

JULIA SIMNER REBECCA SMEES LOUISA J. RINALDI DUNCANA. CARMICHAEL TOBYJ. MCDONALD

What Factors Influence Children's Creative Artistic **Orientation?** The Novel Children's Creative Orientation Test: Artistic

ABSTRACT

Creative orientation is the extent to which different individuals are drawn toward creative activities (e.g., art, music). We know relatively little about child-level creative orientation given certain testing limitations. Adult tools often measure time spent engaged in creative pursuits, but this method is unsuitable for children because their free time is often dictated by parents. To overcome this, we devised an entirely novel measure of creative orientation, the Children's Creative Orientation Test: Artistic (C-COT: Artistic). This short task, suitable for children as young as 6, elicits children's creative urges toward artistic pursuits independently of parental influence and provides quantitative scoring. We applied our measure to over 3000 children aged 6-10 years, where it showed robust reliability, suggesting that creative orientation is a stable trait over time. We show that creative orientation is also influenced by classroom cohort, age, and gender but is unaffected by socio-economic status or seasonal changes (autumn vs. spring testing). We showed too that creative orientation converges with creative thinking (divergent thinking), creative personality (openness to experiences, especially the aesthetics subtrait), and creative engagements in the home. We present our test here in full, as a simple, fast, and robust measure of creative artistic orientation in children.

Keywords: creativity, creative orientation, divergent thinking, children.

For at least 100 years, psychologists have sought to capture the essence of creativity, with the foundations of this science dating as far back as early Greek and Roman traditions (Finke, Ward, & Smith, 1992; Kneller, 1965; Mccarthy & Pittaway, 2014). And studies have described creativity from multiple perspectives, building a comprehensive picture from different angles. One accepted definition has been that creativity generates an idea or product that is novel and appropriate/useful/valuable (Jung, Mead, Carrasco, & Flores, 2013; Runco & Jaeger, 2012; Stein, 1953; Sternberg & Lubart, 1999; Vygotsky, 2004) and it includes ideas or products from a broad array of domains, including the creative arts, science, maths, or everyday problem-solving. From a different perspective entirely, Kaufman and Beghetto (2009) and Stein (1953) defined creativity into a qualitative hierarchy, with creative geniuses at the top (e.g., Da Vinci) through to creative professionals (e.g., artisans), to everyday creativity (e.g., problem-solving), and finally down to the development of creativity in childhood (often referred to as creative potential). Yet, another branch of research has been concerned with the motivational aspects of creativity (Amabile, 1983), which represent the psychological impulses that stimulate creativity to occur. Finally, one helpful contemporary approach has been to triage creativity into three key component domains (Cropley, 2000): creative thinking (i.e., the ability to generate creative ideas), creative products (i.e., the ability to generate a creative output), and creative person/orientation (i.e., the urge that pushes certain individuals toward creative activities, including the personality traits associated with creativity). Our current study investigates an aspect of this third componentchildren's individual orientations toward creative arts activities.

Creativity feels self-evidently different from one person to the next, and individual differences can emerge early in childhood. However, capturing those differences in children poses challenges. There are a number of creativity tests and questionnaires for children, but the majority measure types of creative thinking (e.g., *Torrance Test of Creative Thinking*, *TTCT*; Torrance, 2008) or creative thinking/products (Torrance, 2008; Urban & Jellen, 1996). Very few childhood tests focus on creative orientation—which Vygotsky first described as far back as 1930, as "children's desire to [e.g.,] draw and make up stories" (Vygotsky, 2004)—and Amabile (Amabile, 1983; Amabile et al., 2018) has since called "task motivation." As a result, we know very little about how children differ one from the next in their individual desires to engage in creative pursuits. Yet, understanding this trait can give valuable insight into children's dispositions. And simply understanding that different children place different values on creative pursuits can lead us to better understand their individual pleasures, and their individual conduits to happiness.

One particular challenge in measuring children's creative orientation comes down to a confound that arises when measuring children, which does not arise when measuring adults. In adult tools, creative orientation can be measured by *engagement*, that is, by quantifying the time one spends engaged in creative pursuits—either for leisure or for employment (Batey, 2007; Dollinger, 2003; Hocevar, 1979; Lunke & Meier, 2016; Runco & Albert, 1985; Taylor & Ellison, 1983). The logic here is that engagement is a useful outward sign of creative orientation (i.e., more creatively oriented people engage more). Indeed, we could understand creative orientation by looking at engagement across a range of creative pursuits; for example, the *Creative Activities Checklist* measures engagement in six creative domains in young adults and older children (literature, music, drama, arts, crafts, and science; Runco & Albert, 1985). However, it has been particularly challenging to assess creative orientation in younger children, since their engagement in activities are largely dictated by their parents (and indeed by their parents' financial situation). Hence, a child who spends every weekend at art class or drama group may in fact be far less creatively oriented than one who attends no such classes at all. This makes the "time-spent" metric valueless in young participants, because it reflects instead *their parents' efforts and ability to establish engagement*.

A similar problem would arise if attempting to infer creative orientation not from engagement, but from creative achievements (i.e., with the assumption that more creatively oriented people achieve more). Despite ample measures of creative achievements (Hocevar, 1979; Michael & Colson, 1979; Taylor & Ellison, 1968), these too would be confounded if used to measure orientation in children, again given family circumstances (i.e., financial means) and indeed also the child's age (older children have had more time to engage/achieve; Csikszentmihalyi, 1988; Lareau, 2002; Richards, Garratt, Heath, Anderson, & Altintaş, 2016). As a result, although we can meaningful estimate creative orientation in adults (Dollinger, 2003; Hocevar, 1979; Hocevar & Michael, 1979; Lunke & Meier, 2016) we struggle to measure creative orientation in children at all.

Since it has proved difficult to measure creative orientation via the usual adult metrics ("time-spent" or "achievements gained"), we took on the challenge to devise an entirely novel childhood assessment to overcome this difficulty. Our new test measures children's orientation toward creative activities independently of parental timetabling, and we used our test to understand the creative urges of over 3000 children aged 6 to 10 years. To anticipate our results, we will show that our test can indeed delineate individual differences in creative/artistic orientation, and these validate against other measures, as well as showing demographic differences across gender and age. In our task, children were presented with pictures of 12 different activities, half creative/artistic activities and half non-creative activities. Children were asked to decide which activities they would choose to do on a fictional fun day ("Imagine you are going on a fun day out, and these are the activities you could choose from"). Children were given instructions to allow them to meaningfully rate all 12 activities in an ordered list from most to least preferred. We then scored our test to quantify the extent to which much each child was oriented to creative activities.

In our study, we focused on creative activities in the arts (rather than maths, sciences, or other disciplines) and this was for a number of different reasons. First, creativity researchers as far back as Hocevar (1979)) have demonstrated that artistic activities might be considered *archetypal* creative activities because they represent the largest group of items in any measure of creative activities, for either adults or children—and especially for children (where they are overwhelmingly in the majority, e.g., Dollinger, 2003; Dollinger, Palaskonis, & Pearson, 2004a; Runco, 1987; Dollinger, Urban, & James, 2004b). Second and relatedly, while the average child will have experienced arts-based creativity often, they will have relatively little experience of commonly described *non*-artistic creativity. We can see this by looking at creative scientific items, for example, from Batey's *Biographical Inventory of Creative Behaviours* (e.g., "producing a theory," "publishing a science article"; Batey, 2007) or Runco's measures for older children (e.g., "conducted an original experiment"; Runco, 1987). Although it is of course possible to create child-oriented versions of these activities (e.g., synthesizing chemical structures out of building blocks), these are likely to be relatively less familiar to a young child than, say, painting or drawing. Third, if we were to include such activities (e.g.,

child-oriented science activities) it would be difficult to differentiate in a simple manner that the activity in question was creative, per se, because our test for young children uses pictures with virtually no text. Hence, a picture of child making chemical structures using building blocks (or adding two chemicals in a laboratory, or running experiments in nature, etc.) would be unclear in its *creative* component. In contrast, our own (artistic) items represent creative activities that any child would find easy to understand as such, without explanation. Finally, the framework of our testing crucially allows us to assess children away from parental/socio-economic influences, but involves necessarily placing our activities within fictional fun day. We are therefore naturally constrained to select activities that would commonly fit this framework, and activities such as painting are more common exemplars than science (though both are theoretically possible). In summary, for all these reasons, our creative activities are artistic creative activities, since these are age-appropriate, common to the context, and easily depicted as creative for children.

All children in our cohort completed our test in an initial session, and around a 1000 of them were also given the same test a second time approximately 9 months later (to measure test-retest reliability over time). In a second study, those same children were also given an additional test of a type of creative thinking (i.e., divergent thinking, using the *Alternate Uses Task* from the *TTCT*; Torrance, 2008). This not only allows us to assess whether creative orientation maps to divergent thinking but also offers the chance to test whether our novel measure had convergent validity with other creativity tools. Additionally, our entire cohort was also given a personality test, to examine convergence between our own measure of creative orientation and personality traits typically associated with creativity (e.g., *Openness to Experiences*; see below). We also tested over 700 of their parents or carers (henceforth "parents"), to elicit *parental* ratings of children's personalities, as well as a measurement of how much children engage in creative activities in the home (see below).

