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Ready, Set, Create: What Instructing People to "Be Creative" Reveals About the Meaning and Mechanisms of Divergent Thinking

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The "be creative effect"—instructing people to "be creative" before a divergent thinking task makes the responses more creative—is one of the oldest findings in creativity science. The present research suggests that this seemingly simple effect has underappreciated implications for the assessment of divergent thinking and for theories of the executive and controlled nature of creative thought. An experiment measured fluid intelligence and gave 2 divergent thinking tasks: people completed one with "be creative" instructions and the other with "be fluent" (generate as many ideas as possible) instructions. The responses were scored for creativity (using subjective scoring) and for fluency (the total number of ideas). Multilevel latent variable models found, not surprisingly, a large effect of task instructions: asking people to be creative yielded better but fewer responses, suggesting a focus on quality over quantity. Notably, the study replicated both sides of the contentious intelligence-and-creativity literature. When people were told to come up with a lot of ideas and creativity was scored as fluency, intelligence weakly predicted creativity. But when people were told to be creative and creativity was scored as subjective ratings, intelligence more strongly predicted creativity. We conclude with implications for the assessment of creativity, for models of the intentional and controlled nature of creative thought, and for the ongoing debate over creativity and intelligence.

Keywords: assessment, creativity, divergent thinking, fluid intelligence, verbal fluency

Science can violate our intuition and inspire awe at the unexpected intricacy of the world, but sometimes it just tells us that our common-sense intuitions are totally right. Many experiments, for example, have shown that asking people to "be creative" before working on a creativity task does in fact boost the creativity of their responses. First shown by Guilford and his group (Christensen, Guilford, & Wilson, 1957), this "be creative effect"—sometimes called an "explicit instruction" or "instructional enhancement" effect (Chen et al., 2005; Runco & Okuda, 1991)—has been replicated around 20 times (see Chen et al., 2005; Harrington, 1975; Niu & Liu, 2009). Science has spoken.

But like many seemingly obvious things, the humble be-creative effect has some complex and intriguing implications. One way to view this finding—the prevailing way—is simply as an effect, as one of the many factors that influence divergent thinking. But this simple effect has deeper implications, we think, both for the methods of measuring divergent thinking and for our understanding of the cognitive mechanisms that underlie the generation of creative ideas. In the present research, we explore these two implications. Concerning measurement, we revisit and elaborate on Harrington's (1975) claim that "be creative" instructions are essential for the validity of divergent thinking tasks as measures of creative thought. Concerning mechanisms, we contend that the be-creative effect reveals the controlled and strategic character of effective divergent thinking and thus informs the ongoing controversy about executive aspects of creativity (Kim, 2005; Nusbaum & Silvia, 2011a).

In an experiment, we measured fluid intelligence—an executive ability associated with domain-general reasoning and problem-solving (Carroll, 1993; Plucker & Esping, 2014)—and had people complete two divergent thinking tasks. People received "be creative" instructions for one task and "be fluent" instructions—come up with as many ideas as possible—for the other. The responses were then scored using two different methods: conventional fluency-based scores and contemporary subjective scoring. As we describe below, this design both allows a strong replication of the be-creative effect and some new insights into executive and strategic aspects of creative thought.

Implications of the Be-Creative Effect

Not surprisingly, most methodological research on divergent thinking has focused on how to score the responses, such as frequency methods (e.g., simple fluency, uniqueness, and their variants; Plucker, Qian, & Wang, 2011; Wallach & Kogan, 1965), subjective ratings (Benedek, Mühlmann, Jauk, & Neubauer, 2013;

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The data files and research materials have been archived at Open Science Framework: https://osf.io/p6mrh/. Researchers are welcome to reanalyze and use the data for their own purposes.

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Silvia et al., 2008), and formulas and algorithms (Bossomaier, Harré, Knittel, & Snyder, 2009; Prabhakaran, Green, & Gray, in press). But other research has focused on methods for administering the tasks, such as ideal time limits (Benedek et al., 2013), whether to have a play-like atmosphere (Vernon, 1971), and differences between prompts and task types (e.g., verbal vs. visual tasks or uses vs. consequences prompts; Almeida, Prieto, Ferrando, Oliveira, & Ferrándiz, 2008; Clapham, 2004; Silvia, 2011).

The effect of be-creative instructions on creativity is usually seen as part of the body of research on task administration. Many studies have shown that asking people to be creative, via short prompts or long instructions before the task, will boost the creativity of the resulting responses. The effect is robust across a range of decades, tasks, samples, and outcomes, so it is easy to replicate (see Chen et al., 2005). We contend, however, that there are two deeper messages to be taken away from the be-creative research: one for methodology, and one for mechanisms.

