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People Underestimate the Value of Persistence for Creative Performance

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Across 7 studies, we investigated the prediction that people underestimate the value of persistence for creative performance. Across a range of creative tasks, people consistently underestimated how productive they would be while persisting (Studies 1–3). Study 3 found that the subjectively experienced difficulty, or disfluency, of creative thought accounted for persistence undervaluation. Alternative explanations based on idea quality (Studies 1–2B) and goal setting (Study 4) were considered and ruled out and domain knowledge was explored as a boundary condition (Study 5). In Study 6, the disfluency of creative thought reduced people's willingness to invest in an opportunity to persist, resulting in lower financial performance. This research demonstrates that persistence is a critical determinant of creative performance and that people may undervalue and underutilize persistence in everyday creative problem solving.

Keywords: creativity, performance, effort, persistence, fluency

Persistence, the act of continuing to invest effort toward a task or goal, is considered essential for creative performance. Famous examples include Thomas Edison, who experimented on over 1,600 filament materials—including hairs plucked from a friend's beard—before designing the electric light bulb (Bedi, 2014). And Nobel laureate Linus Pauling, who famously said "I think I think harder, think more than other people do" when asked how he made so many discoveries (Pauling, 1990).

Creativity theory also recognizes the value of persistence. Osborn's (1953) classic "no criticism" rule of brainstorming was specifically intended to remove barriers to persistence during group idea generation. Csikszentmihalyi (1996) proposed that creativity is powerfully facilitated by the experience of flow because in the state of flow, people "persist . . . single-mindedly, disregarding hunger, fatigue, and discomfort" (Nakamura & Csikszentmihalyi, 2002, p. 89). Contemporary social psychological theories of creativity emphasize the importance of persistence as well. Amabile's (1983) componential model of creativity includes skills such as the ability to "concentrate effort for long periods of time" and to "persever[e] in the face of frustration" (p. 365). Finally, the dual pathway to creativity model theorizes that persistence, along with a flexible cognitive processing style, is one of two principle pathways to creative performance (De Dreu, Baas, & Nijstad, 2008).

Numerous empirical studies have found that persistence is associated with increased creative output. For instance, a study of classical composers found that a composer's likelihood of producing a high-quality composition was most significantly predicted by how many total compositions that person produced (Simonton, 1977); similar results were found in the domain of science (Simonton, 2003). Additionally, several studies have shown that a persistent cognitive processing strategy—in which a single idea category is explored in depth—is one of the primary predictors of creative performance (De Dreu et al., 2008). In fact, evidence suggests that persistence can be as important a route to creativity as flexible cognitive processing (Baas, De Dreu, & Nijstad, 2011; Baas, Koch, Nijstad, & De Dreu, 2015; Roskes, De Dreu, & Nijstad, 2012).

Although the link between persistence and creativity is well supported by anecdotes, theory, and research, less is known about whether people recognize the value of persistence in everyday creative problem solving. That is, do people accurately predict how much persistence benefits their own creative performance? This question is the focus of the current investigation. Our primary hypothesis is that people generally underestimate the value of persisting on creative tasks (i.e., persistence undervaluation). We argue that this effect occurs because creative thinking is an effortful process, during which people often feel that additional ideas or solutions will be difficult to generate. We refer to this subjectively experienced feeling of effort, or difficulty, of information processing as *disfluency* (Alter & Oppenheimer, 2009; Schwarz & Clore, 2007). We propose that the disfluent nature of creative thought downward biases performance expectations on creative tasks, and this misperception, in turn, leads people to underestimate the value of persisting on those tasks. Thus, our second hypothesis is that the disfluency of creative thought accounts for persistence undervaluation. In seven studies, we test these predictions and consider alternative explanations and a boundary condition.

The Disfluent Nature of Creative Thought

Creativity is defined as the generation of ideas, insights, or solutions that are novel and useful for a given situation or problem (Amabile, 1996; Amabile, Barsade, Mueller, & Staw, 2005; Sternberg, 1999). Our argument for the disfluent nature of creative thought draws on two attributes of creativity. The first is

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described by the search for ideas in associative memory theory of idea generation (Nijstad, Diehl, & Stroebe, 2003; Nijstad & Stroebe, 2006). Similar to evolutionary models of creative thinking (Simonton, 1999), the search for ideas in associative memory model conceptualizes creative work as involving the repeated search for ideas in associative memory. This process involves two stages. In the first stage, people retrieve problem-relevant knowledge from long-term memory and, in the second stage, they consciously alter the information in working memory to form new ideas. This could involve combining or deconstructing ideas, forming new knowledge, or applying ideas to the problem in a new way. People iteratively move back and forth between the two stages as they generate ideas. An important feature of the theory is that idea generation occurs by trial and error and, consequently, attempts at idea generation are often unsuccessful (see also Simonton, 2003). When trying to generate a creative idea, one might make an association that has already been considered (lacks novelty), does not appropriately address the problem (lacks usefulness), or one can fail to form an association altogether (Nijstad & Stroebe, 2006). Failed idea associations are extremely common during the creative process. They lead to difficulty in getting the creative process started (Smith, 2003) and difficulty in keeping the process going once started (Gettys, Pliske, Manning, & Casey, 1987; Nijstad, Stroebe, & Lodewijkx, 2006).

A second attribute of creative thought that leads creativity to feel disfluent is that people have limited awareness of when they are making progress toward a solution (Schooler & Melcher, 1995). In less creative tasks, people track their progress toward a solution by applying known steps, rules, and procedures. In contrast, in creative tasks people utilize associative thinking, drawing on loose cognitive associations between idea elements. These associations are combined, discarded, and recombined until a creative idea emerges (Campbell, 1960; Simonton, 1999, 2003). The associative and iterative nature of this process makes it difficult to determine whether one is nearing a creative solution. For instance, in one study, people solving math problems (an uncreative task) were able to verbalize their progress and could anticipate when they were getting close to a solution. However, people solving creative insight problems had little awareness of their progress and were unable to verbalize their progress until directly before they generated a solution (Metcalfe & Wiebe, 1987). This helps explain why creative solutions are sometimes experienced as unexpected "moments of insight" (Kounios & Beeman, 2009).

To summarize, creative thought is a trial-and-error process that generally produces a series of failed associations before a creative solution emerges. Furthermore, the associative thinking people draw on during the creative process makes it difficult to assess progress toward a solution. We argue that these features lead people to experience creative thought as effortful and they lead people to feel like additional ideas or solutions will be difficult to generate. In other words, creative tasks are experienced with an inherent level of disfluency that is produced by the creative thinking required to work through those tasks. We next consider how fluency impacts predictions about the value of persisting on creative tasks.