For our personality measure, we chose to administer the Definitional Big Five Inventory 44-items for Children (Def BFI-44-C; Rinaldi, Smees, Carmichael, & Simner, 2020; see John, Donahue, & Kentle, 1991; John, Naumann, & Soto, 2008; Soto, John, Gosling, & Potter, 2008). This self-report instrument measures children's personality along five factors, and one of these factors-Openness to Experience-is particularly associated with creativity and intellect (Caspi, Roberts, & Shiner, 2005; McCrae & Costa, 1987).¹ We also administered an equivalent questionnaire to children's parents (BFI-44-Parent; available from https://www. ocf.berkeley.edu/~johnlab/measures.htm; see John et al., 1991, 2008; John & Srivastava, 1999) because parents' ratings sometimes hold additional information beyond the child's (Markey, Markey, Tinsley, & Ericksen, 2002). We chose these personality instruments in particular because the Big Five factor structure of personality has been validated in both adults and children (Abe, 2005; Abe & Izard, 1999; Digman & Takemoto-Chock, 1981; Halverson et al., 2003; John et al., 2008; John, Caspi, Robins, Moffitt, & Stouthamer-Loeber, 1994; Markey et al., 2002; Scholte, van Aken, & van Lieshout, 1997) and these particular measures (Def BFI-44-C and BFI-44-Parent) have been additionally validated on the same cohort of children tested here (Rinaldi et al., 2020). Finally, with our trait of interest (openness to experience), we will also explore its subfacets of openness to aesthetics and openness to ideas (Soto & John, 2009). We anticipate finding a closer relationship between creative orientation and the former subfacet, since openness to aesthetics is particularly linked with artistic inclination (Kaufman et al., 2016).

We also investigated whether individual differences in creative orientation from child to child could be captured by age, gender, and environment. Gender differences are often found in aspects of creative thinking, engagement, and activities (Baer & Kaufman, 2008; Chan, 2005; Runco, Cramond, Pagnani, 2010a; Runco, 1986), and interact with the fact that interests change with age (Hilton & Berglund, 1974; Tracey, 2002; Tracey & Ward, 1998; Weinburgh, 1995). We also examined three environmental effects: class-room effects, socio-economic effects, and seasonal effects. The former was of interest because teaching styles, for example, are known to impact on children's creativity (Reeve, 2009), and there are significant school or class effects in a number of creativity measures including drawing production (Gralewski & Karwowski, 2012) and divergent thinking (Kuhn & Holling, 2009). Our sample also varied in socio-economic background, and we hypothesized that this could influence creative orientation according to different levels of parental resources. If orientation is linked to previous experience, we may find that families with greater financial resources to direct at creative pursuits (e.g., drama classes) may be those whose children are more oriented in this direction. Alternatively, we may find the opposite: that children without the same financial means to engage in these activities would be more inclined toward them. Finally, we had the opportunity to examine

¹ The other four factors are as follows: *conscientiousness* (e.g., hard work/carefulness), *extraversion* (e.g., outgoing/sociable), *agree-ableness* (e.g., trust/kindness), and *neuroticism* (e.g., worry/anxiety; see Caspi et al., 2005.

seasonal effects since our cohort were tested in either the autumn term (October–December) or the spring term (January–April). We therefore tested whether season (with its differences in mean daily sunlight) influences creative orientation (see Kombeiz & Steidle, 2018, for the influence of lighting on creativity).

In summary, we investigated children's orientation to creative activities, and devised and validated a novel measure, which we have named the *Children's Creative Orientation Test: Artistic (C-COT: Artistic)*. We asked whether creative orientation is a stable trait by testing a large cohort of children (6–10 years) across approximately 9 months. In so doing, we aim to demonstrate the test–retest reliability of our tool, as well as demographic and other influences. In a second study, we will measure the relationship between creative orientation and creative divergent thinking (i.e., *Alternate Uses Task* from the *TTCT*), creative personality (the *Openness to Experiences* trait, within the *Def BFI-44-C* and *BFI-44-Parent*), and in-the-home creative engagement (using a *Home Creative Engagement Questionnaire*; see Methods). These convergent findings will also further validate our measure. Our procedures and results are described below.

STUDY 1: IS CREATIVE ORIENTATION A STABLE TRAIT AND DOES IT SHOW DEMOGRAPHIC, ENVIRONMENTAL, AND SOCIO-ECONOMIC EFFECTS? METHODS

Participants

Testing took place over two sessions. In Session 1, we tested 3,402 children, and in Session 2, we revisited a subset of 920 children (see below for their selection criteria). Children at Session 1 were aged 6–10 years (M = 8.41; SD = 1.17), and at Session 2, they were now aged 6–11 years (M = 9.25; SD = 1.18). At both time points, gender split was approximately equal with 48.7% girls at Session 1, and 51.0% at Session 2. Children were recruited from 22 schools in the southern counties of England, comprising 121 classes from school Years 2–5.² Since opt-out rate was extremely low (1%), this represented virtually the entire student body of all targeted years. As an indicator of affluence/poverty (Taylor, 2018), the mean school-level free school meal (FSM) percentage was 13.4% (range 0.7–38.1%) where the national average for primary schools from the same period was 14.1% (Department for Education, 2017).

We tested but excluded an additional 22 children: 14 were newly arrived in the U.K. with little or no English language proficiency, 4 did not finish the task, 1 was missing a date of birth, and 3 were found to have scrambled ID codes. Ethical permission for all studies reported here was granted by the University of Sussex's Science and Technology Research Ethics Committee.

MATERIALS AND PROCEDURE

Children were tested in person, during two testing sessions. Session 1 took place between October 2016 and April 2017, and Session 2 took place 7–10 months later (M = 9.03 months; SD = 0.73) between November 2017 and March 2018. In the first session, children were tested in their class cohorts with an average size of approximately 29 pupils. Participants were supervised by three researchers at any given time. In the second session, children were tested in group sizes of approximately 16 pupils supervised by at least two researchers at any given time. In both cases, tests were embedded in a series of other tasks as part of a larger project, whose results are reported elsewhere (Simner, Smees, Rinaldi, & Carmichael, 2021; Smees, Rinaldi, & Simner, 2019). The score on one of these tests in Session 1—a multisensory learning task for another project—determined which children were revisited in Session 2 (i.e., those revisited were a sample of children who scored below average, average, and above average in a multisensory learning task pairing numbers with letters, which is unrelated to the current study and described in full in Rinaldi, Smees, Alvarez, & Simner, 2019). Our target measure for children is described below.

CHILDREN'S CREATIVE ORIENTATION TEST: ARTISTIC (C-COT: ARTISTIC)

Stimuli for this test are 12 activities, depicted as pictures on 12 separate cards (5 cm \times 8 cm). These activities were carefully selected so that half were creative in the arts (e.g., "paint or draw a picture") and half were non-creative activities (e.g., "join the gardening club"; see Figure 1³). Creative activities covered

² For non-UK readers, the English primary school years are as follows: reception (age 4–5), Year 1 (age 5–6), Year 2 (age 6–7), Year 3 (age 7–8), Year 4 (age 8–9), Year 5 (age 9–10), and Year 6 (age 10–11). We tested children in Years 2–5 at Session 1.

³ In a different context, with an alternative nuance, gardening can sometimes be construed as creative if it specifically involves elements of garden design. However, in the context our own test ("fun-day activity"), with the wording used ("gardening club") and with the illustration shown (children watering a plant, not holding a sketchbook), all features converge on this being a non-creative activity.



FIGURE 1. Example of two items in the C-COT: Artistic. The left-hand picture shows an example of a creative activity, and the right-hand picture shows an example of a non-creative activity.

three domains (art, music, and literature) as did the non-creative activities (sport, entertainment, and outdoors). Our creative activities were selected from well-used items in the literature, and in particular, our selected creative items are among a set that was empirically validated as creative by a testing cohort in Hocevar (1979). Each of our activities was represented in a black and white line drawing, carefully produced by a professional illustrator to depict each activity unambiguously. For each activity, we ensured that girls and boys were depicted as taking part in equal numbers. Examples of our items are shown in Figure 1, and the full set of activity cards is shown in the Appendix A.

For testing, each child was given their own rectangular testing board, on which we placed their 12 activity cards, randomly ordered from child to child. Down to each vertical edge of the board were numbered placeholders (1-6 running down the left-hand side, 7-12 running down the right-hand side; see Figure 2). Children were told to imagine they were going on a fun-day out and that they would have activities to choose from, shown on the 12 cards. They were instructed to order the activities according to how much they would like to do them, that is, to place their favorite activity ("the activity you would like to do the most") on the box marked number 1; their next favorite on number 2, and so on, all the way down to their least favorite, which they should place on number 12. To aid in this task, children could be encouraged to divide the activities into six they would most like to do and six they would least like to do, and then to order within each of the subsets. Children were instructed to lift each activity card into its desired position (1-12) at the edges of the board, according to their preference. A light adhesive was used to ensure that cards would stay in place (i.e., our cards had Velcro backing, although the task could be replicated on a flat surface without this, or simply by sorting cards into an ordered pile). Children were told there was no right or wrong answer. The task was complete once all 12 placeholders were covered with the 12 activity cards (running 1 through 12). The task took approximately 5 minutes to complete, and our full test and instructions are given in the Appendix A for future users.

RESULTS

Analytic plan

Here and throughout, analyses were computed in SPSS 24.0. with alpha set at the conventional p < .05, and relevant familywise corrections applied where indicated. Our analyses first investigate whether creative orientation (C-COT: Artistic score) is a stable trait over time, based on 920 children who took the test on two occasions (Sessions 1 and 2). We conducted a correlation across the two sessions, then repeated within each year group separately (correcting for multiple comparisons). Next, we consider whether creative orientation shows demographic influences (e.g., gender, age), based on N 3402 children in Session 1. Here, we ran a mixed-effects multiple regression model entering variables of gender and age as fixed covariates, and modeling random variation at the school and classroom level (asking whether some class cohorts more creatively oriented, perhaps relating to teaching style). Our null model (Model 1) shows raw variation in C-COT: Artistic scores across children and school/classroom, while Models 2 and 3 incrementally add gender/ age and the interaction term, respectively. Finally, we assess environmental effects looking first at seasonal influences on creative orientation, by comparing children tested in autumn versus spring using a t-test. Finally, we examined socio-economic influences on creative orientation between school-level C-COT: Artistic scores, and the school's socio-economic metric (percentage FSM; i.e., the percentage of the school eligible for free school meals).



