tests, that the construct of creativity and its structure cannot be reduced to a single general factor (Fee, 1968; Lubart, Besançon, & Barbot, 2011; McKinney & Forman, 1977; Wallbrown, Wallbrown, & Wherry, 1975; Ward, 1967). The question of task specificity in creativity in terms of similarities and differences across content domains (visual art, science, literature, music) and in terms of the underlying processes of the creative process (integrative thinking, divergent thinking) has been raised (Baer, 1993; Baer, 1998; Baer, 2014). Parallel to studies on task specificity, research on creativity and cultures revealed that cultural differences and multiculturalism have an impact on creative potential (Kharkhurin, 2012; Lubart, 2010). Because cultures reinforce different skills and value different domains and processes, they facilitate or inhibit creativity in different areas. For the same reasons, we hypothesized that cultures also have an influence on task specificity in creativity, notably the relationships between performances on different creativity tasks will be affected. Knowing whether cultures have an impact on task specificity is crucial when comparing cultures on the basis of creativity, because comparing creativity scores relies on the assumption that the structure of creative ability is the same across cultures (Byrne & Watkins, 2003). The aim of this study is to test whether there are differences in task specificity in creativity across cultures, using a correlational approach to quantify the relations between task performance in two creativity tests: the Wallach and Kogan Creativity Tests (WKCT: Wallach & Kogan, 1965) and the Evaluation of Potential Creativity (EPoC; Lubart et al., 2011).

CREATIVITY AND TASK SPECIFICITY

Task specificity has been an important issue in creativity research (Baer, 1993, 2003, 2014; Baer & Kaufman, 2005; Silvia, Kaufman, & Pretz, 2009) and has been traditionally studied in connection with the validation of creativity tests, such as the Wallach and Kogan Creativity Tests (WKCT; Wallach & Kogan, 1965), Torrance Test of Creative Thinking (TTCT; Torrance, 1974; Kim, 2006) or the recently proposed Evaluation of Potential Creativity (EPoC; Lubart et al., 2011; Barbot, Besançon, & Lubart, 2011). Wallach and Kogan found their inspiration in the theoretical model proposed by Guilford (1956). Their test battery has been widely used in research on creativity (Chan et al., 2001; Cheung & Lau, 2010; Lau & Cheung, 2010a,b). They distinguished two dimensions of creativity: a dimension that explains creative performance in verbal tasks and a dimension that explains creative performance in figural/graphical tasks. Both of these dimensions are measured with divergent thinking tasks. Several studies focused on the structural validity of the WKCT (Fee, 1968; McKinney & Forman, 1977; Wallbrown et al., 1975; Ward, 1967) revealing a hierarchical structure with a second order factor of creativity and two first-order factors corresponding to the verbal and the figural dimensions (Wallbrown et al., 1975). Concerning EPoC—a new creativity test also based on a distinction between verbal and figural/graphical domains—results are similar. However, unlike WKCT, EPoC measures graphical creativity through actual artistic productions of participants. In EPoC, verbal and graphical dimensions are theoretically and empirically related to some extent (Lubart et al., 2011). In this first approach to task specificity, researchers focused on differences between content domains, more specifically between verbal and graphical contents. This approach to task specificity echoes similar distinctions in the field of intelligence research in which researchers, following Thurstone and Thurstone (1941), distinguished dimensions of intelligence related to content domains, such as verbal intelligence, numerical intelligence, social intelligence, etc. (see Ackerman & Heggestad, 1997 for a review).

In addition to domain-based dimensions, there is another approach to task specificity in creativity that focuses on process characteristics. Kim (2006) proposed a factorial interpretation of the Torrance Tests of Creative Thinking in terms of creative style inspired by Kirton (1976). Kim (2006) distinguishes people who find many quick and novel responses, and people who find few responses that are elaborated. Adopting a process-related perspective, Lubart et al. (2011) defined two modes of creative work: divergent-exploratory thinking and convergent-integrative thinking. The measure that they devised—EPoC—includes both divergent thinking tasks (generate many brief creative solutions for a problem) and integrative thinking tasks (generate one elaborated creative solution for a problem). As opposed to usual divergent thinking tasks, participants are asked in convergent tasks to elaborate on one single idea and not to diverge from it. Divergent thinking and convergent thinking abilities are theoretically and empirically correlated (Lubart et al., 2011). This second approach to task specificity in the field of creativity echoes other distinctions in the field of intelligence research that focus more on processes, such as the Cattell-Horn-Carroll theory of cognitive abilities that traditionally distinguishes nine stratum abilities (Ackerman & Heggestad, 1997; Cattell, 1968; McGrew, 2005). The distinction between divergent exploratory and convergent integrative thinking abilities is also related to a methodological issue, more specifically creativity assessment. Divergent exploratory thinking abilities are usually the name given to the construct that is measured through divergent thinking tasks, whereas convergent integrative thinking abilities are usually related to tests that are closer to intelligence tests (such as the Remote Association Test published by Mednick in 1982) or to the Consensual Assessment Technique (Amabile, 1982). Despite the fact that the distinction between divergent and convergent thinking is associated with methodological differences, this distinction should not be reduced to that aspect. Indeed, there is theoretical and empirical evidence demonstrating that the neuro-cognitive processes involved in divergent and convergent thinking are different (Chermahini & Hommel, 2010). All these arguments lead us to also take into account the distinction between divergent and convergent processes when studying task specificity in creativity.