Fluency and Task Persistence

Fluency powerfully influences judgments, valuations, and decisions (Alter & Oppenheimer, 2009; Clore et al., 2001). Things that are processed fluently are better liked, better believed, and more seriously considered (Reber, Schwarz, & Winkielman, 2004; Schwarz et al., 1991). Relevant to the current research, fluency also guides expectations about task performance (Schwarz & Clore, 2007). When information processing related to a task is easy or fluent, people expect to perform well, whereas when information processing is difficult or disfluent, people reduce their expectations. For instance, in one study, students who read a recipe in a disfluent font type predicted that the recipe would be more difficult to prepare than those who read the recipe in a relatively fluent font type (Song & Schwarz, 2008). In another study, participants who answered trivia questions while making a disfluent facial expression (furrowing their brows) were less confident about their task performance than participants who made a less disfluent facial expression (puffing their cheeks; Alter, Oppenheimer, Epley, & Eyre, 2007). Thus, when a task feels disfluent, people decrease their expectations about how well they will perform. This is important because people's expectations about their future task performance largely determine whether they will invest effort into that task (Feather, 1982). By reducing people's expectations about how well they will perform, disfluency lowers the expected value of persisting.

In noncreative tasks, disfluency often serves as an accurate signal for task difficulty (Schwarz & Clore, 1988). In these cases, disfluency leads people to accurately lower their expectations about future performance and the value of persistence. However, our main theoretical argument is that the accuracy of this disfluency signal is systematically biased in creative tasks. We propose that, like a miscalibrated scale that leads people to systematically underestimate the weight of objects, the disfluent nature of creative thought downward biases people's expectations about their own future performance and leads them to systematically underestimate the value of persisting on creative tasks.

In the current research, we predicted that people would underestimate the value of persisting on creative tasks and that the disfluency of creative thought accounts for this effect. These predictions have important implications for creative performance. First, they mean that people systematically undervalue a central route to creativity, as identified in prominent theoretical models (De Dreu et al., 2008; Osborn, 1953). This is particularly important given evidence from the brainstorming literature that the quality of idea generation improves over time—classic brainstorming research finds evidence that ideas become more creative over the duration of a brainstorming session (Christensen, Guilford, & Wilson, 1957; Parnes, 1961). Thus, undervaluing persistence may lead people to prematurely conclude their creative work and potentially leave their best ideas undiscovered.

Overview of Studies

Across seven studies, we investigate our hypothesis that people underestimate the value of persistence for creative performance. Each study followed a similar format. In the first stage, participants generated ideas or solutions to a task for a set period of time. Next, participants estimated how many more ideas or solutions they would be able to generate during an additional period of time to work on the task (referred to here as *persistence*). In the second stage of the study, participants actually persisted on the task. This procedure allowed us to compare people's predictions of how many ideas they could generate (i.e., the predicted value of persisting) with their actual performance (i.e., the actual value of persisting).

Study 1 provides an initial test of our hypothesis using a creative idea generation task. Studies 2A and 2B expand the scope of the design to include a range of highly creative tasks and less creative tasks. We predicted that people would underestimate how many ideas they can generate while persisting on highly creative tasks and this would be attenuated in less creative tasks. In these studies we also measured idea quality in order to address the alternative explanation that idea quality diminishes over time, in which case people would be right to devalue persistence. In Study 3, we tested an underlying mechanism. Specifically, we tested whether persistence undervaluation is predicted by the disfluency of creative thought. In Study 4, we provide evidence against an alternative explanation based on goal setting and in Study 5, we moved into the field to test a boundary condition based on domain knowledge. In Study 6, we investigated a consequence of undervaluing persistence: whether the disfluency of creative thought reduces people's willingness to invest in an opportunity to persist, to the detriment of their financial performance.

Study 1: Underestimating the Value of Persistence

We recruited students the week before Thanksgiving to complete a Thanksgiving-themed idea generation task. Participants generated solutions for 10 min, predicted how many more solutions they could generate while working on the task for an additional 10 min (i.e., persisting), and then persisted for 10 min. We predicted that participants would underestimate how many solutions they could generate while persisting on the task. In order to address the concern that idea quality diminishes over time, which would lead one to question whether participants are truly undervaluing persistence, we also measured the quality of ideas generated.

Method

Participants. Twenty-four students from Northwestern University (M_{age} = 20.54, SD_{age} = 1.32; 18 women) were recruited to the laboratory to participate in a 30-min session in exchange for $8. We recruited as many participants as we could in the week leading up to Thanksgiving break.

Procedure. Participants arrived to the laboratory in groups of one to seven and completed the study individually at computer stations. In the first part of the survey, participants worked on a Thanksgiving-themed idea generation task for 10 min. Idea generation tasks require divergent thinking and are widely recognized measures of creativity (Amabile, 1996; Guilford, 1967). In our task, participants were asked to "Generate as many original ideas for things to eat or drink at a Thanksgiving dinner as you can." To incentivize task performance, participants learned their responses would be rated for originality by outside judges and that each idea rated as above average would earn a raffle ticket into a $50 lottery.

Participants first generated ideas for 10 min. After 10 min, participants were asked to report how many ideas they generated. In the second stage of the survey, participants were asked to work on the task again (i.e., persist) for an additional 10 min. Before persisting on the task, participants responded to the question, "How many more ideas do you think you will generate with the additional 10 minutes?" This question was our measure of predicted performance while persisting. After participants recorded their prediction, they persisted on the task for 10 min, after which they reported the number of ideas they generated. This provided a measure of actual performance while persisting. Our main analysis compared participants' predicted and actual number of solutions generated while persisting.[1]

Idea quality ratings. As a measure of idea quality, we recruited 41 people from Amazon's Mechanical Turk (Mturk; M_{age} = 36.95, SD_{age} = 13.21; 23 women) to rate the originality of the ideas generated. Ideas were presented in a randomized order and originality was rated on a 3-point scale (1 = *below average*; 2 = *average*; 3 = *above average*). Raters showed high interrater reliability (α = .90). Originality scores ranged from 1.17 to 2.76. For each participant, we calculated an average originality score for ideas generated during the initial time period and for ideas generated while persisting.

Results and Discussion

People generated an average of 21.79 ideas in the initial time period (SD = 14.37). Our main prediction was that people would underestimate how many ideas they could generate while persisting. As displayed in Figure 1, a paired-samples t test revealed that predicted performance while persisting (M = 9.83, SD = 6.21) was significantly lower than actual performance while persisting (M = 15.04, SD = 9.63), $t(23) = -3.68$, p = .001, d = .75, 95% confidence interval (CI) [−8.14, −2.28].

Next we looked at idea quality across the work periods. A paired-samples t test revealed that ideas generated while persisting (M = 1.88, SD = .21) were significantly more original than ideas generated initially (M = 1.76, SD = .17), $t(23)$ = 3.91, p = .001, d = .82, 95% CI [0.06, 0.18].

Persistence is an important determinant of creativity in anecdotal accounts and theoretical models. Despite this attention, Study 1 found that people underestimated how productive they would be while persisting on an idea generation task. Contrary to an alternative explanation based on diminishing idea quality, we also found that ideas generated while persisting were significantly more original than ideas generated initially. Given that people underestimate the value of persisting and that idea quality may increase over time, these results suggest the intriguing possibility that undervaluing persistence may lead people to lose out on their most creative ideas by quitting too soon. In Studies 2A–2B, we expand the scope of our investigation by testing our prediction across different creative tasks.