FIGURE 2. Testing board used in our artistic creativity test: the C-COT: Artistic. 12 activity cards are placed randomly in the center of the board. The participant moves each card to his or her pre-ferred numbered placeholder, in the order from 1 (most preferred) to 12 (least preferred).

STABILITY OF CREATIVE ORIENTATION OVER TIME

To code the test of creative orientation (C-COT: Artistic), we assigned to each of the six creative activities (e.g., "Paint or draw a picture") a score from 1 to 12 depending on the child's preference ranking. If the child had made it Choice 1 (most preferred), it was scored 12 points; Choice 2 was scored 11 points, Choice 3 was scored 10 points, and so on. Scores were then summed across all six creative activities for each child, and a final score was calculated by subtracting 21 (i.e., the lowest possible score, if all six creative items were placed last). This subtraction produces an intuitive final score for each child within the range of 0-36, where higher scores correspond to more creative orientation.

We first compared the C-COT: Artistic scores for each child mapped across the two sessions. Comparing scores in this way shows that test-retest reliability is highly significant (r = .48, p < .001, n = 920) and medium in effect size (using effect size conventions here and throughout from Cohen, 1988). It was, however, strongly mediated by the age of the child, with the strongest effect sizes for children aged 9–10 (r = .65, p < .001; see Table 1) but still medium effects for even our very youngest children aged 6–7 (r = .35, p < .001). These findings show that the trait of creative orientation is stable over time, even in self-report from children as young as 6 years, but become more stable with age.⁴

Investigating child level and environmental effects

We followed up our investigation by considering whether individual differences in creative orientation from child to child could be captured by age, gender, and environment (e.g., influence of school). Creemers

⁴ Since the time gap between Session 1 and Session 2 ranged from 7 to 10 months (i.e., was not uniform across the sample), we confirmed this had no impact on test–retest reliability; that is, time gap between sessions was not associated with the magnitude of change in C-COT: Artistic score, r = .026, p = .433.

TABLE 1. Pearson's correlations (r) for C-COT: Artistic scores at two time points (Session 1 and Session 2) separated by approximately 9 months. Results are broken down by school year (and corresponding ages) with cohort sizes shown (N). Repeating our analyses using intra-class correlations showed an identical pattern of results

	Year group (and age) at Session 1					
	Year 2 (6–7 years)	Year 3 (7–8 years)	Year 4 (8–9 years)	Year 5 (9–10 years)		
r	.35***	.39***	.49***	.65**		
N	214	229	237	240		

Asterisk convention here and throughout is ***p < .001; **p < .01; and *p < .05. *P* values are corrected for multiple comparisons.

and Kyriakides (2010) suggest that school influences are multilevel in nature and situated on four planes: student, classroom, school, and system. Modeling educational effects also provides more reliable estimates of fixed or independent influences (Field, 2013). Hierarchical linear regression techniques are the most appropriate methods for assessing school/class effects, if the number of higher level groups is large enough (Opdenakker & Van Damme, 2000; Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). Since our own dataset was large and indeed hierarchical (children [level 1] nested within classes [level 2], and classes nested within schools [level 3]), we carried out multilevel regression analyses, using the mixed-effects command within SPSS 24.0), entering age and gender as fixed covariates.

Table 2 shows the raw mean C-COT: Artistic (creative orientation) scores for girls and boys in Session 1 (i.e., the largest group size; n = 3402), and Figure 3 shows the age-related differences within each gender, before modeling the data hierarchically.

Model 1 (Table 3) shows the null multilevel model, prior to entering any child predictors. Only classroom was included as a random organizational level, as school variation was not significant so dropped from the initial three-level model (*Est.* = 0.07, *SE* = 0.12, *p* = .573). In Model 2, gender and age were both significant predictors of creative orientation, with girls and older children being more creatively oriented than boys and younger children (Model 2: Girls *Est.* = 3.98, *p* < .001; Age *Est.* = 0.23, *p* < .05). In addition, there was a significant interaction between gender and age (Model 3: *Est.* = 0.93, *p* < .001). This can be seen in Figure 3, which shows that the association between age and C-COT: Artistic score was stronger for girls (i.e., girls' creative orientation increased sharply with age). The same relationship for boys failed to reach significance at the conventional alpha (Model 3: *Est.* = -0.23, *p* = .071; see Table 3) but was trending negative (i.e., unlike girls, boys do not become more creatively oriented with age, but trend the reverse). Finally, a small but significant proportion of variance was explained by environmental differences after gender and age had been taken into account. Although there were no school-level differences in creative orientation scores, there was a significant class-level effects (intra-class correlation [*ICC*] = 0.016; Model 2, Table 3, row 4 column 4) suggesting that children's orientation toward creative pursuits could be shared among their classmates in a significant way.

We ended by considering two final environmental effects. The first relates to the fact that children in Session 1 were tested in either autumn term (October–December) or spring term (January–April). It is possible that mean daily sunlight influences creative orientation (see Kombeiz and Steidle (2018)) for the influence of lighting on creativity). However, we found no difference in C-COT: Artistic scores for children taking the test in the autumn (M = 15.32, SD = 5.97) or spring (M = 15.53, SD = 6.17) terms, t (3400) = -0.97, p = .330. Finally, we considered the socio-economic environment by comparing C-COT:

		Ν	Mean	SD	Range
Session 1	C-COT: Artistic: all	3402	15.45	6.10	0-35
	C-COT: Artistic: girls	1657	17.49	5.95	0-35
	C-COT: Artistic: boys	1745	13.52	5.58	0-35

TABLE 2. Descriptive statistics for the C-COT: Artistic (Session 1)

21026/057, 2022. 4, Downloaded from https://minelibrary.wiley.com/doi/10.1002/joch.555 by NHS Elucation for Securat MES, Edinburgh Central Office, Wiley Online Library on [1505/2024]. See the Terms and Conditions (https://winelitary.wiley conterms-and-conditions) on Wiley Online Library for rules of use; O A articles are governed by the applicable Central Office, Wiley Online Library on [1505/2024]. See the Terms and Conditions (https://winelitary.wiley conterms-and-conditions) on Wiley Online Library for rules of use; O A articles are governed by the applicable Central Office, Wiley Online Library for library.



FIGURE 3. Mean scores for C-COT: Artistic (creative orientation) within boys and girls across age. Error bars show 95% confidence intervals.

TABLE 3. Multilevel models identifying fixed influences on creative orientation (C-COT: Artistic, Session 1). Age (grand-mean-centered, GMC) represents the age of the child at Session 1. Estimate is the model coefficient with the standard error (SE) in brackets. Table shows the estimated C-COT: Artistic scores for girls (compared with boys). Gender*Age is the moderation between gender and age

Parameters	Model 1 estimate (SE)	Model 2 estimate (SE)	Model 3 estimate (SE)	
Fixed effects				
Intercept	15.45 (0.12)***	13.51 (0.15)***	13.52 (0.15)***	
Age (GMC)		0.23 (0.10)*	-0.23 (0.13)#	
Gender (girls)		3.98 (0.20)***	3.98 (0.20)***	
Gender*Age			0.93 (0.17)***	
Random parameters				
Level 2: Class	0.46 (0.23)*	0.50 (0.22)*	0.52 (0.22)*	
Level 1: Pupil	36.69 (0.91)***	32.65 (0.81)***	32.34 (0.80)***	
N	3402	3402	3402	

p < .10, p < .05, p < .01, p < .01.

Artistic creative orientation scores against each school's percent FSM (free school meals). As noted above, FSM is school-level variable taken as indicator of affluence/poverty in the school district (Taylor, 2018) and our schools ranged in FSM status from 0.7% to 38.1% (national average 14.1%). However, we found no significant relationship between each school's FSM and its mean C-COT: Artistic score (at Session 1). This suggests the important information that creative orientation does not appear to be influenced by levels of poverty within each school's district (r = .09, p = .706).

DISCUSSION

Our data show that the trait of creative orientation is stable over time. This was true even in self-report from children as young as 6 years, but it become yet more stable with age (medium effect sizes at 6–7 years and large at 9–10 years). Gender and age were both significant predictors of creative orientation, with girls and older children being more creatively oriented than boys and younger children. We also found an interaction between age and gender, suggesting that creative orientation increases meaningfully for girls over time, but not for boys (and boys even trended in the reverse direction). Finally, we found a significant environmental effect at the class level, suggesting that children's orientation toward creative artistic pursuits is shared among their classmates in a significant way. However, we found no relationship between creative orientation and our socio-economic variable (levels of poverty within the school district), and we found no difference in creative orientation for children taking the test in the autumn versus spring. We therefore conclude that our test itself is not confounded by time of year and, relatedly, that children's creative orientation does not change with the season.

STUDY 2: IS CREATIVE ORIENTATION LINKED TO DIVERGENT THINKING, CREATIVE PERSONALITY, AND/OR CREATIVE ENGAGEMENT? METHODS

Participants

In this study, we tested two cohorts: parents and children. To aid the reader, Figure 4 provides a visual aid for understanding our participant samples.