CREATIVITY AND CULTURE

The role of culture is usually theorized with two different perspectives in creativity research. The first perspective focuses on unique features of cultures that have an impact on various aspects of creative abilities. Because this perspective compares cultures, it could be described as a cultural-differences approach to creativity. In this line of research, psychologists focus on the way unique features of one particular culture have an impact on the development of creativity (Yi, Hu, Plucker, & McWilliams, 2013), on conceptions of creativity (Wong & Niu, 2013), on causal attribution of creative performance (Paletz, Peng, & Li, 2011) or on creative potential (for a review: Lubart, 2010; Kharkhurin, 2012). There are several reasons why creativity

is influenced by unique features of cultures. First, cultures strengthen different skills and cognitive processes, which explains why some individuals may invest more time and energy in one domain compared to another one. For example, the fact that Chinese students have better performance than American students in international contests in mathematics and natural sciences seems to be the result of the emphasis that the Chinese educational system places on analytical skills (Niu & Sternberg, 2003). Cultures have also an impact on values (Schwartz & Sagiv, 1995). For example, individuals from France tend to score higher on individualism and self-direction and lower on conformity compared to individuals from Hong Kong. Such values might determine in turn the extent to which individuals invest in creative performance. Cultural differences are also associated with differences in personality. For example, it has been shown that the general population of Hong Kong tends to score lower on openness than the general population of France (Schmitt, Allik, McCrae, & Benet-Martínez, 2007). As openness is known to be a predictor of creative performance, cultures may have an indirect impact on creative potential through the impact that they have on personality. In a recent paper, Wong and Niu (2013) hypothesized that differences in performance expectations across cultures (China vs. United States) could explain observed differences across cultures regarding creative potential. Because cultures have an impact on stereotypes and social expectations, they could also have an indirect impact on creative performance. If cultures have an impact on creative performance, it is also likely that they have an impact on the structure of creative ability. Therefore, we hypothesize that cultures strengthen different sets of domains or processes which consequently leads to different relationships between different domains of the creative performance.

The second perspective focuses on the impact on creativity of being confronted with several cultures. Because this perspective aims at explaining what happens when several cultures are involved at the same time, this perspective might be called "multicultural". It has been shown that being exposed to more than one culture has a positive impact on several cognitive functions that underlie creative performance. In a series of experiments, Maddux, Adam, and Galinsky (2010) showed that multicultural learning increases creative performance because it facilitates idea flexibility, it increases awareness of connections and associations and it reduces functional fixedness. In another series of experiments, Tadmor, Galinsky, and Maddux (2012) showed that being exposed to several cultures influences identity structure. Individuals who used an acculturation strategy that maintains both cultures are more likely to be creative because it increases the ability to integrate complexity, which in turn, increases creativity. Such experiments show that multiculturalism may strengthen different sets of cognitive processes. We could derive from these experiments that relationships between creativity tasks involving different processes could be different within monocultural samples compared to multicultural samples. Being exposed to several cultures involves often being exposed to several languages, which has consequences on different domains of creative ability (Kharkhurin, 2012). Kharkhurin (2010) showed that monolingual children tend to score higher on verbal creativity tasks compared to multilingual children, whereas the latter tend to score higher on non-verbal creativity tasks. Based on such results, we can hypothesize that bilingualism has an impact on the structure of creative ability, in other words, on task specificity (Kharkhurin, 2010). The literature on cultures and creative potential leads us to hypothesize that culture-related variables (cultural differences and multiculturalism) could have an impact on the relationship between creativity tasks involving different domains (verbal vs. non-verbal) and involving different processes (divergent vs. convergent thinking).

STUDY OVERVIEW

With this study, we aim at exploring the influence of culture on the structure of creative ability by focusing on the correlation patterns between various creativity tasks. It is indeed essential to know whether the scores that are derived from different cultural populations mean the same thing across cultures as part of the investigation of measurement invariance across cultures (Byrne & Watkins, 2003). To examine cultural differences with respect to the literature on culture and creativity, we included four different samples of children: two samples of monocultural children from two different cultures (Chinese children living in China and French children living in France) and two samples of multicultural children (Chinese children living in France and French children living in China). To study task specificity, we included different creativity tasks —from the WKCT and EPoC—that we can distinguish based on the domain that they cover (verbal vs. non-verbal) and based on the processes that they involve (exploratory divergent thinking vs. integrative convergent thinking). The aim of the study was to find out whether we would observe different correlation patterns between tasks across cultures. Using a structural equation modeling framework, we compared five models that correspond to five different assumptions:

- *Model 1: the correlation structure is the same in the four samples. According to this model, culture has no influence on task specificity.*
- *Model 2: cultural origin explains differences in the correlation structure. According to this model, the cultural origin of children (Chinese or French) determines the correlation structure, irrespective of where the children live or the fact that they live in a multicultural context or not.*
- *Model 3: the cultural environment in which the child is living explains differences in the correlation structure. According to this model, the cultural environment in which children live (China or France) determines the correlation structure, irrespective of their cultural origin or the fact that they live in a multicultural context or not.*
- *Model 4: multiculturalism explains differences in the correlation structure. According to this model, living in a multicultural environment (Chinese living in France and French living in China vs. Chinese living in China and French living in France) determines the correlation structure, irrespective of the particular origin individuals have or country they live in.*
- *Model 5: the structure is different in all four samples. According to this model, each cultural configuration is unique and has a different impact on the correlation structure.*

The differences between correlation coefficients were tested for exploratory purposes.