"Be Creative" Is a Methodological Necessity

Harrington (1975) was the first to highlight the implications of be-creative instructions for the validity of divergent thinking scores. In an underappreciated article, he pointed out that failing to instruct people to be creative will inevitably coarsen the resulting scores. If people don't know what they are being evaluated on—effort, creativity, or productivity—then the task goal is unclear. As a result, people will adopt a range of idiosyncratic goals, strategies, and task representations that will add error to the resulting scores: some will try to be creative, some will try to be productive, and others will follow some idiosyncratic goal. Instead, Harrington argued, researchers should standardize the participants' representation of the task by calling the tasks "creativity tasks," telling the participants to be creative, and informing them that their responses will be assessed on the dimension of creativity. In his experiment, Harrington (1975) manipulated "be creative instructions" and "be fluent" instructions between groups. He found that the correlations between the creativity of people's ideas and external criteria (e.g., dimensions of personality important to creativity) were substantially higher when people were told to be creative—the tasks yielded a higher proportion of significant effects and larger effect sizes, and hence stronger evidence for validity.

Although strongly argued, Harrington's position didn't catch on. It's hard to say how many studies use be-creative instructions. In some research groups, it is a standard part of divergent thinking assessment (e.g., Benedek et al., 2013; Silvia et al., 2008), and the Torrance Tests (Torrance, 1988, 2008) emphasize creativity, originality, and playfulness. On the other hand, Wallach and Kogan's (1965) classic approach suggests a game-like atmosphere but otherwise emphasizes fluency over creativity. Nearly all of Runco's large body of work on divergent thinking (see Runco, 2007) uses instructions that emphasize coming up with a lot of ideas. Runco and Acar (2010), for example, described their divergent thinking tasks as using "the standard instructions (i.e., 'give as many ideas as you can. . .')" (p. 145). It's clear, then, that the field disagrees over the necessity of "be creative" instructions.

One might think that the issue of instructions is just one of many ways that assessment varies between labs: one way might be better or tighter but they all basically capture the same construct. But a bizarre wrinkle is that fluency instructions for a divergent thinking task aren't merely a different kind of creativity instruction—they are standard instructions for similar tasks that measure a different construct. Verbal fluency tasks—also known as broad retrieval ability tasks or Gr tasks (Carroll, 1993)—measure how well people can selectively and strategically retrieve stored knowledge. Widely studied since at least the 1940s (e.g., Bousfield & Sedgewick, 1944; Thurstone, 1938), they are standard in many intelligence batteries (Flanagan, Ortiz, & Alfonso, 2007) and in neurocognitive assessment (e.g., Troyer & Moscovitch, 2006; Troyer, Moscovitch, & Winocur, 1997). Verbal fluency is assessed by giving people a prompt—such as *list examples of things that are red*, *list synonyms for good*, and *list words that start with* F—and telling people to list as many words as possible. The tasks are scored by simply counting the number of valid responses, that is, fluency. This similarity creates an odd irony. A creativity researcher who asks people to "list as many things as possible that make a noise" and then counts the number of responses (or the number of unique responses, which is highly correlated with and hence confounded with it; Clark & Mirels, 1970; Dixon, 1979; Hocevar, 1979a, 1979b; Silvia et al., 2008) is measuring *divergent thinking* and *creative potential*, which are presumably weakly related to intelligence (Kim, 2005). But a cognitive psychologist who does the same thing is measuring *verbal fluency*, a major factor of intelligence (McGrew, 2005), a standard part of intelligence batteries (Kaufman, 2009), and a common measure of executive functioning (Alvarez & Emory, 2006).

In short, be-fluent instructions paired with fluency-based scoring systems (e.g., simple fluency or number of unique responses) don't merely add some error or reduce the number of creative ideas—they change the meaning of the tasks to a different construct entirely. One implication is that variation in the instructions used by different researchers is probably one reason why different studies find different effects: they are actually measuring different variables. For example, some research finds large relationships between divergent thinking and components of intelligence (e.g., Benedek, Franz, Heene, & Neubauer, 2012; Nusbaum & Silvia, 2011a; Silvia, Beaty, & Nusbaum, 2013). Most studies, however, find weak relationships (Kim, 2005), so the prevailing view is that creativity and intelligence don't have much in common (Kaufman & Plucker, 2011; Kim, Cramond, & VanTassel-Baska, 2010; Runco, 2007). But the studies that find strong effects tell people to be creative and then rate the scores for creativity, and most of the studies that find weak effects tell people to be fluent and then score for some variation of fluency.

In the present research, we wanted to the test this interpretation of the creativity-and-intelligence controversy. Our study measured fluid intelligence and asked people to complete two divergent thinking tasks: one with be-creative instructions, and one with standard be-fluent instructions. We then scored the tasks for creativity (using subjective ratings) and for fluency, which correlates around .90 in large samples with its popular variants (e.g., the number of unique responses; Silvia, 2008a; Torrance, 2008; Wallach & Kogan, 1965). This design thus allows us to potentially replicate both literatures: does intelligence strongly predict the scores when people are told to be creative and rated for creativity? And does intelligence weakly predict scores when people are told to come up with a lot of ideas and then judged on how many they came up with? By replicating both literatures, we can both reconcile conflicting findings and highlight the necessity of using be-

creative instructions for finding larger effect sizes in creativity research.