Our child sample was a subset of the 920 children tested in Session 2 above, specifically, those children who were 8+ years (i.e., old enough for our measures of personality and divergent thinking; see below). Practically speaking, these were the Session 2 children who were in Years 4–6 (and Years 3–5 when first



FIGURE 4. Visual representation of the tests and participants in Study 2. Boxes in dark gray show parents/parent measures, and boxes in light gray show children/child measures. Boxes in white indicate the data carried over from Study 1. We describe the age of children by their school year when data were collected (mean ages are in main body). In square brackets, we show how/ when data were collected. Acronyms represent the following tests: TTCT: Torrance Test of Creative Thinking Verbal Form A—Unusual Uses (Torrance, 2008); DefBFI-44-C: Definitional Big Five Inventory 44-items for Children ((Rinaldi et al., 2020); see John et al., 2008; John & Srivastava, 1999; Soto et al., 2008); BFI-44-Parent: Big Five Inventory 44-items for Children (available from the Berkeley Personality laboratory (https://www.ocf.berkeley.edu/~johnlab/ measures.htm); and HCE: Home Creative Engagement Questionnaire (Sylva, Melhuish, Sammons, Siraj, & Taggart, 2008).

recruited for Session 1). These comprised 675 children for our self-report personality test (n = 675, mean age = 9.69; SD = 0.88; 52.6% girls) and 704 children for our divergent thinking test (n = 704, M = 9.73; SD = 0.88; 52.7% girls). All children entered this study with their C-COT: Artistic back-data from Study 1, and all testing took place contemporaneously with Session 2 (see Study 1).

We also tested 709 parents, whose children had taken part in Session 1 of Study 1. Their children were $6-12 \text{ years}^5$ (M = 9.00; SD = 1.31; 46.5% girls) at the time of their parent's testing. These 709 parents had responded to a recruitment drive in which we targeted all parents of our child cohort from Study 1. Those parents who responded became our testing sample, comprising 19% of the entire parent body. These was a representative sample: Their children were no different in age (responders: M = 8.41, SD = 1.18; non-responders: M = 8.40, SD = 1.16; t(3400) = 0.248, p = .804), no different in gender (responders = 47% girls; non-responders = 49%; X^2 (1, N = 3402) = 0.55, p = 195), and, crucially, no different in their C-COT: Artistic creative orientation scores (responders: M = 15.53, SD = 6.31; non-responders: M = 15.48, SD = 6.04 terms; t(3400) = 0.521, p = .602).

From our 709 parent respondents, 632 provided data related to their child's home learning environment (M = 9.00; SD = 1.31; 46.2% girls) and 505 provided their child's personality data (M = 9.55; SD = 0.96; 45.3% girls), which was slightly fewer since only children 8+ years and older were included in the latter analysis (see below). For clarity, we point out that our 709 parents partially overlapped with the children for whom we had data from Study 1 of Session 2, but fully overlapped with those children from Study 1 of Session 1. An overview of parent and child participants for this study is shown in Figure 4, which shows our overall test design, and participants within each measure.

MATERIALS AND PROCEDURE

Parent testing

Our parents were sent a questionnaire in October 2017, followed by a reminder approximately 8 months later. Parents completed their questionnaire either electronically (n = 564) using an online testing platform (Qualtrics Provo, 2015) or in a pencil-and-paper version (n = 145). This decision was dictated by whether participating schools contacted their parent body electronically or with paper letters. All tests were presented identically whether electronic or paper, and have been validated across both these formats (Rinaldi et al., 2020). Embedded within this questionnaire were two measures of interest for the current study, which we describe below (with other measures to be reported elsewhere).

Parent-rated personality: BFI-44-Parent (available from the Berkeley Personality laboratory (https://www. ocf.berkeley.edu/~johnlab/measures.htm); see John et al., 1991, 2008; John & Srivastava, 1999). The BFI-44-Parent is a 44-item personality questionnaire. Each item begins with the phrase "I see my child as someone who is..." followed by the description of a personality trait (e.g., Item 22 is "I see my child as someone who is generally trusting"). Parents were asked to indicate how much they equate each statement with their child using a 5-point Likert scale (disagree strongly, disagree a little, neither agree nor disagree, agree a little, and agree strongly). This questionnaire returns five scores (see Results), one for each of the "Big Five" personality traits of openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism. There were 10 ten items for openness, nine for conscientiousness, and eight for extraversion, agreeableness and neuroticism. Our interests here were for the trait of Openness to Experience, which has been found to predict creativity in adults (Batey & Furnham, 2006; Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009; Soto & John, 2009). Although this dimension has been less coherent in children (Measelle, John, Ablow, Cowan, & Cowan, 2005; Resing, Bleichrodt, & Dekker, 1999), it arises as a separate factor with subdomains at around 8 years (Mervielde, Buyst, & De Fruyt, 1995). It was for this reason that we examined personality of our cohort aged 8 and above (either child-rated or parent-rated). The measure took between 5 and 10 minutes to complete.

Home creative engagement questionnaire: Parents were given a questionnaire about home environment and activities, using items previously developed for primary-aged children from the *Effective Pre-school, Pri*mary and Secondary Education Project (Sylva et al., 2008). Within this 20-item task were two questions where parents estimated how often their child performed two different sets of creative activities on their own in the home (1 = paint, draw, make models; 2 = enjoy dance, movement, music). Responses were given on a 5-point Likert scale (never, hardly ever, occasionally, 1 or 3 times a week, and every day), and each of the two sets of creative activities was rated separately. These two items appeared among other family-

 $^{^{5}}$ Children were tested in Session 2 when they were 6–11 years old. Yet, since their parents were given longer to respond to the questionnaire, some of our oldest children recently had their 12^{th} birthday.

oriented questions probing home environment (e.g., highest household qualification, parent-child engagement) and other household factors (e.g., birth order), to be reported elsewhere.

Child testing

We remind the reader that data for this study were elicited during Session 2 of our testing sweep described in Study 1. As before, tests were embedded in a series of other tasks as part of a larger project, whose results are to be reported elsewhere. For our current purposes, our target measures are described below (and Figure 4 summarizes which tests were presented to each participant group).

Torrance Test of Creative Thinking (TTCT) Verbal Form A—Unusual Uses (Torrance, 2008). This task measures creative (divergent) thinking by asking children to generate as many answers as possible to a single question requiring creative thought. Although the link between divergent thinking and creative interests is usually modest (Clapham, 2004; Zeng, Proctor, & Salvendy, 2011), divergent thinking is generally higher in creative people (Runco, 1987) and divergent thinking skills in childhood predict creative achievement, concurrently and in later life (Runco, Millar, Acar, Cramond, 2010b; Runco, 1992). In our study, children were first told they were going to have the opportunity to use their imagination and were asked to think of as many interesting and unusual uses of a cardboard box. Children were told that there were no right or wrong answers, and they could be thinking of one box or many. They provided their answers on a written response sheet containing 50 lines, and were given 10 minutes to complete the task.

Child-rated personality: Def BFI-44-C (Rinaldi et al., 2020). The Def BFI-44-C is a 44-item Likert-style self-report personality questionnaire, suitable for children from age 8 years. This questionnaire is identical to the parent-report personality questionnaire described above, except for the following. Items now begin with the phrase "I see myself as someone who..." (e.g., Item 22 is "I see myself as someone who is generally trusting"). Measures of child-reported personality (and related theories; Mervielde et al., 1995) suit children 8+ years, hence the age of our child participants in this study. This child version provides age-appropriate definitions for 14 vocabulary items, so they are understandable to even the youngest children (e.g., in the item "I see myself as someone who generates a lot of enthusiasm," the final word is defined as "This means getting excited about things"; see Rinaldi et al., 2020). This adaptation was validated by Rinaldi and colleagues (Rinaldi et al., 2020) and was based originally on adult/ adolescent versions of the BFI-44 (John et al., 1991, 2008; Soto et al., 2008). Cronbach's alphas show moderate reliability for all components (openness, $\alpha = .68$; conscientiousness, $\alpha = .70$; extraversion, $\alpha = .66$; agreeableness, $\alpha = .73$; and neuroticism, $\alpha = .68$), and the instrument has concurrent validity in a number of ways (e.g., neuroticism positively correlates with children's anxiety at r = .41, using the SCARED questionnaire; Birmaher, En, Balach, & Neer, 1997; Birmaher et al., 1999).

We administered the questionnaire to children using touchscreen electronic tablets, where definitions appeared as screen pop-ups. Children were given the following instructions "You're going to read some sentences that might describe you, or they might not. For example 'I see myself as someone who is bossy.' Is this true about you?" Each item was placed adjacent to on-screen response buttons displaying the Likert labels (from left to right: strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). The responses were explained to the children, and they were shown how to click for a definition if they did not understand a word. Children completed the *Def BFI-44-C* in approximately 10 minutes.

RESULTS

Analytic plan

Our analyses examine whether children's creative orientation data (taken from the C-COT: Artistic described in Study 1) show relationships with personality (child-completed, parent-completed), divergent thinking (child-completed), and home creative engagement (parent-completed). For our child-completed measures, we compared scores elicited within the same session (i.e., using C-COT: Artistic from Session 2). We ran one correlation on children's data for creative orientation (C-COT: Artistic) and the personality trait of openness, then repeated our correlation for each of the two subfacets of this trait (*openness to aesthetics* and *openness to ideas*; see below) correcting for familywise multiple comparisons. Alongside, we ran parallel analyses on the equivalent parent data, correcting again for multiple comparisons. For parent-completed measures (which were not tied to any particular session), we compared with C-COT: Artistic scores from Session 1, because this included the largest number of C-COT: Artistic participants. Next, we compared creative orientation (C-COT: Artistic scores) against our measure of divergent thinking using the coding described below, running a single correlation for the entire group of children, and then dividing the children

into two groups (see below), running a correlation on each subgroup and correcting for multiple comparisons. We ran a final correlation to compare creative orientation (C-COT: Artistic) scores against home creative engagement.