METHOD

PARTICIPANTS

Participants were children aged from six to eleven and belonging to four groups according to their nationality and their country of residence. About, 287 (143 girls; 134 boys) Chinese children living in China (Mean age = 8.50; *SD* = 1.71), 174 (84 girls; 90 boys) French children living in France (Mean age = 8.57; *SD* = 1.68), 31 (13 girls; 18 boys) Chinese children living in France (Mean age = 8.19; *SD* = 1.76), 46 (25 girls; 21 boys) French children living in China (Mean age = 8.21; *SD* = 1.85) were included in the sample. Most of the children came from two large cities, Paris (France) and Hong Kong (China). Several schools and cultural centers from the two regions were asked to participate in the research project. Institutions that agreed to participate were given documents explaining to parents the nature of the study and asking their authorization for their child to participate in the study. We distinguished children with monocultural backgrounds from children with multicultural backgrounds and defined children with multicultural background as those who have at least one parent who was not born in the country in which the child was currently living (i.e., Chinese father and/or mother for a child living in France, or French father and/or mother for a child living in China). Furthermore, to be considered as a child with a multicultural background, the child had to be schooled in the country in which he or she was living.[1]

PROCEDURE

Children took the tests individually, under the guidance of research assistants, either at school or at home. For EPoC, the order of the tasks (verbal vs. graphical) was randomized in the sample. For the WKCT, the order was the same for the whole sample: first, children completed the verbal items and then the figural items. Children always had to take the tests in their native language. Research assistants were proficient in the same language as the children they assessed. Research assistants recorded children's oral responses to verbal tasks, whereas the computer recorded the drawings made with a mouse for figural tasks.

INSTRUMENTS

WKCT

An electronic version of the WKCT was used, containing verbal and figural items (Cheung & Lau, 2010; Lau & Cheung, 2010a,b; Wallach & Kogan, 1965). This test comprises one instance item ("find as many things as possible that make noise"), two alternate uses items (e.g., "find as many uses as possible for a tire"), two similarities items (e.g., "find as many things as possible that mice and cats have in common"), two line meanings items, and two pattern meaning items. Children were seated before a computer and

[1] The dataset used for this study was used in a previously published study (Lau, Cheung, Lubart, Tong, & Chu, 2013). The focus of the previously published study was to examine potential differences in mean creativity scores across different subsamples (see Lau et al., 2013). This study differs from the previously published study in its focus, analysis, results, conclusion, and contribution to the literature.

guided by instructions provided by research assistants. The instructions emphasized that there were no right or wrong answers, that the activity was more like a game and that children should feel free to give any idea that comes in their mind. The instructions mentioned the fact that ideas should be original. Children had 7 minutes to find as many ideas as they can in each task. This version of the WKCT showed satisfactory psychometric properties in previous research (Lau & Cheung, 2010a,b). Each item was scored in terms of fluency (the exact number of responses generated). For WKCT, two scores—a verbal one (WDV) and a figural one (WDF)—were computed by averaging the fluency sub-scores. The internal consistency of the WKCT was good for the whole scale (Cronbach's alpha = .94) as for the sub-scales (Cronbach's alpha: .89 and .94).

EPoC

The electronic version of EPoC (Coulaud, 2013) was used, containing verbal (stories invention) and graphical items (drawings) (Lubart et al., 2011). Among verbal items, there are two divergent exploratory thinking items (e.g., the child has to invent as many stories as possible ending with a specified sentence) and two convergent integrative thinking items (e.g., the child has to invent a story based on the title). Among graphical items, there are two divergent thinking items (e.g., the child has to make as many drawings as possible including a specified shape) and two convergent thinking items (e.g., the child has to make a drawing including at least four of eight different given abstract polygons). As for the WKCT, children were seated before a computer and guided by instructions provided by research assistants. The instructions emphasized that there were no right or wrong answers, that children should consider it as a game and that they should feel free to give any idea that comes in their minds. The instructions indicated that ideas had to be original. Children had 10 minutes to find as many ideas as they could in each divergent thinking task and 15 minutes to elaborate a story or a drawing in each convergent thinking task. Because EPoC is an electronic test, it integrates a training module to familiarize children with the software and teach them how to rotate shapes, draw lines or add colors to their drawings. This version of EPoC showed satisfactory psychometric properties (Lubart et al., 2011). A fluency score was computed for the number of stories the participant invented (EDV), and for the number of drawings the participant made in divergent thinking tasks (EDG). Concerning the convergent-integrative score for drawings (EIG) and stories (EIV), the Consensual Assessment Technique was used (Amabile, 1982). French productions were evaluated by six French judges (3 men and 3 women; Mean age = 30.67; *SD* = 4.13) and Chinese productions were evaluated by three Chinese judges (1 man and 2 women; Mean age = 29.67; *SD* = 5.86) who provided ratings of each story and drawing on a 7-point scale with the convergent-integrative creativity score calculated as the mean rating. These judges were researchers working on creativity who received a definition of creativity in terms of originality, appropriateness and elaboration and were trained according to the procedure described by Storme, Myszkowski, Celik, and Lubart (2014) to reduce individual differences in creativity ratings (Storme & Lubart, 2012). The productions were presented in a random order to each judge, without information about the children who made them. Recent research on the consensual assessment technique has shown that expertise was needed when evaluating specific domains, such as creative engineering (Kaufman & Baer, 2012; Kaufman, Baer, Cropley, Reiter-Palmon, & Sinnett, 2013). This research also indicated that domains requiring less technical skills, which are sometimes referred as involving little c creativity, such as short stories written by university students, can be evaluated reliably by quasi-experts. Stories and drawings made by children fall into this category, which is the reason why we used quasi-experts in our methodology. Inter-rater reliability was satisfactory (French judges inter-rater reliability in verbal tasks = .91 and in graphical tasks = .89; Chinese judges inter-rater reliability in verbal tasks = .91 and in graphical tasks = .87).