Study 2A: High- and Low-Creativity Tasks

Study 1 found that people underestimated how productive they would be while persisting on a creative idea generation task. The

[1] We refer to the number of ideas generated or the number of problems solved as *performance* or *productivity*, rather than as *ideational fluency* as is typical of some creativity research. We do this to avoid confusion between information processing fluency (general feelings of ease or difficulty) and ideational fluency (the number of ideas generated).

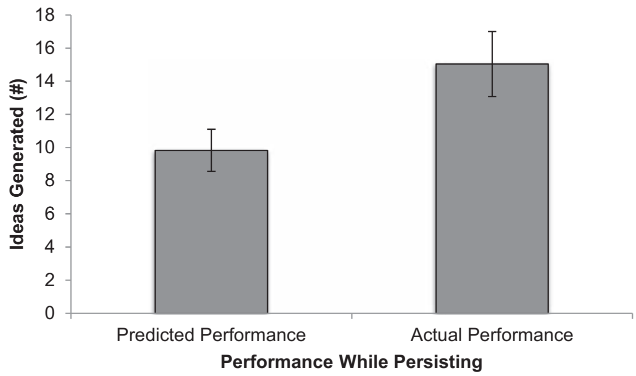

Figure 1. Comparison of mean levels of predicted versus actual performance while persisting (± 95% confidence interval) in Study 1.

main goal of Study 2A was to test the breadth of persistence undervaluation across three different creativity tasks that we drew from prior creativity literature (*high-creativity* tasks). We also included three *low-creativity* tasks for comparison. Because low-creativity tasks require less creative thought, we expected to find less persistence undervaluation in these tasks. We predicted that people would underestimate how productive they would be while persisting on the high-creativity tasks and that this effect would be attenuated on the low-creativity tasks. Persistence undervaluation was tested as a within-participants factor and task type (high-creativity, low-creativity) as a between-participants factor.

Method

Participants. Seven hundred two participants (M_{age} = 33.68, SD = 11.86; 385 women) were recruited from Mturk and compensated $0.51. Our recruitment goals for the Mturk studies (Studies 2–4 and 6) were based on a heuristic of "at least 50 participants per condition," that, based on pilot testing, we sometimes increased a priori. In Studies 2A and 2B, we set our recruitment goal at 100 participants per task because we expected the effect sizes of the low-creativity tasks to be smaller. Mturk respondents are recognized to produce data of comparable quality to the laboratory and other online platforms (Buhrmester, Kwang, & Gosling, 2011). To further promote data quality, participation was restricted to those with IP addresses located in the United States and a filter was applied to screen out those who participated in similar surveys. These recruitment procedures were used in all Mturk studies. We excluded 54 participants who failed the attention check and one outlier suspected of cheating (who generated all possible solutions), leaving 647 for analysis. The six tasks in this study were administered across three surveys; controlling for survey did not change the interpretation of any results, and age and gender did not significantly differ by survey, ps $>$.20.

Procedure. Participants received our survey through an online portal provided by Mturk. Participants were assigned to complete either a high-creativity task or a low-creativity task (all six tasks described in Table 1). In the first stage of the survey, all participants received task instructions and then worked on their task for 4 min (a built-in survey timer auto-advanced the page after 4 min). After completing the task, participants reported how many solu-

Table 1
Description of Tasks Used in Study 2A and Statistical Tests Comparing Each Test to the Midpoint (5.50) of the Creative Thinking Scale

Task	Creativity	Task description	Example response	Pretest survey	Comparison to scale midpoint
Unusual uses	High	Participants were asked to "Generate as many uses for a cardboard box as you can"	*Playhouse for a child, doorstop, weapon*	M = 8.70 SD = 1.80	Sig. higher, $t(78)$ = 15.78, $p < .001$, d = 1.79, CI [2.79, 3.60]
Advertisement slogans	High	Participants saw a picture of a hamburger and French fries and were asked to "Generate as many slogans for this product as you can"	*It's okay to have a little grease now and then*	M = 8.80 SD = 1.40	Sig. higher, $t(78)$ = 20.94, $p < .001$, d = 2.37, CI [2.98, 3.61]
Anagrams	High	Participants formed words from the letters *AENOPSR*; words were between 2 and 5 characters; letters could be used only once	*SOAP PEAR*	M = 6.48 SD = 2.37	Sig. higher, $t(78)$ = 3.67, $p < .001$, d = .42, CI [0.45, 1.51]
Math problems	Low	Participants solved story-based math problems. 50 problems were presented on a single page, participants could solve in any order. Problems were around 70 words long, involved simple math operations (e.g., addition, division) and typically involved multiple steps		M = 3.77 SD = 2.54	Sig. lower, $t(78)$ = − 6.04, $p < .001$, d = .68, CI [−2.30, −1.16]
Value of words	Low	Participants calculated the numeric value of words based on the alphanumeric position of the letters that make up the word. For example, the value of the word bat is 23 [(b = 2) + (a = 1) + (t = 20) = 23]		M = 3.71 SD = 2.76	Sig. lower, $t(78)$ = − 5.78, $p < .001$, d = .65, CI [−2.41, −1.17]
Word search	Low	Participants were presented with a 20 × 20 character letter matrix and were asked to find as many words as they could; the matrix contained 100 words, all words were at least 2 letters long		M = 4.86 SD = 2.68	Sig. lower, $t(78)$ = − 2.12, p = .037, d = .24, CI [−1.24,−0.04]

Note. For the unusual uses, advertisement slogans, anagrams, and word search tasks, the exact same stimuli were used during the initial time period and while persisting. For the math problems and value-of-words tasks, participants initially viewed 50 different problems. Problems solved during the initial time period were removed and all unsolved problems were presented to participants while persisting. Sig. = significantly; CI = 95% confidence interval.