Divergent Thinking Is Strategic and Controlled

A second intriguing implication of the be-creative effect is for our understanding of how people generate good ideas. An obvious conclusion is that the effect shows that people can exert control over the cognitive processes involved in creative thinking. But the early demonstration that people have some deliberate control over creative thought (Christensen et al., 1957) didn't appreciably influence early models of creative cognition, which emphasized associative processes, such as spreading activation from common to increasingly remote ideas (Wallach & Kogan, 1965) or the organization of conceptual knowledge into loose or tight structures (Mednick, 1962). Since then, creativity research has for the most part adhered to associative models of creative thought (e.g., Runco, 2007) despite the surprisingly small amount of direct evidence that creativity works this way (see Benedek & Neubauer, 2013; Beaty & Silvia, 2012; Weisberg, 2006).

Recently, however, research has begun to consider executive and controlled aspects of creative thought, consistent with psychology's broader interest in concepts related to self-regulation and executive control. In an important project, Gilhooly, Fioratou, Anthony, and Wynn (2007) conducted think-aloud protocols during divergent thinking tasks and revealed a family of strategies that people use to come up with ideas. Some strategies, such as disassembling an item and using its parts, were clearly effective; others, such as repeating the object's name to oneself or trying to recall uses from memory, clearly weren't. Much of creativity was thus rooted in how people identified and enacted mental strategies. In another line of research, researchers have explored how cognitive abilities associated with cognitive control (Beaty & Silvia, 2013; Nusbaum & Silvia, 2011a) and selective knowledge retrieval (Benedek, Könen, & Neubauer, 2012; Silvia et al., 2013) predict divergent thinking in latent variable studies. A third body of work uses experimental (e.g., Zabelina & Robinson, 2010) and biological (e.g., Benedek, Bergner, Könen, Fink, & Neubauer, 2011) paradigms to illuminate aspects of cognitive control that influence creative thought.

The be-creative effect is an interesting paradigm for examining controlled aspects of creativity. Apart from showing, in a broad way, that people can deliberately be more creative, the effect can be used to explore what people actually do when they set out to think creative thoughts. When we tell people to "be creative," what are they doing that works? What gets set in motion? And, critical to the present research, who benefits more from being nudged to be creative? For example, some people clearly have a creative edge, such as people higher in openness to experience, people with more domain-relevant knowledge, and people higher in intelligence. Does instructing people to be creative compensate for or exaggerate these differences? Do the instructions help close the gap, or do they amplify existing differences?

The answer can inform the broader question of how creative thought works. For example, if be-creative instructions primarily benefit less intelligent participants, then it's likely that the instructions work by affecting mechanisms that require fewer executive resources, such as by establishing an appropriate task goal, increasing motivation, or standardizing the sample's understanding of the task's purpose (Harrington, 1975). But if be-creative instructions primarily benefit more intelligent participants, then it's likely that they work by spurring people to enact challenging strategies and processes that require executive control and thus lie outside the mental reach of the less intelligent participants.

Based on past work, we suspect that asking people to be creative will exaggerate the differences between people lower and higher in intelligence. Generating good ideas requires mental operations that are abstract (e.g., finding an ideational strategy that works) and fragile (e.g., keeping the strategy in mind, inhibiting obvious ideas, and switching between conceptual categories). People higher in intelligence are presumably more creative because they can execute complex, abstract operations in the face of distractions and interference. As a result, they can enact the fertile processes and strategies that yield good ideas. People lower in intelligence, in contrast, are likely to use the easy-but-ineffective strategies that require fewer cognitive resources, such as repeating the name of the object, trying to make one's mind blank, or searching memory for examples of how the object has been used (Gilhooly et al., 2007). An example of this in action comes from a study (Nusbaum & Silvia, 2011a, Study 2) that manipulated exposure to a good strategy (object disassembly; Gilhooly et al., 2007). People higher in fluid intelligence did better on the divergent thinking task overall, but suggesting a strategy enhanced their advantage—they were the ones capable of enacting this abstract and complex ideational strategy.

The Present Research

In the present research, we examined the effects of individual differences in fluid intelligence and be-creative instructions on people's responses to two divergent thinking tasks. We manipulated task instructions within-person: people received "be creative" instructions for one and "be fluent" instructions for another. We assessed both the creative quality of their responses (using subjective scoring) along with the mere quantity of responses. The design allows us to explore both methodological and conceptual problems. First, does telling people to be creative affect the responses' quality, quantity, or both? Second, does the effect of intelligence on creativity depend on the assessment approach? Specifically, is the effect weak for fluency instructions and fluency scores but stronger for creativity instructions and subjective creativity ratings? And third, do be-creative instructions narrow or widen the creative gap between people lower and higher in fluid intelligence?