RESULTS

Our focus is not on the amount of creativity across cultures (comparison of mean values),[2] but on the links between the different types of tasks (comparison of correlations). The methodology of Structural Equation Modeling is appropriate to compare correlation structures. The chosen significance level was .05. We used four statistical indexes to evaluate the model fit: χ^2/df ratio (satisfactory fit when χ^2/df <3), Comparative Fit Index (satisfactory fit when CFI >.90), Root Mean Square Error of Approximation (satisfactory fit when RMSEA <.08), and Standardized Root Mean Square Residual (satisfactory fit when SRMR <.08) (Hu & Bentler, 1999). We checked first the factor structure of the WKCT and EpoC and then we compared the

[2] Readers who are interested in mean comparisons for this dataset will find relevant information in Lau et al. (2013).

correlation matrices in the four samples to test whether the structure of the creative ability varies across cultures.

FACTOR STRUCTURE OF THE WKCT AND EPOC

Concerning the WKCT, we fit a simplified two-correlated-factor theoretical model including only fluency (see Figure 1) using confirmatory factor analysis (model based on Cheung & Lau, 2010; Lau & Cheung, 2010a,b). For EPoC, we used the theoretical model described by Lubart et al. (2011) (see Figure 2).

In the whole sample, we found a satisfactory fit for the WKCT (χ^2/df = 10.704/4 = 2.676, CFI = .998, RMSEA = .056, SRMR = .007) as well as for EPoC (χ^2/df = 10.156/14 = 0.725, CFI = .999, RMSEA = .001, SRMR = .015). We replicated the same analyses in the sample of Chinese children living in China and in the sample of French children living in France to check whether the basic factor structure was the same across cultures (configural invariance). Results showed that both the WKCT and EPoC had satisfactory fit in both samples.

CORRELATION BETWEEN TASKS ACROSS CULTURES

One way to explore task specificity in creativity and the structure of the creative ability is to analyze the correlations between tasks requiring different processes (divergent or convergent thinking) in different domains (verbal or graphic). Strong correlations indicate the presence of a general ability, whereas weak correlations argue for greater task specificity. No theoretically expected latent model fit the whole dataset, including both WKCT and EPoC scores. Therefore, the study focused on correlation matrices of the six scores provided by WKCT and EPoC. The correlation matrices of the two monocultural samples and the two multi-cultural samples are presented in Table 1.

The four correlation matrices (Chinese in China, French in France, Chinese in France, and French in China) were compared using structural equation modeling to find out what is the most likely scenario concerning the link between culture and task specificity in creativity. Several exploratory hypotheses were made, each corresponding to a model that we tested. The simplest hypothesis was to consider that the structure is the same in all samples, in other words all samples have equivalent correlation matrices. This first model

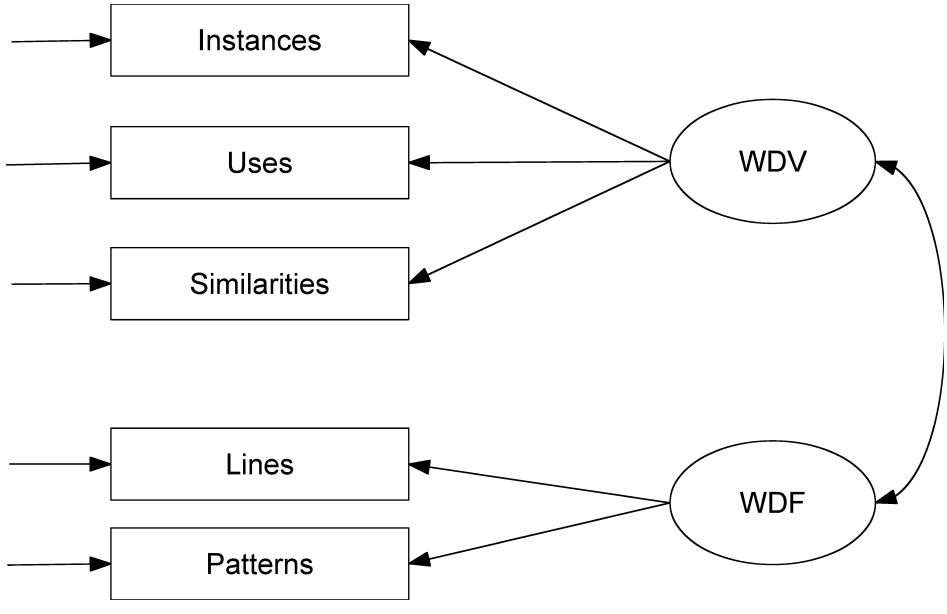

FIGURE 1. Simplified WKCT model including only the fluency scores (based on Cheung & Lau, 2010; Lau & Cheung, 2010a,b). *Note.* WDV stands for WKCT Divergent thinking Verbal scores and WDF for WKCT Divergent thinking Figural scores.