Table 2
Means and Standard Deviations of Predicted and Actual Performance While Persisting in Each of the High- and Low-Creativity Tasks in Study 2A

	Initial effort						Persistence		
	Actual		Predicted		Actual				
Task	*M*	*SD*	*M*	*SD*	*M*	*SD*	*t*	*d*	CI
Creative task composite (N = 342)			5.82	5.70	10.40	13.40	**−6.68**[***]	.58	[−4.73, −3.27]
Noncreative task composite (N = 305)			7.47	5.58	8.33	5.48	**−3.40**[**]	.19	[−1.36, −0.36]
Creative tasks									
Unusual uses (N = 109)	12.83	5.74	4.89	3.32	7.94	4.88	**−8.38**[***]	.80	[−3.77, −2.33]
Anagrams (N = 128)	29.65	15.66	7.96	8.10	14.96	10.59	**−8.34**[***]	.74	[−8.66, −5.34]
Ad slogans (N = 105)	7.79	3.87	4.21	2.40	5.54	3.52	**−4.58**[***]	.45	[−1.91, −0.75]
Noncreative tasks									
Value of words (N = 90)	5.98	2.98	6.68	3.15	7.70	4.43	**−3.65**[***]	.38	[−1.58, −0.46]
Math problems (N = 95)	4.32	2.62	4.66	2.12	5.22	2.67	**−2.43**[*]	.25	[−1.02, −0.10]
Word search (N = 120)	15.95	7.61	10.29	7.34	11.28	6.30	−1.70	.15	[−2.15, 0.17]

Note. The *t* test compares predicted versus actual performance while persisting. Values in boldface indicate statistically significant. CI = 95% confidence interval.
[*] $p < .05$. [**] $p < .01$ [***] $p < .001$.

tions they generated. In the second stage of the survey, participants read that they would persist on the task for an additional 4 min. As in Study 1, participants predicted how many solutions they could generate during the additional time, and after recording their prediction, they persisted on the task for 4 min. In all tasks, performance was incentivized with small monetary bonuses or tickets into a cash prize lottery.

Tasks and pretest survey. We tested our hypothesis across three different high-creativity tasks we drew from the creativity literature: the unusual uses task, advertisement slogans task, and anagrams (Bowden, 1997; Guilford, 1967; Sternberg, 1999).[2] We also included three low-creativity tasks: math problems, value of words, and word search. To validate our task selection, we introduced 79 Mturk participants (M_{age} = 32.57, SD = 10.92; 37 women) to each of the six tasks and asked them to rate how much each task required creative thinking (1 = *not at all*; 10 = *extremely*). Specifically, we asked, "To what extent do you think the ability to think creatively is important for doing well on tasks like this one?" Verifying our task selection, the three high-creativity tasks were rated significantly above the scale midpoint and the three low-creativity tasks were rated significantly below the scale midpoint (results reported in Table 1).

Results and Discussion

We predicted people would significantly underestimate the value of persistence in the high-creativity tasks and that this effect would be attenuated in the low-creativity tasks. First we compared the three high-creativity tasks with the three low-creativity tasks. A 2 (Performance: predicted, actual) × 2 (Task: high-creativity, low-creativity) mixed-factor analysis of variance (ANOVA) revealed the predicted Performance × Task interaction, $F(1, 645) = 46.55$, $p < .001$, η_p^2 = 07. Predicted performance while persisting was significantly lower than actual performance while persisting for the high-creativity tasks, $t(340) = -6.68$, $p < .001$. This was also the case for the low-creativity tasks, $t(303) = -3.40$, $p = .001$, however an effect size comparison revealed that the effect size of the high-creativity tasks (d = .58) was significantly larger than that of the low-creativity tasks (d = .19, $p < .001$), as indicated by the nonoverlapping confidence intervals (see Table 2). The main effect of performance was significant, $F(1, 645) = 111.85$, $p < .001$, $\eta_p^2 = .15$, and the main effect of task was nonsignificant, $F(1, 645) = .026$, $p = .872$, $\eta_p^2 = .00$. To further explore the data, Table 2 also displays the paired-samples t tests comparing predicted to actual performance for each task.

To address the concern that idea quality diminishes over time, we looked at idea quality in the unusual uses task and the advertisement slogans task. Idea quality was rated using a similar method to Study 1.[3] Contrary to the diminishing idea quality concern, in the unusual uses task, ideas generated while persisting (M = 1.83, SD = .33) were significantly more original than ideas generated initially (M = 1.77, SD = .20), $t(108) = 1.99$, $p = .05$, d = .19, 95% CI [0.00, 0.13], and in the advertisement slogan task, slogans generated while persisting (M = 1.83, SD = .14) were of significantly higher quality than slogans generated initially (M = 1.80, SD = .12), $t(100) = 2.57$, $p = .012$, d = .26, 95% CI [0.01, 0.06].

It is notable that, overall, the low-creativity tasks also showed a small but significant persistence undervaluation effect. Although it is possible that the low levels of creativity in these tasks helped

[2] Anagrams are considered to test creative insight. Although it is possible to solve anagrams uncreatively by systematically working through all possible letter combinations, most people lack the mental endurance to use this strategy exclusively—in our task, there were 3,612 letter combinations. Instead they tend to approach the task like a creative insight problem (Mumford, Hester, & Robledo, 2012).

[3] For the unusual uses task, 160 people from Mturk (M_{age} = 38.55, SD_{age} = 12.95; 104 women) rated idea originality, using a 3-point scale (1 = *below average*; 2 = *average*; 3 = *above average*). Each person rated only 25% of the responses, to prevent fatigue. Thus, each slogan received approximately 40 ratings. The four groups of raters showed high interrater reliability: αs = .90, .91, .92, and .93. Originality scores ranged from 1.24 to 2.43. For the advertisement slogans task, 160 people from Mturk (M_{age} = 37.42, SD_{age} = 12.97; 102 women) each rated 25% of the slogans on the dimensions of engagement and positivity, using 3-point scales (1 = *below average*; 2 = *average*; 3 = *above average*). The two dimensions were averaged into a measure of slogan quality. Each slogan received approximately 40 ratings. The four groups of raters showed adequate interrater reliability: αs = .73, .74, .77, and .78. Slogan quality scores ranged from 1.47 to 2.15.

produce the effect, we also recognize that other factors besides task creativity may lead people to underestimate the value of persisting. For instance, post hoc analyses found evidence that persistence undervaluation in the low-creativity tasks can be partially explained by "practice effects," or the tendency for performance to improve over time. As a proxy for practice effects, we coded participants whose performance improved between the first and the second work periods as "improvers" and those whose performance stayed the same or declined as "nonimprovers." Controlling for improvement, persistence undervaluation in the high-creativity tasks remained significant, $F(1, 340) = 26.92$, $p < .001$, $\eta_p^2 = 07$, however, persistence undervaluation in the low-creativity tasks became nonsignificant, $F(1, 303) = 2.36$, $p = .126$, $\eta_p^2 = 01$. The Performance × Task interaction also remained significant, $F(1, 644) = 12.89$, $p < .001$, $\eta_p^2 = 02$.

In Study 2A, people underestimated how productive they would be while persisting across three distinct creative tasks, and this effect was significantly attenuated in less creative tasks. We also found that the quality of ideas generated while persisting was higher than ideas generated initially, providing further evidence against the concern that idea quality may diminish over time. It is notable that a significant persistence undervaluation effect was found in the low-creativity tasks. It suggests that factors besides task creativity, such as practice effects, may also influence persistence undervaluation. Given that the effect size in the high-creativity tasks was stronger than that of the low-creativity tasks, we do not see this as incompatible with our theorizing. It is an interesting question for future research. In Study 2B, we turn to a potential methodological concern from Study 2A.