Method

Participants and Design

A final sample of 141 college students participated in this study. This sample was composed of mostly Caucasian (47%), African American (33%), and Asian (15%) women (72%). The average age of participants was 19.6 years ($SD = 4.2$), and for most people, this was their first (40%) or second (21%) semester in college. Only about 6% of the sample majored in what would be considered a "creative" major (e.g., music, theater, dance, visual arts, interior architecture; Silvia & Nusbaum, 2012). A total of 12 people were excluded because they had no divergent thinking data, they left the

room during important parts of the study, or (most often) they completed the study far too quickly to have taken it seriously.

We manipulated task instructions—be creative versus be fluent—within-person. Each person completed two divergent thinking tasks (unusual uses for a box and a rope), and they were instructed to be creative for one and to come up with a lot of ideas for the other. The order of the instructions (be creative: first or last) was counterbalanced between groups, as was the task order (box first or rope first). People were thus randomly assigned to one of four between-person conditions according to the counterbalancing.

Procedure

People participated in groups ranging from 1 to 8. As they entered the lab room, participants received a consent form to read and sign. The experimenter instructed people briefly on the two different creativity tasks before beginning the assessments. All tasks were completed on computers using MediaLab (Empirisoft, NY); the files can be downloaded at https://osf.io/p6mrh/.

Divergent thinking tasks and instructions. To evaluate creativity, people completed two divergent thinking tasks — one asked people to come up with uses for a rope, and the other asked people to come up with uses for a box. The tasks varied in the instructions participants were given. For one of the tasks, people were given "be creative" instructions. The experimenter and the written instructions explained that "the goal is to come up with creative ideas, which are ideas that strike people as clever, unusual, interesting, uncommon, humorous, innovative, or different." In addition, based on work showing that creative ideas are more likely to be generated on the spot than retrieved from memory (Benedek, Jauk et al., 2014; Gilhooly et al., 2007), we emphasized that the ideas should be new rather than remembered: "these ideas should be new to you, meaning you have never seen, heard, or thought of these ideas before." Finally, we emphasized the importance of quality over quantity: "the task will take 3 minutes, so you can type in as many ideas as you like until then, but it is more important to come up with creative ideas than a lot of ideas."

For the other task, people received the standard "be fluent" instructions that are common practice in divergent thinking research (Runco & Acar, 2010). For this task, they were told to focus on quantity by coming up with "as many uses as possible." The experimenter emphasized that they should try to come up with as many ideas as they could within the 3-minute task period, and that they should focus on the number of ideas. As noted earlier, both the order of instructions (be creative first or be fluent first) and the task prompt (rope first or box first) were counterbalanced between the groups.

Creativity scoring. We scored the tasks to yield *fluency scores* and *creativity scores.* Fluency scores were simply the total number of different responses people gave on a task, so the typical participant had two fluency scores (one for box, another for rope). Duplicate responses—such as writing "play fort" twice for the box task—were rare, but people received a point only for the first response.

Creativity scores were obtained using subjective scoring methods (Silvia et al., 2008). Each response was scored by 3 raters—the 3 authors of this paper, not coincidentally—who rated each response on a 1 (*not at all creative*) to 5 (*very creative*) scale. Following Wilson, Guilford, and Christensen (1953), we defined creative responses as ideas that typically are uncommon, remote, and clever. The responses were given a random id and then sorted alphabetically. As in our other work with subjective scoring (e.g., Silvia et al., 2008; Silvia & Kimbrel, 2010; Silvia, Martin, & Nusbaum, 2009), all identifying information was removed before rating, including the serial position of a response, the participant who gave it, the total number of responses the participant gave for that task, and all information about the participants. The raters scored the responses separately and were unaware of the other raters' scores, although they could occasionally hear giggling and exasperated sighs coming from the other lab room.

After all the responses were rated, we created creativity scores for analysis by using average scoring (Silvia et al., 2008). This approach averages each rater's scores for each task (e.g., all of Rater 2's ratings for a participant's box responses are averaged to yield that participant's "Rater 2: Box" score). The typical participant thus ended up with 6 divergent thinking scores: 3 ratings for each task. These ratings were then used as indicators in latent variable models (see Results).

Fluid intelligence. After the divergent thinking tasks, participants completed several measures of fluid intelligence, most of which we have used extensively in our recent research (Beaty & Silvia, 2012, 2013; Nusbaum & Silvia, 2011a; Silvia & Beaty, 2012; Silvia et al., 2013). The instructions for the tasks emphasized getting as many correct as possible within the time limit. Three tasks assessed inductive reasoning, perhaps the core component of fluid intelligence (Carroll, 1993). A letter sets task showed people a list of five groups of four letters and asked them to identify which one of the sets didn't follow the pattern found in the other four (15 items, 4 minutes; Ekstrom, French, Harman, & Dermen, 1976). A number series task presented a series of digits, and people had to decipher the pattern to decide which number would come next in the series (15 items, 4.5 minutes; Thurstone, 1938). A series completion task showed a series of patterns and shapes and asked people to indicate which option would correctly complete the series (13 items, 3 minutes; Cattell & Cattell, 1961/2008). The fourth task, a visuospatial reasoning task, presented images in which pieces of paper were folded and had holes punched through them. People had to identify what the paper would look like when unfolded (10 items, 3 minutes; Ekstrom et al., 1976).