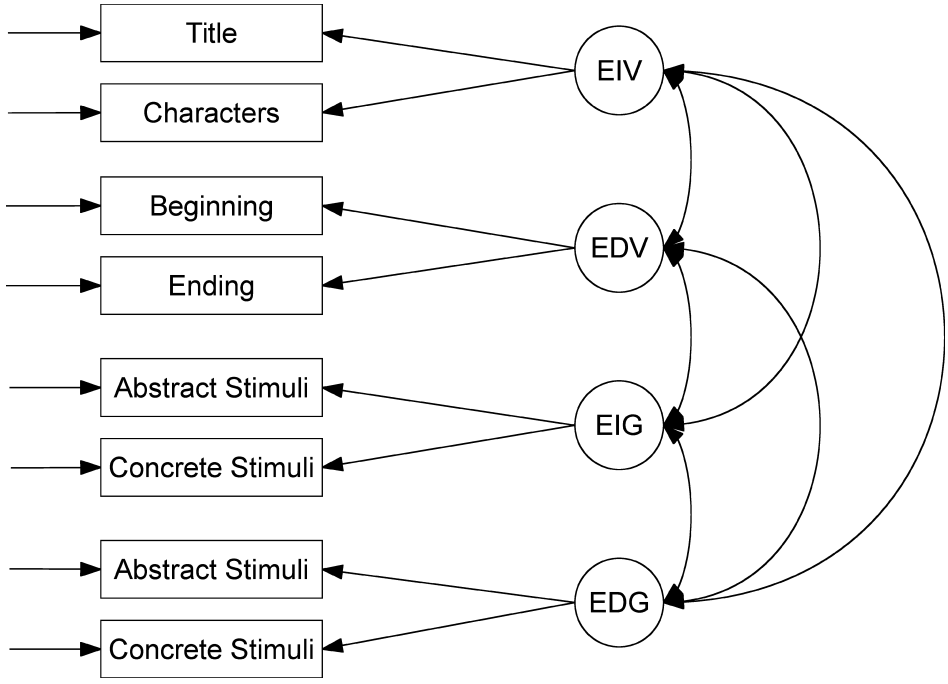

FIGURE 2. EPoC model (Lubart et al., 2011). *Note.* EIV stands for Integrative thinking score in Verbal tasks, EDV for EPoC Divergent thinking score in Verbal tasks, EIG for EPoC Integrative thinking score in Graphical tasks, and EDG for EPoC Divergent thinking score in Graphical tasks.

was called "All equal." Another hypothesis was to consider that cultural origin modifies the structure of creative ability, such that the matrices in samples coming from the same origin are equal (Chinese origins vs. French origins). This second model was called "Origin." A third hypothesis was to consider that the country in which the child lives has an influence on the structure of creativity; the matrices in samples coming from the same country are equal (living in China vs. living in France). This third model was called "Environment." A fourth hypothesis was to consider that the mono- or multicultural context in which the child lives has an influence on the structure of creativity, in other words the matrices in samples coming from the same mono- or multicultural environment are equal (living in mono cultural environment vs. living in multicultural environment). This fourth model was called "Multiculturalism." The fifth model was the saturated one: it considered that the four correlation matrices are different.

When analyzing statistical models, we can look at the absolute quality of model fit with criteria such as the χ^2/df ratio, the RMSEA or the SRMR, but we can also look at the relative quality of model by comparing several models. When comparing statistical models, it is recommended to use information criteria, such as the Akaike Information Criterion (AIC) (Burnham & Anderson, 2002). Burnham and Anderson (2002) suggested to consider that, when the observed difference between the AIC of two models is superior to 2, researchers should consider that they have substantial evidence for the model with the lowest AIC. For each one of the models that we described above, we checked first whether they had a satisfactory absolute fit with the data and then we compared the different models based on the value of their AIC. The values of the indices of the different models are presented in Table 2.

Based on the χ^2/df ratio, on the RMSEA and on the SRMR, it appears that the five models have a satisfactory level of absolute fit with the data. However, when looking at the AIC, it appears that we have substantial evidence to consider that the saturated model, hypothesizing that all correlation matrices are different, is more likely than the four other models. Indeed, the AIC of the saturated model is 5.49 points

TABLE 1. Observed Correlation Matrices in the Four Samples: Chinese from China ($N = 287$), French from France ($N = 174$), French from China ($N = 46$), and Chinese from France ($N = 31$)

	Mean (*SD*)	WKCT—Div. Verb.	WKCT—Div. Fig.	EPOC—Div. Verb.	EPOC—Int. Verb.	EPOC—Div. Grap.
Chinese children living in China						
WKCT—Div. Verb.	49.80 (22.19)					
WKCT—Div. Fig.	32.41 (15.64)	.74**	1	–	–	–
EPOC—Div. Verb.	3.00 (2.25)	.09	.06	1	–	–
EPOC—Int. Verb.	6.81 (3.39)	.33**	.25**	.11	1	–
EPOC—Div. Grap.	6.17 (3.14)	.23**	.14**	.21**	.17**	1
EPOC—Int. Grap.	5.13 (2.66)	.16**	.07	.02	.28**	.03
French children living in France						
WKCT—Div. Verb.	18.78 (15.47)					
WKCT—Div. Fig.	6.78 (6.38)	.78**	1	–	–	–
EPOC—Div. Verb.	3.33 (2.07)	.12	.15	1	–	–
EPOC—Int. Verb.	6.42 (2.96)	.28**	.32**	.14	1	–
EPOC—Div. Grap.	5.70 (3.10)	.13	.20*	.18*	.13	1
EPOC—Int. Grap.	6.43 (2.79)	.12	0.11	.08	.38**	.04
French children living in China						
WKCT—Div. Verb.	24.09 (11.77)					
WKCT—Div. Fig.	11.46 (6.50)	.53**	1	–	–	–
EPOC—Div. Verb.	2.04 (1.86)	−.03	−.17	1	–	–
EPOC—Int. Verb.	5.07 (3.83)	.48**	.35*	.05	1	–
EPOC—Div. Grap.	4.37 (2.27)	.19	.39**	−.04	.00	1
EPOC—Int. Grap.	7.05 (2.18)	.15	.21	−.15	.33*	−.18
Chinese children living in France						
WKCT—Div. Verb.	18.74 (14.95)					
WKCT—Div. Fig.	5.87 (5.18)	.49**	1	–	–	–
EPOC—Div. Verb.	2.42 (1.06)	.19	.02	1	–	–
EPOC—Int. Verb.	5.95 (2.98)	.56**	.32	.21	1	–
EPOC—Div. Grap.	7.03 (2.39)	.55**	.53**	.04	.28	1
EPOC—Int. Grap.	8.97 (2.55)	.20	−.03	−.16	.14	.20