Study 2B

Study 2A found converging evidence for persistence undervaluation across three distinct creative tasks and also found that the effect was attenuated in three less creative tasks. A benefit of Study 2A is that it demonstrated persistence undervaluation across multiple creative tasks drawn from the creativity literature. However, one concern is that these tasks may have differed on dimensions other than task creativity. In Study 2B, we address this concern by developing high- and low-creativity versions of the same idea generation task. We expected to find greater persistence undervaluation in the high- compared with the low-creativity version of the task. Persistence undervaluation was tested as a within-participants factor and task type (high-creativity, low-creativity) as a between-participants factor.

Method

Participants. Two hundred twenty-two participants ($M_{age} = 36.65$, $SD = 13.24$; 113 women) were recruited from Mturk and compensated $0.51. Twenty-three participants failed an attention check, leaving 199 for analysis.

Procedure. The procedure followed that of Study 2A. The only difference was that the two work periods were reduced from 4 min each to 2 min each. Participants worked on the task for 2 min, predicted how many more ideas they would generate during an additional 2 min, and then persisted on the task for 2 min.

Study manipulation. The main task was an idea generation task in which participants thought of foods and drinks that have peanut butter as an ingredient. The *high-creativity* and *low-creativity* conditions differed only by whether participants were asked to think of "creative" ideas or "common" ideas, respectively. Specifically, participants were instructed to "list ideas for foods or drinks that use or incorporate peanut butter in a *creative* [*common*] way." In a pretest survey, 80 Mturk participants ($M_{age} = 35.65$, $SD = 11.14$; 30 women) completed either the high- or the low-creativity version of the task and then rated how much the task "required creative thinking," whether they considered it "a creative task," and how much "the ability to think creatively is important for doing well on tasks like this one" (1 = *not at all*; 10 = *extremely*). We averaged responses into a composite measure of creative thinking ($\alpha = .91$). Confirming our manipulation, the high-creativity version ($M = 7.84$, $SD = 1.58$) was rated as requiring significantly more creative thinking than the low-creativity version ($M = 6.25$, $SD = 2.54$), $t(78) = 3.24$, $p = .002$, $d = .72$, 95% CI [0.61, 2.56].

Results and Discussion

We predicted people would significantly underestimate the value of persistence in the high-creativity condition and that this effect would be attenuated in the low-creativity condition. A 2 (Performance: predicted, actual) × 2 (Creativity: high, low) mixed-factor ANOVA revealed the predicted Performance × Task interaction, $F(1, 197) = 4.78$, $p = .030$, $\eta_p^2 = 02$. In the high-creativity condition, predicted performance while persisting ($M = 2.53$, $SD = 1.76$) was significantly lower than actual performance while persisting ($M = 4.31$, $SD = 2.96$), $t(98) = -7.19$, $p < .001$, $d = .72$, 95% CI [−2.28, −1.29]. In the low-creativity condition, predicted performance while persisting ($M = 2.78$, $SD = 2.57$) was also significantly lower than actual performance while persisting ($M = 3.48$, $SD = 2.50$), $t(99) = -3.91$, $p < .001$, $d = .39$, 95% CI [−1.52, −0.49]. However, the effect size of the persistence undervaluation effect in the high-creativity condition was significantly larger than that of the low-creativity condition at $p < .05$, as indicated by confidence intervals that do not overlap with the mean difference of predicted and actual performance. The main effect of performance was significant, $F(1, 197) = 60.87$, $p < .001$, $\eta_p^2 = .24$, and the main effect of task was nonsignificant, $F(1, 197) = 2.11$, $p = .148$, $\eta_p^2 = .01$.

Next we looked at the quality of the responses generated. As in previous studies, idea quality was assessed by a separate sample of raters.[4] Serving as a manipulation check, responses generated in the high-creativity condition ($M = 2.10$, $SD = .27$) were rated as significantly more creative than responses generated in the low-creativity condition ($M = 1.80$, $SD = .24$), $t(197) = 8.21$, $p < .001$, $d = 1.16$, 95% CI [0.22, 0.37]. Looking at creativity across the work periods we found that responses generated while persisting ($M = 2.06$, $SD = .30$)

[4] We recruited 251 people from Mturk ($M_{age} = 37.03$, $SD_{age} = 12.46$; 128 women) who each rated the creativity of 10% of the responses (1 = *below average*; 2 = *average*; 3 = *above average*). Thus, each response received about 25 ratings. Creative uses were defined as uses that are both novel and interesting/appetizing. Raters showed high interrater reliability (all αs between .83 and .95). Creativity scores ranged from 1.00 to 2.96.

were significantly more creative than responses generated initially ($M = 1.88$, $SD = .36$), $t(187) = -7.28$, $p < .001$, $d = .53$, 95% CI [−0.23, −0.13]. This was the case in the high-creativity condition ($M_{initial} = 2.06$, $SD_{initial} = .34$, $M_{persistence} = 2.18$, $SD_{persistence} = .27$), $t(94) = -3.37$, $p = .001$, $d = .35$, 95% CI [−0.19, −0.05], and in the low-creativity condition ($M_{initial} = 1.70$, $SD_{initial} = .29$, $M_{persistence} = 1.94$, $SD_{persistence} = .28$), $t(92) = -7.32$, $p < .001$, $d = .76$, 95% CI [−0.31, −0.17].

Whereas Study 2A compared different high- and low-creativity tasks, Study 2B manipulated the creativity required in the same idea generation task and found stronger persistence undervaluation in the version that required more creativity. This provides converging evidence that people underestimate the value of persisting on creative tasks and that this effect is attenuated in less creative tasks. We also found that ideas generated while persisting were more creative than ideas generated initially, further speaking against a diminishing idea quality alternative explanation.

Studies 1, 2A, and 2B provide a robust demonstration that people underestimate how productive they can be while persisting on a creative task and, in doing so, they underestimate their own ability to generate ideas that are of the same or higher quality as those generated initially. In Study 3, we shift the investigation to focus on a mechanism underlying this effect.

Study 3: The Role of Fluency

Study 3 had two goals. First, we tested persistence undervaluation using a creative insight task. Second, we investigated whether fluency experienced during the initial work period accounts for persistence undervaluation. We proposed that people underestimate the value of persistence because the disfluent nature of creative thought downward biases their performance expectations. Participants worked on a high-creativity task or a low-creativity task, reported the fluency experienced during the initial work period, and then estimated how many solutions they could generate during an additional work period. We predicted that people would underestimate the value of persisting in the high-creativity task and that fluency would account for this effect.

Method

Participants. One hundred sixty-one participants ($M_{age} = 33.91$, $SD_{age} = 11.59$; 70 women) were recruited from Mturk and compensated $0.51. Twelve failed the attention check, leaving 149 for analysis.