Personality: Openness to experiences: For both the child-rated measure (*Def BFI-44-C*) and parent-rated measure (*BFI-44-Parent*), the response to each item was scored 1–5, from *disagree strongly* to *agree strongly*, with reverse-coding where appropriate (i.e., where traits were negatively expressed; e.g., *conscientiousness*; "I see myself as someone who can be somewhat careless"). Scores were then averaged within each trait, to produce a score for each of the five personality dimensions (*openness to experience, conscientiousness, extraversion, agreeableness*, and *neuroticism*). Scores from the (child-rated) Def BFI-44-C were ipsatized to account for acquiescence in responding (following Rinaldi et al., 2020). Our interests here were for the trait of *openness to experience*, which has been found to predict creativity in adults (Batey & Furnham, 2006; Silvia et al., 2009; Soto & John, 2009). We found a significant association between C-COT: Artistic scores (in Session 2) and the factor of openness, which was medium in child's ratings (r = .30, p < .001, n = 675) and smaller in parent's rating (r = .23, p < .001, n = 505).

However, the factor of openness to experience can also be analyzed as two separate facets: *openness to aesthetics* and *openness to ideas* (see for details of items; Soto & John, 2009). The former facet is particularly of interest, given that our measure investigates artistic inclination (Kaufman et al., 2016). As predicted, we found a significant association between C-COT: Artistic scores and the *aesthetics* facet, with a medium effect size (child's rating: r = .34, p < .001, n = 675; parent's rating r = .17, p < .001, n = 675; parent's rating r = .13, p < .001, n = 505), with p values corrected for multiple comparisons.

Divergent thinking: In this analysis, we compared divergent thinking scores (from the TTCT) against creative orientation (from the C-COT: Artistic). For the divergent thinking task (uses of a cardboard box; TTCT), answers were scored on fluency (the number of legitimate ideas produced) and flexibility (number of different types of ideas produced). For fluency, any viable idea (i.e., not nonsense) received a single fluency point, and a child's total fluency score equaled the sum of all viable ideas produced. Flexibility was calculated as the number of different categories of ideas the child had used (e.g., household items; buildings; transport). For example, if a child had listed 10 ideas, five types of building, and five different household items, they would receive a fluency score of 10 and a flexibility score of 2. Possible categories were taken from Torrance (Torrance, 2008) who provided 28 different category types in total. A second coder verified all codings, and any disagreements not resolved by discussion were sent to the publisher of the TTCT (Scholastic Testing Service Inc.) for a final coding decision. In line with others (Mouchiroud & Lubart, 2001), we chose not to use the third score originality due to unreliability concerns (e.g., Kim, 2006). Specifically, many of the objects mentioned by our child participants in 2017-18 would have been classed as "original" simply because they were not in existence when the manual was written in 2008 (e.g., electronic tablets). This problematic aspect of originality scoring has been raised by others (e.g., Kim, 2006, who noted that "originality scores also would change among various demographics over time [so I] question the credibility of originality scores from 1998, which used the same lists as in 1984." p. 10).⁶

Across the entire sample (age 8–11 years at Session 2), we failed to find an association between C-COT: Artistic creative orientation and divergent thinking (fluency r = -0.03, p = .371; flexibility r = .02, p = .533, n = 704). However, we reasoned that although children not gifted in divergent thinking may still wish to engage (paint, draw etc.), those who *are* gifted may *absolutely* wish to engage. In other words, we reasoned that there may be a relationship to C-COT: Artistic for children with higher divergent thinking skills. We therefore took the highest scoring children in the divergent thinking test and examined whether they showed a relationship between divergent thinking and creative orientation (C-COT: Artistic). To do this, we selected the top 25% performers in one domain of divergent thinking (fluency, the most commonly used metric) and examined whether the other domain (flexibility) mapped onto creative orientation. (In other words, we kept one element of divergent thinking constant, while exploring the other.) We found a significant relationship between children's flexibility and C-COT: Artistic scores within this high-performing group (r = .24, p < .001, n = 704; p-value-corrected). This suggests that for children who are fluent in creative ideas, they are more drawn to creative activities as their creative flexibility increases. This relationship can be seen in Figure 5.

⁶ We were unable to create subjective scoring of originality from two independent raters, given our unusually large sample size: Two raters of 704 children, each child giving an average of 23 responses, would have required 32,384 individual judgments.



FIGURE 5. Relationship between TTCT divergent thinking (flexibility) and C-COT: Artistic for high- and lower fluency groups. The high-fluency group (top 25% in the fluency test) is shown in black (with a significant relationship between creative orientation and divergent thinking/ flexibility). All remaining children are shown in gray (remaining 75% in the fluency test).

Home creative engagement questionnaire: parents: Parents described the frequency with which their child performed two sets of creative activities on their own at home (paint, draw, make models and enjoy dance, movement, and music). We scored each set of response 1–5 (never, hardly ever, occasionally, 1 or 2 times a week, and every day) and then averaged these two scores to give each child an overall creative engagement score. There was a significant association with creative orientation (with a small effect size, r = 0.27, p < .001, n = 632), suggesting that children's orientation toward creative activities in the C-COT: Artistic also related to the amount of time they spent engaged in creative activities at home.

DISCUSSION

Our data show that children's self-reports about their creative orientation matched to a creative personality type (*openness to experiences*), as elicited from both children and parents. Within this trait, we explored both subfacets (*openness to aesthetics* and *openness to ideas*; Soto & John, 2009) and found, as expected, a stronger relationship with the former than the latter (since *openness to aesthetics* is the subfacet particularly linked with artistic inclination; Kaufman et al., 2016). We also found that creative children's orientation toward creative activities in the C-COT: Artistic related to the amount of time they spent engaged in creative activities at home.

We failed to find an association between creative orientation and divergent thinking in our overall sample (i.e., fluency and flexibility in their uses for a cardboard box). This suggested that children can enjoy and seek out painting, drama, and music even if they have no superior divergent thinking abilities. Nonetheless, when looking at children with the very *highest* divergent thinking skills (i.e., top 25% most fluent children), we found that creative orientation did relate to divergent thinking skills (i.e., keeping one element of divergent thinking constant [fluency], while exploring the other [flexibility]). This finding tells us that children who are fluent in creative ideas are more drawn to creative activities as their creative flexibility increases. Our null result (groupwise) and significant result (in the top quartile) paint an interesting picture. They show that children largely wish to engage in creative activities whether they are gifted in divergent thinking or not. Yet importantly, those who *are* gifted *absolutely* wish to engage, all the more so as their flexible thinking increases.

GENERAL DISCUSSION

Our novel measure of creative orientation, the C-COT: Artistic, assesses children's preferences for creative artistic activities (Amabile, 1983; Kaufman, 2013; Runco, 1996) and aptly captures how much children would like to engage in creative artistic activities (whether they routinely do in daily life or not). This avoids the bias arising from differing home backgrounds with their socio-economic and motivational differences, all of which could influence creative engagement according to different levels of parental resources and drive. We first showed that creative orientation as measured by the C-COT: Artistic is an enduring trait, with significant reliability across test and retest, over approximately 9 months. Unsurprisingly, although still significant and moderate, the effect size was smallest for the very youngest children (6–7 years, r = .35) but more robust for children aged 9–10 years (r = .65). Changeable interests at younger ages have been found elsewhere (Tracey, 2002; Tracey & Ward, 1998; Wigfield & Eccles, 1994) and our instrument holds up very well against earlier findings. For example, Tracey (Tracey, 2002) generated a comparable score by eliciting children's "liking" ratings for 5 artistic activities (e.g., drawing; using a 5-point scale from do not like at all, to like a lot). "Liking" measurements have a long history in creativity research (e.g., Helson, 1966), and Tracey's measurements were taken as part of the Inventory of Children's Activities (ICA), which assesses 6 different types of interest (e.g., Artistic interests, Social interests; Holland, 1973, 1985). As found here, the stability of artistic interests over 1 year was greater for their older children (middle school, age 12–13 years, r = .72) than for their younger children (elementary school, age 10–11 years, r = .46). Importantly, our own measure appears to be more robust over time than the ICA, given a comparison where our age-groups coincide (i.e., our stability for 9- to 10-year-olds over approximately 9 months was r = .65 compared to r = .46for the ICA). Indeed, our long-term retest over 9 months showed robustness that was similar or greater to a retest of the ICA conducted over just 1 week (Tracey & Ward, 1998; 9- to 10-year-olds tested over 1 weeks, r = .58; and our own 9- to 10-year-olds over approximately 9 months, r = .65). Our measure therefore performs particularly well over extended time periods, while also showing known age-related differences.

We also found demographic and environmental influences. Creative arts orientation was higher for girls than for boys, and a similar finding emerged in previous "liking" judgments for creative activities (e.g., Tracey, 2002). Similar gender differences are also found in other aspects of creative thinking, and creative engagements and activities (Runco, Cramond, Pagnani, 2010a; Baer & Kaufman, 2008; Chan, 2005; Runco, 1986), as well as in openness to experiences (Weisberg, DeYoung, & Hirsh, 2011) although findings are sometimes mixed. We also found that age interacted with gender, because creative orientation increased with age for girls, but not boys-and these latter showed a numerical trend in the opposite direction (approaching significance, p = .07). This finding is likely to reflect a broader gender effect, widely noted elsewhere. For example, arts participation by girls (e.g., theater, drama, music, literature) already outstrips boys by school entry, and can be further seen in academic choices they make in later schooling (Blood, Lomas, & Robinson, 2016). Such differences reflect changes in interests (Hilton & Berglund, 1974; Tracey, 2002; Tracey & Ward, 1998; Weinburgh, 1995) and may in turn relate to differences in how the genders perceive their competence in different domains (Bian, Leslie, & Cimpian, 2017; Marsh & Yeung, 1998; Tracey, 2002; Tracey & Ward, 1998). It should be noted, however, that preferences for particular activities may reflect motivations other than creative expression, such as those related to emotion regulation (Drake & Winner, 2013), as well as the perceived difficulty or value of artistic subjects in schools (McPherson & O'Neill, 2010). However, our study shows for the first time that gender effects are apparent for creative arts activities even where children are given the most opportunity to freely indicate their creative orientation, unrelated to parental influences, and these are apparent from the very youngest ages.