Note. *$p < .05$; **$p < .01$.

TABLE 2. Comparison of Five Models to Explain the Variability between the Four Correlation Matrices

	χ^2	df	*p*	AIC	RMSEA (IC 90%)	SRMR
All equal	132.32	45	<.001	258.32	.06 (.05, .07)	.05
Origin	68.49	30	<.001	224.49	.05 (.03, .06)	.04
Environment	80.01	30	<.001	236.01	.06 (.04, .07)	.05
Multiculturalism	65.49	30	<.001	221.49	.05 (.03, .06)	.04
Saturated model	–	–	–	216	–	0

lower than the AIC of the best of all the other candidates, which is the model explaining differences in terms of multiculturalism.

Pairwise comparisons of within test correlation coefficients revealed that the correlation between the two dimensions of the WKCT is higher among monocultural children than among multicultural children. We did not observe differences either between Chinese children living in China and French children living in France ($z = 0.98$, $p = .33$), or between Chinese children living in France and French children living in China ($z = 0.22$, $p = .83$). However, the observed correlation among Chinese children living in China was significantly higher than the correlation among Chinese children living in France ($z = 2.09$, $p = .04$) and among French children living in China ($z = 2.20$, $p = .03$). Similarly, the observed correlation among French children living in France was significantly higher than the correlation among Chinese children living in France ($z = 2.50$, $p = .01$) and among French children living in China ($z = 2.67$, $p < .01$). No significant differences were observed between the four groups regarding within test correlations of EPoC.

Regarding cross test correlations, pairwise comparisons of correlation coefficients revealed that the performance in the two figural/graphical divergent thinking subtests (WKCT and EPoC) was significantly more strongly correlated among Chinese children living in France than among Chinese children living in China ($z = 2.27$, $p = .02$). Finally, we found that the correlation between the graphic divergent thinking task of EPoC and the verbal divergent task of WKCT was significantly stronger among Chinese children living in France than among French children living in France ($z = 2.39$, $p = .02$).

DISCUSSION

Both WKCT and EPoC showed good cross-cultural structural validity. No theoretically valid model fit the whole dataset, including both WKCT and EPoC. This is due to some unexpected correlation values, such as some weak correlations between the WKCT scores and the EPoC verbal divergent thinking score. Nevertheless, it should be noted that the verbal divergent tasks are different in the WKCT and EPoC. In EPoC, the units that are produced are short stories, whereas in the WKCT, units are simple ideas that are found in few a seconds. It is also important to note that the WKCT and EPoC were administered in an electronic format, which may influence children's performance compared to paper-and-pencil tests used in previous studies of EPoC (Lubart et al., 2011). Further research should try to clarify the relationship between EPoC and WKCT.

The main result of the present study is the finding that culture has an impact on the structure of creative ability. More specifically, the correlation patterns are different in the four groups that we investigated. The best model is indeed the one hypothesizing that all correlation matrices are different. The results showed that some differences in the structure of creative ability can be explained by the monocultural or multicultural environment in which the child lives. It is the case for the correlation between the verbal and non-verbal dimensions of the WKCT: Comparisons revealed that the two scores of the WKCT were significantly more strongly correlated in the monocultural environment than in the multicultural one. This result could be explained by the fact that children who are bicultural learn to adapt their behavior to their cultural context. For example, a child in France whose home culture is Chinese may show flexible, adaptive behavior depending on the cultural context. Therefore, this kind of children may also be more task-context sensitive, showing more variability in performance, leading to lower correlations between tasks, which draw the child toward a "visual" culture in one case and a "literary" culture in another. For monocultural children, the tendency may be to process most tasks (including graphic ones) through the same cultural frame. Previous research on the effect of multiculturalism on creativity did not take into account task specificity using both verbal and graphical tasks (Maddux et al., 2010; Tadmor et al., 2012). In combination with previous research (e.g., Kharkhurin, 2010), our study shows that it is, however, important to take into account the

fact that cultural settings do not all necessarily have the same positive effect on creativity depending on content domains. Some differences cannot be related to simple categories such as monocultural versus multicultural or Chinese culture versus French culture. For example, we found that the performance in the two figural/graphical divergent thinking subtests (WKCT and EPoC) was significantly more strongly correlated among Chinese children living in France than among Chinese children living in China. Another example is that we found that the correlation between the graphic divergent thinking task of EPoC and the verbal divergent task of WKCT was significantly stronger among Chinese children living in France than among French children living in France.