Personality and creative achievement. To enrich the dataset, we included measures of individual differences beyond cognitive abilities that are relevant to creativity. We measured creative achievements using the Creative Achievement Questionnaire (CAQ; Carson, Peterson, & Higgins, 2005), which is a popular measure of creative accomplishments across the life span (see Silvia, Wigert, Reiter-Palmon, & Kaufman, 2012). The CAQ measures achievements in 10 domains. We summed the scores across the domains and then log-transformed the total score to reduce the skew. We measured personality using the NEO-FFI (McCrae & Costa, 2007), a 60-item version of the NEO Personality Inventory. The NEO-FFI measures the five broad factors of personality—neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (McCrae & Costa, 2008)—with 12 items per factor. People used a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Although all five factors are interesting for creativity research, we were primarily interested in openness to experience, which plays the biggest role by far in creativity (Feist, 1998, 2010; Kaufman, 2013; Nusbaum & Silvia, 2011b).

Results

Analytic Approach and Model Specification

We analyzed the data using multilevel modeling, which can accommodate the complex structure of the data (Singer & Willett, 2003). We have within-person variables (the "be creative" manipulation), between-person variables (fluid intelligence), and an interest in how they might interact. The be-creative manipulation was scored −1 (be fluent) and 1 (be creative). All models were estimated using maximum likelihood with robust standard errors in Mplus 7.11. Unless specifically noted otherwise, all regression coefficients are raw, unstandardized weights. Table 1 displays descriptive statistics. The raw data (in SPSS and Mplus formats) and sample Mplus input files have been archived at Open Science Framework: https://osf.io/p6mrh/. We invite readers to reanalyze the data and explore their own questions.

Our analyses extended conventional multilevel models by adding latent variables (Skrondal & Rabe-Hesketh, 2004), as in some of our past work (Beaty & Silvia, 2012; Silvia, 2008b). One latent variable was creativity scores—the three raters' average scores for the rope and box tasks. A latent creativity variable was specified with three indicators, one for each rater; the path to the first rater was fixed to 1. This latent creativity variable, the outcome, varies at both the within and between model levels. As recommended by Heck and Thomas (2009), we constrained the factor loadings across levels so that the latent variable was invariant across the levels. The between-person residual variances of the indicators were extremely small, so they were fixed to zero (Heck & Thomas, 2009). The reliability of the creativity variable was estimated from the within-person CFA, using the maximal reliability H statistic (see Drewes, 2000; Hancock & Mueller, 2001; Silvia, 2011). It was quite good, $H = .91$, consistent with past work using subjective ratings. The CFA, shown as part of the full model described later, is shown in Figure 1.

A second latent variable was fluid intelligence, which was a straightforward between-person variable defined by four indicators, one for each task. The indicators were centered at their grand mean, and the path from that latent variable to the series completion task was fixed to 1. Model fit was strong on some indices (SRMR = .043, CFI = .906) but weaker on others (RMSEA = .163, 90% CI = .070, .273). The reliability of the latent variable was good but lower than the creativity variable, $H = .68$.

Being Creative: Within-Person Main Effects

Does varying the task instructions influence the *creativity* of people's divergent thinking responses? Likewise, does varying the task instructions influence the *number* of people's divergent thinking responses? Our analyses start with the within-person main effects of instructing people to "be creative" or "be fluent" on the quality and quantity of their ideas. We expected that the type of instructions people received for the divergent thinking tasks ("be creative" or "be fluent") would be the only important predictor of creativity, but we also included the counterbalancing variables task order (brick first [1] vs. rope first [−1]) and instruction order ("be creative" first [1] vs. "be fluent" first [−1]) to explore possible order effects. Instruction order had essentially no effect ($b = .016$, $SE = .020$, $p = .413$), and people did somewhat better when they did the rope task before the box task ($b = -.071$, $SE = .022$, $p = .001$). But as expected, we found a significant effect of asking people to be creative on the creativity of their responses ($b = .169$, $SE = .024$, $p < .001$). When told to focus on creative quality over mere quantity, people's responses received higher ratings. An estimated standardized effect was $\beta = .47$, indicating a large effect size.

What about quantity? A second model was estimated to explore the effect of be creative versus be fluent instructions on the number of responses people generated. As before, the effect of instruction order was small and nonsignificant ($b = -.182$, $SE = .180$, $p = .312$), and people generated slightly more ideas for the box task than the rope task (roughly .90 more; $b = .446$, $SE = .179$, $p = .013$). But the largest and most interesting effect, not surprisingly, was for the be-creative versus be-fluent instructions ($b = -1.040$, $SE = .179$, $p < .001$): people told to be creative generated significantly fewer uses than people told to simply come up with a lot of ideas (roughly 2.1 fewer). The estimated standardized effect was $\beta = -.32$, indicating a medium effect size.