We also found a significant effect of school class, although it was very small (approximately 2% of the variance in C-COT: Artistic scores was attributable to the class). This was notably smaller than 5–10% typical of class effects in cognition/academic attainment, but very much in line with smaller effects typical of psychological well-being and social behavior (Crawford & Benton, 2017; Sammons et al., 2008). We point out that the variation found between classes was within our English schooling system and that class/school effects can vary markedly from country to country (OECD, 2004). Finally, we found no evidence of other environmental influences: Children were no more creatively orientated from one season to the next, and there no was effect of their school's socio-economic environment, as measured by the percentage FSM metric (i.e., of free school meals for children within each school).

Next, we considered whether creative orientation was linked to other traits of personality and cognition. In doing so, we also tested whether our C-COT: Artistic instrument converges with related tools. Although domains of creativity have weaker associations among them than domains of, say, cognition (Lunke & Meier, 2016; Plucker & Runco, 1998; Runco, 1987), we nonetheless found associations between the C-COT: Artistic and other creativity measures (we tested openness to experience, divergent thinking, and home creative engagement). Hence, the C-COT: Artistic predicted both *openness to experiences* and engagement in creative activities at home, with moderate associations (rs = .3). When *openness to experiences* was split into its two component facets (*aesthetics* and *ideas*), both were significantly related to C-COT: artistic scores, but *aesthetics* had the stronger relationship (r = .34 vs. r = .17). This is to be expected given the *aesthetics* facet is concerned primarily with interest in the creative arts. Our findings also suggest that traits measured by the *ideas* facet (i.e., children's ability to generate ideas, be curious, and have wide interests) are more distinct from creative orientation.

The C-COT: Artistic did not predict divergent thinking skills for the entire group aged 6–10 years. This suggests that children can wish to seek out painting, drama, and music whether they have superior divergent thinking abilities or not. This finding is in line with the lower association we found between C-COT: Artistic and the *ideas* subfacet discussed above (i.e., creative orientation has only a remote association with a creative facet linked to ideas). Furthermore, it also patterns with a recent study, which, like us, elicited from children fluency scores using our divergent thinking task (the TTCT; requiring multiple uses for an object; Okuda, Runco, & Berger, 1991). Okunda and colleagues found no significant groupwise association between fluency and a measure of how many times children performed creative activities in the past (i.e., a task of creative engagement, which are used as a proxy in the adult literature for creative orientation—although see *Introduction* for the limitations on this in children). Together, our findings support previous research suggesting that domains of creativity sometimes have relatively weak associations among them (Lunke & Meier, 2016; Plucker & Runco, 1998; Runco, 1987).

We did find a significant relationship between C-COT: Artistic and divergent thinking for a subset of our participants, and these were children excelling in divergent thinking. Hence, the top 25% of children within (the fluency dimension of) our divergent thinking task showed a relationship between creative orientation and the flexibility of their divergent thinking. In other words, children who are gifted in divergent thinking become more driven to engage in creative activities as their creative flexibility increases. A close parallel to this finding can be seen in the field of cognition, where a parallel trait to creative orientation is called "Need for Cognition" (i.e., whereas creative orientation is one's intrinsic motivation to engage in creative pursuits, *Need for Cognition* requires a minimum amount of cognitive expertise (in working memory capacity) to show any relationship with cognitive thinking (Hill, Foster, Sofko, Elliott, & Shelton, 2016). Here, we see a parallel finding: that creative orientation may require a minimum amount of creative expertise to see any relationship with creative thinking. It is important to recognize, however, that our approach was exploratory and should therefore be considered only a preliminary early suggestion. Future studies would benefit from replicating our findings more directly before we could conclude with confidence that flexible thinking relates to creative orientation, for children who already think creatively.

Finally, we found a small but significant relationship between creative orientation (C-COT: Artistic) and the time spent engaged in creative activities in the home. To some extent, it is not surprising that children would choose to do activities on a fictional fun day that they also complete at home—assuming this latter has at least some degree of free choice. However, whereas home activities may be restricted by parental influences or home resources (not all home have clay for modeling, for example), the C-COT: Artistic paradigm allows children greater freedom to express their creative arts orientation, in ways that home or other engagement metrics cannot (see Introduction).

In summary, we have investigated children's creative orientation while also validating a novel measure of creative orientation for children as young as 6 years old. Our test is fast and easy to administer, and it provides a measure of creativity that is complementary to existing instruments (e.g., personality instruments) while adding a novel dimension hitherto under-explored. Children reported during our study that they enjoyed completing the task, and they did so quickly (within 5 minutes; see *Methods*). They also completed our task without requiring support from researchers, and we were able to administer the task meaningfully within large cohorts (we were able to screen entire classes together). Our measure avoids the confounds associated with eliciting creative engagements, which although successful in adults, falls short when testing children. Understanding children's creative orientations gives especially valuable insight into their individual

dispositions and sources of pleasure. It might also provide pathways to well-being if their creative orientations can be revealed through testing, and then matched with an opportunity to enact them. We present our complete C-COT: Artistic task in the Supplementary material, and encourage researchers to use our measure when researching the children's creative orientation.

DECLARATION OF INTEREST

We declare no financial interest in conducting this research.

AUTHOR CONTRIBUTIONS

RS, JS, TM, DC, and LR designed the study. RS interpreted the results and ran the data analysis. RS and JS wrote the manuscript. RS, DA, and LR carried out the data collection.

DATA AVAILABILITY STATEMENT

Author elects to not share data.

REFERENCES

- Abe, J.A.A. (2005). The predictive validity of the Five-Factor Model of personality with preschool age children: A nine year followup study. Journal of Research in Personality, 39, 423–442; doi: 10.1016/J.JRP.2004.05.002.
- Abe, J.A.A., & Izard, C.E. (1999). A longitudinal study of emotion expression and personality relations in early development. Journal of Personality and Social Psychology, 77, 566–577; doi: 10.1037/0022-3514.77.3.566.
- Amabile, T.M. (1983). The social psychology of creativity: A componential conceptualization. Journal of Personality and Social Psychology, 45, 357–376; doi: 10.1037/0022-3514.45.2.357.
- Amabile, T.M., Collins, M.A., Conti, R., Phillips, E., Picariello, M., Ruscio, J., & Whitney, D. (2018). Creativity in context. New York, NY: Routledge.
- Baer, J., & Kaufman, J.C. (2008). Gender differences in creativity. The Journal of Creative Behavior, 42, 75–105; doi: 10.1002/j.2162-6057.2008.tb01289.x.
- Batey, M. D. (2007). A psychometric investigation of everyday creativity (Publication No. 1427280692) [Doctoral dissertation, University of London, University College London]. ProQuest Dissertations and These Global.
- Batey, M., & Furnham, A. (2006). Creativity, intelligence, and personality: A critical review of the scattered literature. Genetic, Social, and General Psychology Monographs, 132, 355–429; doi: 10.3200/MONO.132.4.355-430.
- Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. Science, 355, 389–391; doi: 10.1126/science.aah6524.
- Birmaher, B., Brent, D.A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 38, 1230–1236; doi: 10.1097/00004583-199910000-00011.
- Birmaher, B., En, M.C.M., Balach, L., & Neer, S.M. (1997). The screen for child anxiety related emotional disorders (SCARED): Scale construction and psychometric characteristics. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 545–553.
- Blood, I., Lomas, M., & Robinson, M. (2016). Every child: equality and diversity in arts and culture with, by and for children and young people. Manchester, MA: Arts Council England.
- Cacioppo, J.T., & Petty, R.E. (1982). The need for cognition. Journal of Personality and Social Psychology, 42, 116–131; doi: 10.1037/0022-3514.42.1.116.
- Caspi, A., Roberts, B.W., & Shiner, R.L. (2005). Personality development: Stability and change. Annual Review of Psychology, 56, 453–484; doi: 10.1146/annurev.psych.55.090902.141913.
- Chan, D.W. (2005). Self-perceived creativity, family hardiness, and emotional intelligence of Chinese gifted students in Hong Kong. Journal of Secondary Gifted Education, 16, 47–56; doi: 10.4219/jsge-2005-471.
- Clapham, M.M. (2004). The convergent validity of the Torrance Tests of Creative Thinking and creativity interest inventories. Educational and Psychological Measurement, 64, 828–841; doi: 10.1177/0013164404263883.
- Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New York, NY: L. Erlbaum Associates.
- Crawford, C., & Benton, T. (2017). Volatility happens: Understanding variation in schools' GCSE results. Cambridge, UK: Cambridge Assessment.
- Creemers, B., & Kyriakides, L. (2010). School factors explaining achievement on cognitive and affective outcomes: Establishing a dynamic model of educational effectiveness. Scandinavian Journal of Educational Research, 54, 263–294; doi: 10.1080/ 00313831003764529.
- Cropley, A.J. (2000). Defining and measuring creativity: Are creativity tests worth using? *Roeper Review*, 23, 72–79; doi: 10.1080/02783190009554069.
- Csikszentmihalyi, M. (1988). Society, culture, and person: A systems view of creativity. In R.J. Sternberg (Ed.), The nature of creativity. Cambridge, UK: Cambridge University Press.