Our study has several limitations that could be addressed in further research. First, we did not measure language proficiency of multicultural children and, as a consequence, we do not know whether they were bilingual children or not. Knowing the level of bilingualism could help explain why the correlation between the two dimensions of the WKCT is lower among multicultural children than among monocultural children. If our measure of multiculturalism is also a measure of bilingualism, our result could relate to findings of Kharkhurin (2010) who found that monolingual children scored higher on verbal creativity tasks than multilingual children, whereas the latter scored higher on non-verbal creativity tasks pointing at a possible effect of multiculturalism on task specificity. Another limitation is the small size of both multicultural samples, which limits the conclusion we can draw about the link between multiculturalism and task specificity in creativity. Further investigation could focus on the influence of multiculturalism on task specificity in creativity either with larger samples or with experimental paradigms. Because it is often related to multilingualism, multiculturalism may reveal greater dimensionality between domains and hide dimensionality between processes. This could be tested experimentally, as it was performed with multiculturalism by Leung and Chiu (2010), in the context of verbal or graphic creation. Such research would help to provide stronger results on the relationship between multiculturalism and task specificity in creativity. Because the literature indicates that patterns of relationships across fluency, flexibility, and originality scores are consistent across cultures (Rudowicz, Lok, & Kitto, 1995; Torrance, Gowan, Wu, & Aliotti, 1970), we did not score flexibility and originality for EPoC. We did not challenge this assumption with our data and further research could examine it.

In sum and despite its limitations, the current study shows that culture has an impact on the structure of creative ability. It means that researchers focusing on the impact of culture on creativity—whether they are interested in unique features of cultures when comparing one cultural setting to another or in multiculturalism—should take into account task specificity. Indeed it might be the case that results that are found using one specific task are not generalizable to all kinds of tasks.

REFERENCES

Ackerman, P.L., & Heggestad, E.D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin*, *121*, 219.

Amabile, T.M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, *43*, 997–1013.

Baer, J. (1993). *Creativity and divergent thinking: A task-specific approach*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Baer, J. (1998). The case for domain specificity of creativity. *Creativity Research Journal*, *11*, 173–177.

Baer, J. (2003). Evaluative thinking, creativity, and task specificity: Separating wheat from chaff is not the same as finding needles in haystacks. In M.A. Runco (Ed.), *Critical creative processes* (pp. 129–151). Cresskill, NJ: Hampton Press.

Baer, J. (2014). *Creativity and divergent thinking: A task-specific approach*. Florence, KY: Psychology Press.

Baer, J., & Kaufman, J.C. (2005). Bridging generality and specificity: The Amusement Park Theoretical (APT) model of creativity. *Roeper Review*, *27*, 158–163.

Barbot, B., Besançon, M., & Lubart, T. (2011). Assessing creativity in the classroom. *The Open Education Journal*, *4*, 58–66.

Burnham, K.P., & Anderson, D.R. (2002). *Model Selection and Multimodel Inference: A practical information-theoretic approach* (2nd edn). New York: Springer-Verlag.

Byrne, B.M., & Watkins, D. (2003). The issue of measurement invariance revisited. *Journal of Cross-Cultural Psychology*, *34*, 155–175.

Cattell, R.B. (1968). Fluid and crystallized intelligence. *Psychology Today*, *3*, 56–62.

Chan, D.W., Cheung, P.C., Lau, S., Wu, W.Y.H., Kwong, J.M.L., & Li, W.L. (2001). Assessing ideational fluency in primary students in Hong-Kong. *Creativity Research Journal*, *13*, 359–365.

Chermahini, S.A., & Hommel, B. (2010). The (b) link between creativity and dopamine: Spontaneous eye blink rates predict and dissociate divergent and convergent thinking. *Cognition*, *115*, 458–465.

Cheung, P.C., & Lau, S. (2010). Gender differences in the creativity of Hong Kong school children: Comparison by using the new electronic Wallach-Kogan Creativity Tests. *Creativity Research Journal*, *22*, 194–199.

Coulaud, H. (2013). *Prototype for a computerized version of EPoC*. Paris: University Paris Descartes.

Fee, F. (1968). An alternative to Ward's factor analysis of Wallach and Kogan's creativity correlations. *British Journal of Educational Psychology*, *38*, 319–321.

Guilford, J.P. (1956). Structure of intellect. *Psychological Bulletin*, *53*, 267–293.

Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1–19.

Kaufman, J.C., & Baer, J. (2012). Beyond new and appropriate: Who decides what is creative? *Creativity Research Journal*, *24*, 83–91.

Kaufman, J.C., Baer, J., Cropley, D.H., Reiter-Palmon, R., & Sinnett, S. (2013). Furious activity vs. understanding: How much expertise is needed to evaluate creative work? *Psychology of Aesthetics, Creativity, and the Arts*, *7*, 332.

Kharkhurin, A.V. (2010). Bilingual verbal and nonverbal creative behavior. *International Journal of Bilingualism*, *14*, 211–226.

Kharkhurin, A.V. (2012). *Multilingualism and creativity*. Bristol, UK: Multilingual Matters.

Kim, K. (2006). Meta-analyses of the relationship of creative achievement to both IQ and divergent thinking test scores. *Journal of Creative Behavior*, *42*, 106–130.

Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology*, *61*, 622–629.

Lau, S., & Cheung, P.C. (2010a). Developmental trends of creativity: What twists of turn do boys and girls take at different grades? *Creativity Research Journal*, *22*, 329–336.

Lau, S., & Cheung, P.C. (2010b). Creativity assessment: Comparability of the electronic and paper-and-pencil versions of the Wallach-Kogan Creativity Tests. *Thinking Skills and Creativity*, *5*, 101–107.