Intelligence as a Moderator

Thus far, we've shown that instructing people to be creative yields fewer ideas (as shown by lower fluency scores) but better

Table 1
Descriptive Statistics

Variable	Mean	*SD*	Min, Max	1	2	3	4	5	6	7	8	9	10	11	12
1. Gf: Series completion	7.68	1.52	2, 11	1											
2. Gf: Paper folding	4.80	1.93	1, 10	.40	1										
3. Gf: Letter sets	7.79	2.58	1, 14	.21	.24	1									
4. Gf: Number series	7.80	2.26	2, 13	.35	.34	.43	1								
5. Fluency: Box	8.73	4.66	1, 33	.09	.07	.14	−.01	1							
6. Fluency: Rope	8.36	4.19	1, 25	−.03	−.04	.10	.00	.40	1						
7. Box: Rater 1	1.87	.46	1.00, 3.50	.06	.13	.01	.05	−.03	.18	1					
8. Box: Rater 2	1.45	.34	1.00, 3.00	.12	.12	−.05	.02	−.09	.15	.61	1				
9. Box: Rater 3	1.46	.43	1.00, 3.00	.03	.12	.06	.05	−.09	.11	.65	.78	1			
10. Rope: Rater 1	2.19	.57	1.40, 4.67	.24	.23	.14	.11	.11	−.35	−.10	−.07	.00	1		
11. Rope: Rater 2	1.41	.42	1.00, 3.00	.18	.28	.03	.04	.13	−.39	−.18	−.06	−.03	.78	1	
12. Rope: Rater 3	1.42	.51	1.00, 3.67	.14	.21	.06	.03	.04	−.45	−.08	−.04	.03	.72	.83	1

Note. $n = 141$. Readers should keep in mind that the overall descriptive statistics do not capture the effect of the within-person manipulation and counterbalancing, so reanalyses should be conducted using the raw data (https://osf.io/p6mrh/).

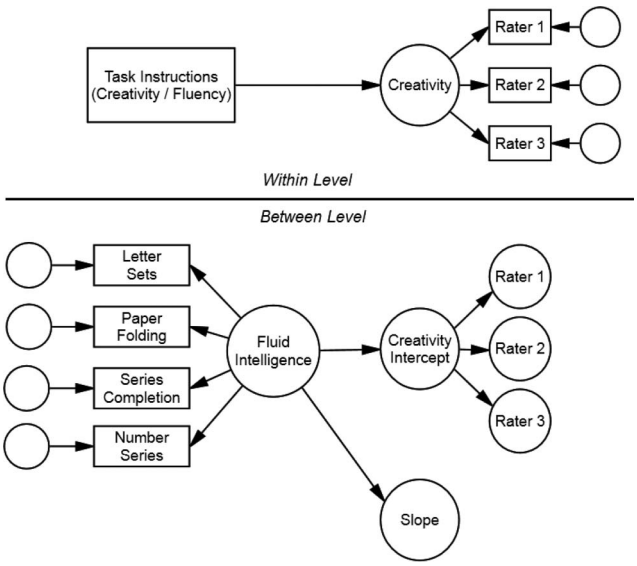

Figure 1. A multilevel latent variable model for the effects of be-creative instructions, fluid intelligence, and their interaction on the creativity of divergent thinking responses.

ideas (as shown by higher subjective ratings). The next key question concerns moderation. Our next models examined the role of fluid intelligence in the creativity and fluency of people's ideas. Does asking people to be creative benefit everyone equally?

First, we estimated the simple between-person main effect of fluid intelligence on creativity and fluency. (We should point that these main effects aren't especially revealing in their own right, given the large effect of the within-person manipulation on the responses.) Fluid intelligence had a significant main effect on creativity ratings ($b = .133$, $SE = .057$, $p = .019$) but not on fluency ($b = .575$, $SE = .778$, $p = .460$): as intelligence increased, people generated better ideas but not more ideas.

Second, and most central to our hypotheses, we examined the interaction between fluid intelligence and "be creative" instructions. (For these models, the residual variances for the random intercepts and random slopes were very close to zero, so they were fixed to zero to aid convergence; Heck & Thomas, 2009). Did telling people to be creative help less intelligent people catch up, or did it exaggerate more intelligent people's advantage? For creativity, we found a significant interaction ($b = .103$, $SE = .046$, $p = .026$). The shape of the interaction indicated that the rich got richer: creativity was highest when people higher in fluid intelligence were asked to be creative. As a concrete example, we can evaluate the effects of be-creative instructions for people at $\pm$ 1.5 *SD*s in fluid intelligence. The predicted slopes are roughly .07 and .27 for the low and high fluid intelligence groups. Phrased differently, telling people to be creative (vs. to be fluent) improves creativity by only .14 points (on the 1 to 5 rating scale) for the low intelligence group but by .54, several times more, for the high intelligence group. Telling people to be creative thus exaggerated the positive effect of intelligence on creativity.