- Department for Education. (2017). Schools, pupils and their characteristics: January 2017 GOV.UK. London, UK: Department for Education.
- Digman, J.M., & Takemoto-Chock, N.K. (1981). Factors in the natural language of personality: Re-analysis, comparison, and interpretation of six major studies. *Multivariate Behavioral Research*, 16, 149–170; doi: 10.1207/s15327906mbr1602_2.
- Dollinger, S.J. (2003). Need for uniqueness, need for cognition, and creativity. *The Journal of Creative Behavior*, 37, 99–116; doi: 10. 1002/j.2162-6057.2003.tb00828.x.
- Dollinger, S.J., Palaskonis, D.G., & Pearson, J.L. (2004a). Creativity and intuition revisited. The Journal of Creative Behavior, 38, 244–259; doi: 10.1002/J.2162-6057.2004.TB01243.X.
- Dollinger, S.J., Urban, K.K., & James, T.A. (2004b). Creativity and openness: Further validation of two creative product measures. Creativity Research Journal, 16, 35–47; doi: 10.1207/s15326934crj1601_4.
- Drake, J.E., & Winner, E. (2013). How children use drawing to regulate their emotions. Cognition and Emotion, 27(3), 512–520.
- Field, A. (2013). Discovering statistics using IBM SPSS Statistics. London, UK: Sage.
- Finke, R.A., Ward, T.B., & Smith, S.M. (1992). Creative cognition: Theory, research, and applications. Cambridge, MA: MIT press.
- Gralewski, J., & Karwowski, M. (2012). Creativity and school grades: A case from Poland. Thinking Skills and Creativity, 7(3), 198–208; doi: 10.1016/J.TSC.2012.03.002.
- Halverson, C.F., Havill, V.L., Deal, J., Baker, S.R., Victor, J.B., Pavlopoulos, V., ... Wen, L. (2003). Personality structure as derived from parental ratings of free descriptions of children: The Inventory of Child Individual Differences. *Journal of Personality*, 71 (6), 995–1026; doi: 10.1111/1467-6494.7106005.
- Helson, R. (1966). Personality of women with imaginative and artistic interests: The role of masculinity, originality, and other characteristics in their creativity1. Journal of Personality, 34, 1–25; doi: 10.1111/J.1467-6494.1966.TB01695.X.
- Hill, B.D., Foster, J.D., Sofko, C., Elliott, E.M., & Shelton, J.T. (2016). The interaction of ability and motivation: Average working memory is required for Need for Cognition to positively benefit intelligence and the effect increases with ability. *Personality* and Individual Differences, 98, 225–228; doi: 10.1016/J.PAID.2016.04.043.
- Hilton, T.L., & Berglund, G.W. (1974). Sex differences in mathematics achievement A longitudinal study. Journal of Educational Research, 67, 231–237; doi: 10.1080/00220671.1974.10884613.
- Hocevar, D. (1979). The development of the Creative Behavior Inventory (CBI). Paper presented at the Annual Meeting of the Rocky. Las Vegas, NV: Rocky Mountain Psychological Association.
- Hocevar, D., & Michael, W.B. (1979). The effects of scoring formulas on the discriminant validity of tests of divergent thinking. Educational and Psychological Measurement, 39, 917–921; doi: 10.1177/001316447903900427.
- Holland, J.L. (1973). Making vocational choices: A theory of careers. Hoboken, NJ: Prentice Hall.
- Holland, J.L. (1985). Making vocational choices: A theory of vocational personalities and work environments (2nd edn). Hoboken, NJ: Prentice Hall.
- John, O.P., Caspi, A., Robins, R.W., Moffitt, T.E., & Stouthamer-Loeber, M. (1994). The "Little Five": Exploring the nomological network of the Five-Factor Model of personality in adolescent boys. *Child Development*, 65, 160–178; doi: 10.1111/j.1467-8624. 1994.tb00742.x.
- John, O.P., Donahue, E.M., & Kentle, R.L. (1991). The big five inventory-versions 4a and 54. Berkeley: University of California, Institute of Personality and Social Research.
- John, O.P., Naumann, L.P., & Soto, C.J. (2008). Paradigm shift to the integrative big five trait taxonomy. In O.P. John, R.W. Robins, & L. Pervin (Eds.), *Handbook of personality: theory and research* (pp. 114–158). London, UK: Guilford Press.
- John, O.P., & Srivastava, S. (1999). The big five trait taxonomy: History, measurement, and theoretical perspectives. In L.A. Pervin & O.P. John (Eds.), *Handbook of personality: Theory and research* (Vol. 2, pp. 102–138). New York, NY: Guilford Press.
- Jung, R.E., Mead, B.S., Carrasco, J., & Flores, R.A. (2013). The structure of creative cognition in the human brain. Frontiers in Human Neuroscience, 7, 1–13; doi: 10.3389/fnhum.2013.00330.
- Kaufman, S.B. (2013). Opening up openness to experience: A four-factor model and relations to creative achievement in the arts and sciences. The Journal of Creative Behavior, 47, 233–255; doi: 10.1002/jocb.33.
- Kaufman, J.C., & Beghetto, R.A. (2009). Beyond big and little: The four c model of creativity. *Review of General Psychology*, 13, 1–12; doi: 10.1037/a0013688.
- Kaufman, S.B., Quilty, L.C., Grazioplene, R.G., Hirsh, J.B., Gray, J.R., Peterson, J.B., & DeYoung, C.G. (2016). Openness to experience and intellect differentially predict creative achievement in the arts and sciences. *Journal of Personality*, 84, 248–258; doi: 10.1111/jopy.12156.
- Kim, K.H. (2006). Can we trust creativity tests? A review of the Torrance tests of creative thinking (TTCT). Creativity Research Journal, 18, 3–14; doi: 10.1207/s15326934crj1801_2.
- Kneller, G.F. (1965). The art and science of creativity. London, UK: Holt, Rinehart and Winston.
- Kombeiz, O., & Steidle, A. (2018). Facilitation of creative performance by using blue and red accent lighting in work and learning areas. *Ergonomics*, 61, 456–463; doi: 10.1080/00140139.2017.1349940.
- Kuhn, J.-T., & Holling, H. (2009). Exploring the nature of divergent thinking: A multilevel analysis. Thinking Skills and Creativity, 4, 116–123; doi: 10.1016/J.TSC.2009.06.004.
- Lareau, A. (2002). Invisible inequality: Social class and childrearing in black and white families. American Sociological Review, 67(5), 747–776; doi: 10.2307/3088916.

Measuring Creative Orientation in Children

- Lunke, K., & Meier, B. (2016). Disentangling the impact of artistic creativity on creative thinking, working memory, attention, and intelligence: Evidence for domain-specific relationships with a new self-report questionnaire. *Frontiers in Psychology*, 7, 1089; doi: 10.3389/fpsyg.2016.01089.
- Markey, P.M., Markey, C.N., Tinsley, B.J., & Ericksen, A.J. (2002). A preliminary validation of preadolescents' self-reports using the Five-Factor Model of personality. *Journal of Research in Personality*, 36(2), 173–181; doi: 10.1006/JRPE.2001.2341.
- Marsh, H.W., & Yeung, A. (1998). Longitudinal structural equation models of academic self-concept and achievement: Gender differences in the development of math and English constructs. American Educational Research Journal, 35(4), 705–738; doi: 10. 3102/00028312035004705.
- Mccarthy, R., & Pittaway, S. (2014). An historical exploration of creativity research. In N. Fitzallen, R. Reaburn & S. Fan (Eds.), *The future of educational research* (pp. 111–120). Rotterdam, The Netherlands: Sense Publishers.
- McCrae, R.R., & Costa, P.T. (1987). Validation of the five-factor model of personality across instruments and observers. Journal of Personality and Social Psychology, 52, 81–90; doi: 10.1037/0022-3514.52.1.81.
- McPherson, G.E., & O'Neill, S.A. (2010). Students' motivation to study music as compared to other school subjects: A comparison of eight countries. *Research Studies in Music Education*, 32, 101–137; doi: 10.1177/1321103X10384202.
- Measelle, J.R., John, O.P., Ablow, J.C., Cowan, P.A., & Cowan, C.P. (2005). Can children provide coherent, stable, and valid selfreports on the Big Five dimensions? A longitudinal study from ages 5 to 7. *Journal of Personality and Social Psychology*, 89, 90–106; doi: 10.1037/0022-3514.89.1.90.
- Mervielde, I., Buyst, V., & De Fruyt, F. (1995). The validity of the Big-five as a model for teachers' ratings of individual differences among children aged 4–12 years. *Personality and Individual Differences*, 18, 525–534; doi: 10.1016/0191-8869(94)00175-R.
- Michael, W.B., & Colson, K.R. (1979). The development and validation of a life experience inventory for the identification of creative electrical engineers. *Educational and Psychological Measurement*, 39, 463–470; doi: 10.1177/001316447903900228.
- Mouchiroud, C., & Lubart, T. (2001). Children's original thinking: An empirical examination of alternative measures derived from divergent thinking tasks. The Journal of Genetic Psychology, 162, 382–401; doi: 10.1080/00221320109597491.
- OECD. (2004). Learning for tomorrow's world: First results from PISA 2003. Paris, France: OECD Publishing.
- Okuda, S.M., Runco, M.A., & Berger, D.E. (1991). Creativity and the finding and solving of real-world problems. Journal of Psychoeducational Assessment, 9, 45–53; doi: 10.1177/073428299100900104.
- Opdenakker, M.-C., & Van Damme, J. (2000). Effects of schools, teaching staff and classes on achievement and well-being in secondary education: Similarities and differences between school outcomes. School Effectiveness and School Improvement, 11, 165– 196; doi: 10.1076/0924-3453(200006)11:2;1-Q;FT165.
- Plucker, J.A., & Runco, M.A. (1998). The death of creativity measurement has been greatly exaggerated: Current issues, recent advances, and future directions in creativity assessment. *Roeper Review*, 21, 36–39; doi: 10.1080/02783199809553924.
- Qualtrics Provo. (2015). Qualtrics. Provo, UT: Qualtrics.
- Raudenbush, S.W., & Bryk, A.S. (2002). Hierarchical linear models: Applications and data analysis methods. Thousand Oaks, CA: Sage.
- Reeve, J.M. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist*, 44, 159–175; doi: 10.1080/00461520903028990.
- Resing, W.C.M., Bleichrodt, N., & Dekker, P.H. (1999). Measuring personality traits in the classroom. European Journal of Personality, 13, 493–509.
- Richards, L., Garratt, E., Heath, A.F., Anderson, L., & Altintaş, E. (2016). The childhood origins of social mobility: Socio-economic inequalities and changing opportunities. London, UK: Social Mobility Commission.
- Rinaldi, L. J., Smees, R., Alvarez, J., & Simner, J. (2019). Do thes colors of educational number-tools improve children's mathematics and numerosity? *Child Development*, 91, e799–e813. doi: 10.1111/cdev.13314
- Rinaldi, L.J., Smees, R., Carmichael, D.A., & Simner, J. (2020). What is the personality profile of a child synaesthete. *Frontiers in Bioscience*, 12, 162–182; doi: 10.2741/E865.
- Runco, M.A. (1986). Predicting children's creative performance. Psychological Reports, 59, 1247–1254.
- Runco, M.A. (1987). The generality of creative performance in gifted and nongifted children. Gifted Child Quarterly, 31, 121–125; doi: 10.1177/001698628703100306.
- Runco, M.A. (1992). Children's divergent thinking and creative ideation. *Developmental Review*, 12, 233–264; doi: 10.1016/0273-2297(92)90010-Y.
- Runco, M.A. (1996). Personal creativity: Definition and developmental issues. New Directions for Child and Adolescent Development, 72, 3–30; doi: 10.1002/cd.23219967203.
- Runco, M.A., & Albert, R.S. (1985). The reliability and validity of ideational originality in the divergent thinking of academically gifted and nongifted children. *Educational and Psychological Measurement*, 45(3), 483–501; doi: 10.1177/001316448504500306.
- Runco, M.A., Cramond, B., & Pagnani, A.R. (2010a). Gender and creativity. In Handbook of gender research in psychology (pp. 343– 357). New York: Springer; doi: 10.1007/978-1-4419-1465-1_17.
- Runco, M.A., & Jaeger, G.J. (2012). The standard definition of creativity. Creativity Research Journal, 24, 92-96; doi: 10.1080/10400419.2012.650092.
- Runco, M.A., Millar, G., Acar, S., & Cramond, B. (2010b). Torrance Tests of Creative Thinking as predictors of personal and public achievement: A fifty-year follow-up. Creativity Research Journal, 22, 361–368; doi: 10.1080/10400419.2010.523393.