Procedure. Participants received the survey through an online portal provided by Mturk. In the first stage of the survey, participants received instructions for a high-creativity task or a low-creativity task. The high-creativity task was the remote associates task (RAT), a common measure of creative insight and problem solving (Mednick, 1962). In this task participants view a triad of three words that can be logically associated by a fourth word. For example, one triad consists of the words *manners*, *round*, and *tennis*. For this triad, the solution is *table* because the word table logically associates with each of the three words in the triad, that is, *table manners*, *round table*, and *table tennis*. Participants solve the problem by providing the fourth word. The low-creativity task was the math problems task used in Study 2A. For both tasks participants were told to solve as many problems as they could and that each problem they solved would earn them a ticket into a raffle for a $50 gift card.

Participants began the task by advancing the survey page, which started a 4-min timer and, depending on condition, displayed 50 RAT triads or 50 math problems. Pretests determined that 50 problems were far more than any participant could solve in 8 min. Participants were told they did not have to solve the problems in order. After 4 min, the survey advanced to a page that displayed how many problems were correctly solved.

Next participants reported how disfluently they experienced the task. Participants indicated their agreement with three questions on 7-point scales (1 = *disagree completely*; 7 = *agree completely*): "It was difficult to generate solutions during the 4 minutes," "Solutions came easily to me during the 4 minutes," and "I had a tough time generating solutions during the 4 minutes." The second question was reverse scored so that higher scores reflect greater disfluency ($\alpha = .82$).

In the second stage of the survey participants predicted how many solutions they could generate during an additional 4 min and then they persisted on the task for an additional 4 min. During the additional 4 min, the survey displayed each of the 50 problems that were not solved during the initial time period.

Results and Discussion

On the RAT (high-creativity) people initially solved an average of 9.84 triads ($SD = 5.30$) and on the math task (low-creativity) people initially solved an average of 4.51 problems ($SD = 2.74$).

First, we looked for persistence undervaluation. A 2 (Task: high-creativity, low-creativity) × 2 (Performance: predicted, actual) mixed-factor ANOVA revealed the predicted Performance × Task interaction, $F(1, 147) = 20.00$, $p < .001$, $\eta_p^2 = 12$. On the high-creativity task, predicted performance while persisting ($M = 6.31$, $SD = 3.66$) was significantly lower than actual performance while persisting ($M = 8.71$, $SD = 4.46$), $t(74) = -4.54$, $p < .001$, $d = .52$, 95% CI [−3.45, −1.35]. However, for the low-creativity task, predicted ($M = 5.43$, $SD = 3.03$) and actual ($M = 5.09$, $SD = 2.97$) performance while persisting did not differ, $t(73) = 1.12$, $p = .270$, $d = .13$, 95% CI [−0.27, 0.94]. The main effects of task, $F(1, 147) = 20.05$, $p = .002$, $\eta_p^2 = .12$, and performance, $F(1, 147) = 11.34$, $p = .001$, $\eta_p^2 = .07$, were significant.

Next we tested whether fluency predicted persistence undervaluation. For this analysis we computed a percentage of underestimation score: (actual performance − predicted performance)/predicted performance. Thus, if a participant predicted she would solve six solutions and actually solved 10, the percentage of underestimation would be .67, or 67%. Regression analysis found that disfluency significantly predicted the percentage of underestimation in the high-creativity task ($\beta = .25$, $t = 2.24$, $p = .028$). In the low-creativity task, disfluency did not significantly predict percentage of underestimation ($\beta = .04$, $t = .32$, $p = .754$). A comparison of r coefficients revealed a nonsignificant difference between the size of the disfluency effect for the high-creativity task ($r = .25$) and for the low-creativity task ($r = .04$, $z = 1.33$, $p = .183$).

In Study 3, we replicated the persistence undervaluation effect in a new creative task, the remote associates task, and found no evidence of the effect in the low-creativity task. Consistent with our theorizing, we found that the fluency of the initial work period accounted for the persistence undervaluation effect in the high-creativity task. Having found evidence of a mechanism underlying persistence undervaluation, in Studies 4–5, we address an alternative explanation and a boundary condition.

Study 4: Ruling out Goal Setting

Study 4 addressed an alternative explanation. The goal-setting literature finds that performance predictions sometimes act as performance goals that then motivate higher performance (Heath, Larrick, & Wu, 1999). This raises the possibility that in our studies people's performance predictions may have motivated higher performance while persisting, which would artificially produce a persistence undervaluation effect. In the current study we address this concern by having some participants persist on a creative task after making performance predictions (*prediction* condition) and others persist on the task without making performance predictions (*no prediction* condition). If making a prediction inflates performance while persisting, then those in the prediction condition should perform better than those in the no prediction condition. Alternatively, if both groups perform similarly, it will suggest that the act of making a performance prediction does not account for the persistence undervaluation effect.

Method

Participants. One hundred nine participants (M_{age} = 34.70, SD_{age} = 11.29; 48 women) were recruited from Mturk and compensated $0.51. Eight participants failed the attention check, leaving 101 for analysis.

Procedure. In this study all participants completed the unusual uses task. The task and survey were the same as in Study 2, except that we manipulated whether participants made performance predictions. In the *prediction* condition participants worked on the task for 4 min, made predictions about their performance during an additional 4 min, and then persisted for 4 min. In the *no prediction* condition participants worked on the task for 4 min and then persisted on the task for an additional 4 min without making a prediction.

Results and Discussion

In the prediction condition people initially generated 13.64 uses (SD = 5.77) and in the no prediction condition people initially generated 13.65 uses (SD = 8.98). Replicating the persistence undervaluation effect found in Study 2, a paired samples t test on those in the prediction condition found that predicted performance while persisting (M = 5.58, SD = 3.76) was significantly lower than actual performance while persisting (M = 8.70, SD = 4.56), $t(53) = -5.65$, $p < .001$, d = .78, 95% CI [−4.23, −2.01].

Importantly, actual performance while persisting did not differ between the prediction and no prediction (M = 8.65, SD = 5.24) conditions, $t(99)$ = .05, p = .957, d = .01, 95% CI [−1.88, 1.99]. This study failed to support an alternative explanation based on goal setting. In Study 5, we address domain knowledge as a possible boundary condition.

Study 5: Domain Knowledge and Experience

Domain knowledge, or knowledge relevant to the domain in which the creative task occurs, and experience are known to influence creative performance (Amabile, 1996). Because we did not assess either factor in our prior studies, one could question whether persistence undervaluation generalizes to people with prior knowledge or experience in the creative domain. It is possible that persistence undervaluation occurs only when participants lack relevant task knowledge or experience. In Study 5, we addressed this issue by recruiting professional comedy performers from SketchFest, the largest sketch comedy festival in the United States, and asking them to complete a creative task relevant to comedy writing. We tested whether persistence undervaluation would extend to these performers who have extensive task knowledge and experience.