Lau, S., Cheung, P.C., Lubart, T., Tong, T.M., & Chu, D.H. (2013). Bicultural effects on the creative potential of Chinese and French children. *Creativity Research Journal*, *25*, 109–118.

Leung, A.K., & Chiu, C. (2010). Multicultural experience, idea receptiveness, and creativity. *Journal of Cross-Cultural Psychology*, *41*, 723–741.

Lubart, T. (2010). Cross-cultural perspectives on creativity. In J.C. Kaufman & R.J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 265–278). New York: Cambridge University Press.

Lubart, T., Besançon, M., & Barbot, B. (2011). *Evaluation du Potentiel Créatif (EPoC)*. Paris: Hogrefe.

Maddux, W.W., Adam, H., & Galinsky, A.D. (2010). When in Rome. . .Learn why the Romans do what they do: How multicultural learning experiences facilitate creativity. *Personality and Social Psychology Bulletin*, *36*, 731–741.

McGrew, K.S. (2005). The Cattell-Horn-Carroll theory of cognitive abilities: Past, present, and future. In D.P. Flanagan & P.L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 136–181). New York: Guilford Press.

McKinney, J.D., & Forman, S.G. (1977). Factor of the Wallach-Kogan Tests of Creativity and measures of intelligence and achievement. *Psychology in the Schools*, *14*, 41–44.

Niu, W., & Sternberg, R.J. (2003). Societal and school influence on students' creativity. *Psychology in the Schools*, *40*, 103–114.

Paletz, S.B., Peng, K., & Li, S. (2011). In the world or in the head: External and internal implicit theories of creativity. *Creativity Research Journal*, *23*, 83–98.

Rudowicz, E., Lok, D., & Kitto, J. (1995). Use of the Torrance Tests of Creative Thinking in an exploratory study of creativity in Hong Kong primary school children: A cross-cultural comparison. *International Journal of Psychology*, *30*, 417–430.

Schmitt, D.P., Allik, J., McCrae, R.R., & Benet-Martínez, V. (2007). The geographic distribution of Big Five personality traits patterns and profiles of human self-description across 56 nations. *Journal of Cross-Cultural Psychology*, *38*, 173–212.

Schwartz, S.H., & Sagiv, L. (1995). Identifying culture-specifics in the content and structure of values. *Journal of Cross-Cultural Psychology*, *26*, 92–116.

Silvia, P., Kaufman, J.C., & Pretz, J.E. (2009). Is creativity domain-specific? Latent class models of creative accomplishments and creative self-descriptions *Psychology of Aesthetics, Creativity, and the Arts*, *3*, 139–148.

Sternberg, R., & Lubart, T. (1999). The concept of creativity: Prospects and paradigms. In R.J. Sternberg (Ed.), *Handbook of creativity* (pp. 3–15). New York: Cambridge University Press.

Storme, M., & Lubart, T. (2012). Conceptions of creativity and relations with judges' intelligence and personality. *Journal of Creative Behavior*, *46*, 138–149.

Storme, M., Myszkowski, N., Celik, P., & Lubart, T. (2014). Learning to judge creativity: The underlying mechanisms in creativity training for non-expert judges. *Learning and Individual Differences*, *32*, 19–25.

Tadmor, C.T., Galinsky, A.D., & Maddux, W.W. (2012). Getting the most out of living abroad: Biculturalism and integrative complexity as key drivers of creative and professional success. *Journal of Personality and Social Psychology*, *103*, 520.

Thurstone, L.L., & Thurstone, T.G. (1941). Factorial studies of intelligence. *Monograph No. 2. Chicago*: University of Chicago Press.

Torrance, E. (1974). *The Torrance Tests of Creative Thinking-Norms-Technical Manual Research Edition-Verbal Tests, Forms A and B- Figural Tests, Forms A and B. Princeton*. Princeton, NJ: Personnel Press.

Torrance, E.P., Gowan, J.C., Wu, J.J., & Aliotti, N.C. (1970). Creative functioning of monolingual and bilingual children in Singapore. *Journal of Educational Psychology*, *61*, 72.

Wallach, M., & Kogan, N. (1965). *Modes of thinking in young children*. New York: Holt, Rinehart & Winston.

Wallbrown, F.H., Wallbrown, J.D., & Wherry, R.J. (1975). The construct validity of the Wallach-Kogan creativity test for inner-city children. *Journal of General Psychology*, *92*, 83–96.

Ward, J. (1967). An oblique factorization of Wallach and Kogan's creativity correlations. *British Journal of Educational Psychology*, *37*, 380–382.

Wong, R., & Niu, W. (2013). Cultural difference in stereotype perceptions and performances in nonverbal deductive reasoning and creativity. *The Journal of Creative Behavior*, *47*, 41–59.

Yi, X., Hu, W., Plucker, J.A., & McWilliams, J. (2013). Is there a developmental slump in creativity in China? The relationship between organizational climate and creativity development in Chinese adolescents. *The Journal of Creative Behavior*, *47*, 22–40.

Martin Storme, Todd Lubart, Nils Myszkowski, Université Paris Descartes

Ping Chung Cheung, The Chinese University of Hong Kong

Toby Tong, Sing Lau, Hong Kong Baptist University

Correspondence concerning this article should be addressed to Martin Storme, Université Paris Descartes, 71 avenue Vaillant, Boulogne-Billancourt 92774, France. E-mail: martinstorme@ymail.com