What about the number of ideas? For fluency, no interaction appeared ($b = -.090$, $SE = .270$, $p = .740$): be creative instructions reduced fluency regardless of fluid intelligence levels. Fluid intelligence thus moderated the effects of be-creative instructions on the creative quality, not the mere quantity, of ideas.

Personality as a Moderator

The effects of personality and creative achievements are peripheral to our main purpose, but we report them here for curious readers. Openness to experience had the only significant main effect on creativity ($b = 0.136$, $SE = .049$, $p = .005$): not surprisingly, people high in openness generated ideas that the raters found much more creative. Several traits had main effects on fluency: people generated more ideas when they were higher in creative achievements ($b = 1.582$, $SE = .475$, $p = .001$), higher in extraversion ($b = 1.188$, $SE = .486$, $p = .014$), higher in conscientiousness ($b = .969$, $SE = .556$, $p = .081$), and lower in agreeableness ($b = -1.395$, $SE = .515$, $p = .007$). Concerning interactions, only neuroticism moderated the effect of be-creative instructions on creativity ($b = 0.115$, $SE = .042$, $p = .006$)—people high in neuroticism benefitted more from being told to be creative—and nothing moderated the effects on fluency.

Discussion

The current study examined whether giving people instructions to "be creative" influences the creativity and number of their responses on divergent thinking tasks. The be-creative effect is one of the oldest findings in creativity research, but some of its implications aren't fully appreciated. In the present study, we instructed people to either come up with creative ideas or with a lot of ideas, which represent the two most common ways of administering divergent thinking tests. The responses were scored with subjective creativity ratings, an increasingly popular method, or with fluency scores, a classic approach that correlates highly with related scoring methods (e.g., number of unique responses).

We found, not surprisingly, a large effect of be-creative instructions on the raters' judgments: the participants were much more creative when asked to try. There was a notable effect, too, on the number of responses. In short, asking people to be creative greatly boosts the quality of the responses but reduces the quantity. Stated the other way, using the "standard instructions" (Runco & Acar, 2010) to come up with as many ideas as possible does increase quantity but greatly reduces the creative quality. Because the manipulation was within-person, we can see how different instructions sharply change creative ideation: the same people became either more creative or more fluent depending on how the task's goal was framed.

Beyond these main effects, we found an interaction between fluid intelligence and the task instructions. When people were asked to be creative, people high in fluid intelligence were much more creative. The boost in creativity was specific to subjective ratings of creativity—fluency scores didn't show a similar effect, so intelligence specifically fostered creative quality, not simple quantity.

Implications for the Assessment of Divergent Thinking Scores

Our findings reinforce and extend Harrington's (1975) original arguments: telling people to be creative is essential to the validity

of the resulting scores. As our within-person manipulation shows, people are capable of being much more creative than they might seem. When asked to come up with a lot of ideas, they take the task at face value and churn out a lot of ideas that, as a whole, are less creative. But when asked to be more creative, they generate ideas that are much better. What Runco and Acar (2010) describe as the "standard instructions" thus systematically underestimate creativity.

In some respects, the logic of fluency instructions and scoring is hard to discern. If we instruct participants to generate as many ideas as possible, it seems odd to then judge them based on how many creative or unique ideas they generated. For one, people can shift between ideational strategies that foster fluency or creativity—as our study's within-person effects show—so researchers may as well ask for creativity if they want it. Furthermore, with a fluency system, the people who take the experiment at face value and adhere to the instructions (*Okay, I'll crank out a lot of ideas*) will get worse scores than people who disregard the task's instructions (*Whatever, I'll just have fun with it*). Penalizing the people who follow the directions strikes us as psychometrically perverse.

One defense of the standard fluency method might be that it seeks to assess "incidental creativity"—how creative people are when unprompted. This might seem reasonable, except that the fluency method for assessing divergent thinking is identical to the standard method for assessing verbal fluency. As we noted earlier, verbal fluency tasks ask people to generate as many responses as possible and then score them for fluency. The standard approach for assessing divergent thinking is eerily similar, a point noted in some reviews of verbal fluency and creativity tasks (e.g., Carroll, 1993, p. 429). One wonders, in fact, how fluency scores for a divergent thinking task given under fluency instructions differ from fluency scores from a garden-variety verbal fluency task. This resemblance is troubling.