- Sammons, P., Sylva, K., Melhuish, E.C., Siraj-Blatchford, I., Taggart, B., Jelicic, H., ... Smees, R. (2008). Relationships between pupils' self-perceptions, views of primary school and their development in Year 5. London, UK: Department for Children, Schools and Families.
- Scholte, R.H., van Aken, M.A.G., & van Lieshout, C.F.M. (1997). Adolescent personality factors in self-ratings and peer nominations and their prediction of peer acceptance and peer rejection. *Journal of Personality Assessment*, 69, 534–554; doi: 10.1207/ s15327752jpa6903_8.
- Silvia, P.J., Nusbaum, E.C., Berg, C., Martin, C., & O'Connor, A. (2009). Openness to experience, plasticity, and creativity: Exploring lower-order, high-order, and interactive effects. *Journal of Research in Personality*, 43, 1087–1090; doi: 10.1016/J.JRP.2009. 04.015.
- Simner, J., Smees, R., Rinaldi, L.J., & Carmichael, D.A. (2021). Wellbeing differences in children with synaesthesia: Anxiety and mood regulation. Frontiers in Bioscience (Elite Edition), 13, 195–215; doi: 10.2741/878.
- Smees, R., Rinaldi, L.J., & Simner, J. (2019). Well-being measures for younger children. Psychological Assessment, 32, 154–169; doi: 10.1037/pas0000768.
- Snijders, T.A.B., & Bosker, R.J. (1999). Multilevel analysis: an introduction to basic and advanced multilevel modeling. London, UK: Sage.
- Soto, C.J., & John, O.P. (2009). Ten facet scales for the Big Five Inventory: Convergence with NEO PI-R facets, self-peer agreement, and discriminant validity. *Journal of Research in Personality*, 43, 84–90; doi: 10.1016/J.JRP.2008.10.002.
- Soto, C.J., John, O.P., Gosling, S.D., & Potter, J. (2008). The developmental psychometrics of big five self-reports: Acquiescence, factor structure, coherence, and differentiation from ages 10 to 20. *Journal of Personality and Social Psychology*, 94, 718–737; doi: 10.1037/0022-3514.94.4.718.
- Stein, M.I. (1953). Creativity and culture. The Journal of Psychology, 36, 311-322; doi: 10.1080/00223980.1953.9712897.
- Sternberg, R.J., & Lubart, T.I. (1999). The concept of creativity: Prospects and paradigms. In R.J. Sternberg (Ed.), Handbook of creativity (pp. 3–31). Cambridge, UK: Cambridge University Press.
- Sylva, K., Melhuish, E.C., Sammons, P., Siraj, I., & Taggart, B. (2008). Final report from the primary phase: Pre-school, school and family influences on children's development during key stage 2 (7–11). London, UK: Department for Children, Schools and Families.
- Taylor, C. (2018). The reliability of free school meal eligibility as a measure of socio-economic disadvantage: Evidence from the millennium cohort study in Wales. *British Journal of Educational Studies*, 66, 29–51.
- Taylor, C.W., & Ellison, R.L. (1968). The Alpha Biographical Inventory. Greensboro, NC: Prediction Press.
- Taylor, C.W., & Ellison, R.L. (1983). Searching for student talent resources relevant to our USDE types of giftedness. Gifted Child Quarterly, 27, 99–106; doi: 10.1177/001698628302700301.
- Torrance, E.P. (2008). Torrance tests of creative thinking. Bensenville, IL: Scholastic Testing Service.
- Tracey, T.J.G. (2002). Development of interests and competency beliefs: A 1-year longitudinal study of fifth- to eighth-grade students using the ICA-R and structural equation modeling. *Journal of Counseling Psychology*, 49, 148–163; doi: 10.1037/0022-0167.49.2.148.
- Tracey, T.J.G., & Ward, C.C. (1998). The structure of children's interests and competence perceptions. Journal of Counseling Psychology, 45, 290–303; doi: 10.1037/0022-0167.45.3.290.
- Urban, K.K., & Jellen, H.G. (1996). Manual. Test for creative thinking-drawing production. Manual: Test for creative thinking-drawing production. Lisse, The Netherlands: Swets and Zeitlinger.
- Vygotsky, L.S. (2004). Imagination and creativity in childhood. Journal of Russian and East European Psychology, 42, 7–97; doi: 10. 1080/10610405.2004.11059210.
- Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991. Journal of Research in Science Teaching, 32, 387–398; doi: 10.1002/tea.3660320407.
- Weisberg, Y.J., DeYoung, C.G., & Hirsh, J.B. (2011). Gender differences in personality across the ten aspects of the Big Five. Frontiers in Psychology, 2, 178; doi: 10.3389/fpsyg.2011.00178.
- Wigfield, A., & Eccles, J.S. (1994). Children's competence beliefs, achievement values, and general self-esteem. The Journal of Early Adolescence, 14, 107–138; doi: 10.1177/027243169401400203.
- Zeng, L., Proctor, R.W., & Salvendy, G. (2011). Can traditional divergent thinking tests be trusted in measuring and predicting real-world creativity? *Creativity Research Journal*, 23, 24–37; doi: 10.1080/10400419.2011.545713.

Julia Simner, School of Psychology, University of Sussex, UK and Department of Psychology, University of Edinburgh, UK

Rebecca Smees, Louisa J. Rinaldi, School of Psychology, University of Sussex, UK

Duncan A. Carmichael, School of Psychology, University of Sussex, UK and Department of Psychology, Edinburgh Napier University, UK

Toby J. McDonald, School of Psychology, University of Sussex, UK and Edinburgh Medical School, University of Edinburgh, UK

Correspondence concerning this article should be addressed to concerning this article should be addressed to: Rebecca Smees, School of Psychology, University of Sussex, UK and Department of Psychology, University of Edinburgh, UK. E-mail: r.smees@sussex.ac.uk

AUTHOR NOTE

Julia Simner and Rebecca Smees share first authorship of this paper.

We are grateful to Juliet Wilkes, Olivia Casey-Haworth, Monica Boutros, Dermot Crowley, and Molly Berenhaus for help in schools and Gabriel McAlpine, Juliet Wilkes, and Mira Kaut for help with data entry. We are indebted to the schools and families for their engagement.

APPENDIX A

CHILDREN'S CREATIVE ORIENTATION TEST: ARTISTIC (C-COT: ARTISTIC)

Below are the 12 of our test (first six = creative; second six = non-creative). Activities must be printed onto 12 individual cards (5.0 cm \times 8.0 cm) and laid out randomly on a testing board (29.5 cm \times 42.0 cm; see Figure 1). The instructions given to children are as follows:



Imagine you are going on a fun day out, and these are the activities you could choose from. Put your favorite activity (the activity you would like to do the most) on number 1; your next favorite on number 2, your next favorite on 3, and so on, all the way down to your least favorite which goes on number 12. So you are ordering them by how much you would like to do them. There are no right or wrong answers, just place them wherever you think best.