Method

Participants and recruitment. SketchFest is a 10-day comedy festival that hosts sketch comedy groups from around the United States. Groups must apply and be selected into the event. In collaboration with our contact at the organization, we sent a recruitment letter to each of the 131 groups that performed in SketchFest 2015; groups ranged in size from two to dozens of people. Recruitment letters were sent via email or Facebook message. The letters contained a link to our survey and participants who completed the survey were compensated with a $5 gift card. We kept the survey link active until we stopped receiving responses (21 days). We received completed surveys from 45 participants (M_{age} = 27.58, SD_{age} = 5.70; 14 women). Forty-three participants (96%) self-identified as professional or aspiring professional comedians, 11 (24%) as amateur comedians, and five (11%) as hobbyists (participants could check multiple categories). On average, participants reported 4.26 years of training (SD = 3.96, median = 3, range = 0–24) and 6.97 years of experience (SD = 4.71, median = 7, range = 1–25).

Creative task. Sketch comedy is a form of comedic performance in which a group of comedic actors perform a series of short comedy scenes. In order to ensure that the task in our survey was relevant to sketch comedy, we designed the task in collaboration with two comedians affiliated with SketchFest. In our task, participants were given the "set-up" of a comedic scene and were asked to generate endings for the scene.[5] Endings could range in length from a few words to a few sentences and could involve stage directions, but were not required to. Here is an example of a scene set-up: "Four people are laughing hysterically on stage. Two of them high five and everyone stops laughing immediately and someone says ____." Examples of endings participants generated are "In this country high fives mean 'orgy,' (all say) RUN!" and ". . . and that is how the Glue brothers became joined at the palm." Participants were asked to think of as many endings as they could. To

[5] Among comedians, this exercise is called a "blackout" and it is taught in many introductory courses in professional comedy schools. The exercise is meant to develop improvisation and creative writing skills. Sketch comedy writers consider these types of improvisation exercises important for the early stages of sketch writing.

incentivize performance, each ending participants generated earned them a raffle ticket into a lottery for a \$50 gift card.

Procedure. This survey followed the same procedure as our previous online surveys. Participants worked on the task for 4 min, predicted how many endings they would generate during an additional 4 min, and then persisted for 4 min.

Results and Discussion

Participants initially generated an average of 6.38 (SD = 3.80) responses. A paired samples t test found that participants' predicted performance while persisting (M = 5.33, SD = 3.07) was significantly lower than their actual performance while persisting (M = 6.07, SD = 3.21), $t(44) = -2.11$, p = .040, d = .32, 95% CI [−1.43, −0.03]. As in Study 3, we calculated a percentage of underestimation score and found that percentage of underestimation was not predicted by participants' years of training, $b = -.02$, SE = .02, $t(43) = -.68$, p = .503, or experience, b = .02, SE = .02, $t(43)$ = .98, p = .331.

This study found that people with extensive task knowledge and experience in a creative domain also underestimate the value of persistence. This speaks to the robustness of persistence undervaluation and demonstrates that it is not limited to novices in novel domains. In our final study we test a consequence of undervaluing persistence. Specifically, we look at whether people underinvest in an opportunity to persist.

Study 6: Investing in Persistence

The decision to persist is an investment that incurs the opportunity cost of not being able to allocate one's resources elsewhere. In Study 6, we simulated this investment decision by giving participants the choice of whether to invest in additional time to persist on an incentivized creative task. We predicted that those who chose not to invest in persistence would earn less money than those who chose to invest and those in a control condition. We also predicted that fluency would predict participants' decisions to persist.

Method

Participants. One hundred participants (M_{age} = 33.42, SD = 10.96; 46 women) were recruited from Mturk and compensated \$0.51. Nine participants failed the attention check and were excluded, leaving 91 for analysis.

Procedure. Participants received the survey through an online portal provided by Mturk. Participants were first introduced to the creative problem-solving task. In this task participants imagined that they work for a cancer-related charity organization whose task was to think of ways to increase charitable donations from members of the local community. Participants were instructed to generate as many solutions as they could but that the solutions could not be impossible to implement. Further, participants learned that they would receive a 2-cent bonus for each solution they generated and were instructed to make as much money as they could. Examples of solutions participants generated were *organize a charity sports league, develop an iPhone app,* and *sponsor a casino night*.

In the first stage of the survey participants generated solutions for 4 min. Then they reported the disfluency they experienced while working on the task using the same questions as in Study 3 (α = .92). In the second stage of the survey participants were presented with the decision of whether to invest in an additional 4 min to work on the task. Participants who chose to invest in persistence ("investors") continued generating ideas for 4 min and those who did not ("noninvestors") worked for 4 min on an unrelated, nonincentivized, task.

Study conditions. We included two investment conditions. To inform participants' investment decisions they learned that in a previous survey another group of participants generated an average of five solutions while persisting, which amounts to a 10-cent bonus. In the *high-cost* investment condition, investing cost 6-cents (60% of the average expected return) and in the *low-cost* investment condition investing cost 1-cent (10% of the average expected return). Thus, in both conditions participants could expect to make a profit if they performed on par with previous participants.

Decision to persist. The decision to persist was measured on a binomial response scale (0 = *switch tasks*; 1 = *persist*).

Results and Discussion

As expected, more participants persisted in the low-investment condition (32 of 46, 70%) compared with the high-investment condition (17 of 45, 38%), χ^2 = 9.25, p = .002, suggesting that investment cost was a salient decision factor.

Our main analysis compared the total earnings of noninvestors (coded as 1) and investors (coded as 2). The total earnings of noninvestors equaled their total bonus amount from the initial period. For investors, total earnings equaled their total bonus amount from the initial and persistence periods minus the investment fee (i.e., 1 or 6 cents). For this analysis we collected a *control* condition[6] (N = 49) in which participants persisted without the option to switch tasks (coded as 3). This provided a performance comparison group free from self-selection effects. A one-way ANOVA found that total earnings significantly differed by condition, $F(2, 137) = 20.19$, $p < .001$, η^2 = .23 (see Figure 2). As predicted, noninvestors (M = 17 cents, SD = 6.94) earned significantly less than investors (M = 37 cents, SD = 18.89), $t(62.24)$ = 6.91, $p < .001$, d = 1.45, and significantly less than controls (M = 30 cents, SD = 16.19), $t(66.86)$ = 5.32, $p < .001$, d = 1.12. Investors and the controls did not significantly differ, $t(93.80)$ = 1.83, p = .070, d = .38. Although self-selection effects might have predicted that investors would outperform noninvestors, the fact that noninvestors significantly underperformed the control group suggests that noninvestors would have done better by investing. Thus, 30% and 62% of participants in the low- and high-cost investment conditions, respectively, may have underinvested in persistence.

Next we tested whether disfluency predicted the decision to persist. We tested two models with binomial logistic regression (see Table 3). In the first model disfluency was a significant negative predictor of the decision to persist, β = .65, $\chi^2(1)$ = 6.86,

[6] For this condition, 52 participants (M_{age} = 35.00, SD = 10.38; 36 women) were recruited from Mturk. Three failed the attention check, leaving 49 for analysis. The two samples did not differ by age (p = .392). They did significantly differ by gender (p = .006). Controlling for gender did not change the statistical conclusions of any analyses in this study.