Our findings demonstrated how the different task instructions can create different patterns of results. Our experiment, for example, replicated both branches of the controversial literature on creativity and intelligence. When people were told to generate a lot of ideas, fluid intelligence didn't significantly predict fluency, and it weakly predicted creative quality—in short, the findings from Wallach and Kogan (1965) and Kim's (2005) meta-analysis were observed. But when people were told to be creative and had their responses rated for creativity, fluid intelligence predicted creativity much more strongly—in short, the findings from recent studies advocating for an executive approach to creativity were observed (Beaty & Silvia, 2012; Benedek, Franz et al., 2012; Nusbaum & Silvia, 2011a).

A clear take-home message for researchers is that be-creative instructions are essential to the valid assessment of divergent thinking. The "standard instructions" that emphasize fluency (Runco & Acar, 2010) yield weaker effects, appear essentially identical to ways of assessing a different construct (verbal fluency), and obscure the fact that the participants could be much more creative if the researchers merely asked. Two faults in particular—measuring a different construct and underestimating the participants' creativity—strike us as serious and probably fatal, and we think the standard instructions probably need to be strongly justified in light of them.

Implications for the Mechanisms of Divergent Thinking

In our view, the be-creative effect is a simple but powerful demonstration of the essentially top-down nature of creative thought. An executive approach to creative thought emphasizes self-regulated cognition, such as creative goals, representations of end points and ideal states, ideational strategies, selective retrieval and combination of crystallized knowledge, and interference management. At its most basic level, the be-creative effect shows that creativity is partly under people's control. But what is being controlled?

In the present study, different possible interactions between be-creative instructions and fluid intelligence would imply different underlying mechanisms. For example, if be-creative instructions narrowed the high versus low intelligence gap, then the instructions probably work by processes that don't demand substantial cognitive resources, such as standardizing the sample's understanding of the task (Harrington, 1975), ensuring that everyone has a creative end-state as the target, or shifting mindsets toward approach-oriented goals (Zabelina, Felps, & Blanton, 2013). But if be-creative instructions exaggerate the effects of intelligence, then they probably work by sparking more intelligent people to enact strategies and processes that are beyond the reach of less intelligent people. For example, the strategies shown to lead to good ideas in Gilhooly et al.'s (2007) research are abstract—for example, disassembling a seemingly unitary object into parts, isolating an abstract object feature and searching for other objects that share it, and searching for highly general classes of uses—so it is hard to identify the strategies, deploy the higher-order mechanisms they require, and keep the strategies in mind while generating ideas. Beyond strategies, interference is a major issue in divergent thinking tasks—such as interference from obvious, salient, and previously generated uses—so executive control is needed to identify new ideas in the face of these distractors (Nusbaum & Silvia, 2011a).

Our study found a Matthew effect (Merton, 1968) in miniature: telling people to be creative made the rich get richer. When fluid intelligence was low, telling people to be creative or be fluent had a minor effect on the creativity of their responses. But when fluid intelligence was high, telling people to be creative produced gains in creativity that were several times larger.

It appears that asking people to be creative allows smarter people to put things into action that other people can't. What might these things be? The pattern of the interaction, in light of past research, strongly suggests that executive processes are at work, but the evidence is nevertheless indirect. Two approaches thus seem particularly fertile for following up this work by targeting likely mechanisms. First, based on Gilhooly et al.'s (2007) methods, it would be revealing to select samples high and low in fluid intelligence, manipulate be-creative instructions, and then measure strategy use during the task. Collecting think-alouds during the task or measuring self-reported strategies afterward could identify any strategic differences that come online when people are told to be creative. Second, the cognitive neuroscience of creativity has an increasingly detailed understanding of the neural signatures of executive control during creative thought (Benedek, Jauk et al., 2014; Benedek, Beaty et al., 2014; Fink & Benedek, 2013; Gonen-Yaacovi et al., 2013). The be-creative effect is a practical paradigm

for scanning environments: instructions can be manipulated within-person, as in the present work. In either case, the broader take-home conceptual message is that the be-creative effect offers both a strong demonstration of people's substantial top-down control of creative thought and a fertile paradigm for studying top-down influences on creativity.

The present findings cast additional doubt on classic associative models of creative thought, such as Mednick's (1962) landmark model of associative hierarchies. Mednick proposed that creative people's concepts are less tightly bound in memory, so they will generate unusual ideas as activation spreads from close to remote concepts. Recent work, however, shows that people high and low in creativity have essentially similar associative hierarchies when they are measured directly (Benedek & Neubauer, 2013). Moreover, ideas do tend to get more creative over time, as Mednick predicted, but people higher in fluid intelligence can generate creative ideas from the start (Beaty & Silvia, 2012), which suggests that they are not generating good ideas by letting associative processes unfold over time. And in the present study, we showed that people can deliberately choose to come up with better ideas when asked to do so, particularly when they are higher in fluid intelligence—people can thus direct their creative processes actively. Taken together, the evidence thus suggests that structural and organizational aspects of crystallized knowledge are less important than early models contended (Mednick, 1962; Wallach & Kogan, 1965). Instead, fluid cognitive processes that allow people to selectively retrieve and manipulate the knowledge they have probably deserve more attention.

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