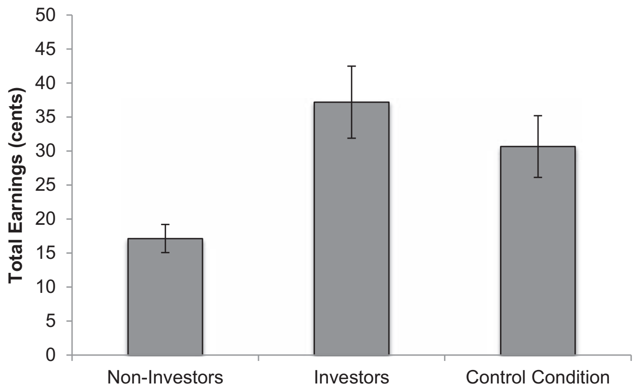

Figure 2. Total earnings (± 95% confidence interval) as a function of whether participants switched tasks, chose to persist, or were instructed to persist in the no-decision control condition in Study 6.

$p = .009$. In the second model, disfluency remained a significant negative predictor, $\beta = .66$, $\chi^2(1) = 4.77$, $p = .029$, when including initial performance, $\beta = .90$, $\chi^2(1) = 3.49$, $p = .062$, and investment condition, $\beta = 1.39$, $\chi^2(1) = 10.65$, $p = .001$.

Study 6 looked at participants' willingness to invest in an opportunity to persist. The fact that noninvestors underperformed investors and the control group that was instructed to persist, suggests that noninvestors, 46% of participants, underinvested in persistence. Additionally, participants' decisions were predicted by the disfluency of the initial work period. Strikingly, this analysis found that people's investment decisions were driven more by their subjective feelings of disfluency at the time of the decision than by past performance, a more objective indicator.

General Discussion

The current research found evidence that people underestimate the value of persistence for their own creative performance and that disfluency experienced during initial creative work accounts for this effect. We found persistence undervaluation in samples that ranged from students, to adults, to professional comedians, and across a variety of creative idea generation (Studies 1, 2A, 2B, 4, and 5) and creative problem solving (Studies 2A and 3) tasks. We theorized that the disfluent nature of creative thought downward biases people's performance expectations on creative tasks, and this misperception, in turn, leads them to underestimate the value of persisting on that task. Consistent with this theorizing the disfluency of creative thought predicted persistence undervaluation (Study 3) and it predicted the decision to turn down a profitable opportunity to persist (Study 6). Additionally, persistence undervaluation was significantly attenuated in less creative tasks (Studies 2A–3).

Across our studies, we addressed two alternative explanations and considered a boundary condition. The first alternative explanation is that idea quality diminishes over the course of idea generation, which would reduce the value of persisting. Contrary to this account, Studies 1–2B found that ideas generated while persisting were of higher quality than ideas generated initially. Furthermore, the notion that ideas get better over time amplifies the value of persisting on creative tasks. Another alternative explanation is that performance predictions serve as performance goals that motivate higher performance, which would artificially create an underestimation effect. Inconsistent with this explanation, Study 4 found no performance differences between a group who made performance goal predictions and a group that did not. Finally, we tested whether domain knowledge and experience would serve as a boundary condition of our effect. Study 5 found significant persistence undervaluation among professional comedic performers, suggesting that the effect is generalizable to people with significant domain knowledge and experience. Our studies are the first to demonstrate that people's predictions about the value of persisting on creative tasks are miscalibrated.[7] We found that people systematically underestimated their own creative ability and underinvested in an opportunity to persist.

These studies make theoretical contributions to the creativity and decision-making literatures. First, we demonstrate that people's valuations of persistence in creative tasks are significantly influenced by the fluency experienced at the time of judgment. Most theories of creativity treat motivation as a relatively static predictor of creativity (e.g., Amabile, 1985). Our studies demonstrate how key elements of creative performance, for example, willingness to persist, can interact with basic psychological processes over time to impact performance. Second, we contribute to the creativity literature by investigating beliefs about persistence and creativity and whether those beliefs are accurate. Our finding that people underestimate the value of persisting on creative tasks complements past research which finds that people tend to associate creativity more with cognitive flexibility rather than persistence and perseverance (Baas et al., 2015; De Dreu et al., 2008). Our studies also contribute to the judgment and decision-making literature by demonstrating the impact of fluency on judgments about the value of persistence. Although previous research has looked at the impact of fluency on perceptions of how much effort a task requires (Alter et al., 2007; Song & Schwarz, 2008), our studies demonstrate how fluency influences predictions about the performance value of persisting.

We see a number of directions for future research. One question is whether persistence undervaluation is influenced by mood states. The dual pathway to creativity model proposes that people generate ideas with a flexible cognitive processing strategy when they experience positive-activating moods (e.g., joy) and with a persistent processing strategy when they experience negative-activating moods (e.g., anger). One hypothesis is that people experiencing negative-activating moods might be less likely to

[7] We theorize that disfluency produces persistence undervaluation because of its influence on *predictions* about creative performance. However, it is also possible that the effect is somehow produced by disfluency's influence on the creative process itself. To support our theorizing we conducted an additional analysis to test whether disfluency more strongly influenced *predictions* about performance or *actual* performance. The analysis included all creative task data that contained the relevant correlations. We found that the correlation between disfluency and predicted performance while persisting, $r(75) = -.54$, $p < .001$ (Study 3), was significantly stronger than the correlation between disfluency and actual performance while persisting, $r(180) = -.24$, $p = .001$ (Study 3 and Study 6's investor and control participants), $Z = 2.57$, $p = .01$, 95% CI [0.07, 0.50]. This suggests that persistence undervaluation is more strongly produced by disfluency's influence on performance predictions rather than actual performance.

Table 3
Predictors of the Decision to Persist in Study 6

Predictor	Model 1				Model 2			
	β	*b*	*SE*	χ^2	β	*b*	*SE*	χ^2
Disfluency	0.65	−0.43	0.16	**6.86****	0.66	−0.41	0.19	**4.77***
Initial performance					0.90	0.11	0.06	3.49
Investment condition					1.39	−0.33	0.10	**10.65****

Note. Values in boldface indicate statistically significant.
* $p < .05$. ** $p < .01$.

undervalue persistence because feelings of disfluency are more consistent with their negative affective state (a "fit" hypothesis). This may result from transient mood states or individual differences that promote a persistent processing strategy, such as prevention focus (Baas et al., 2011), avoidance motivation (Roskes et al., 2012) or working memory capacity (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012). Another important direction for future work is to investigate persistence undervaluation in tasks and projects with longer timescales. Although we found persistence undervaluation to be robust across several different samples and creative tasks, the idea generation tasks in our studies ranged from 4 to 20 min in duration. Future research should investigate tasks or projects that involve longer timescales.

Judgments and Beliefs About Creativity

In a discussion of how people view creativity, Staw (1995) asserted that most people hold misguided beliefs about what truly creative work necessitates. For instance, he anecdotally described how the average person does not appreciate the risk-taking, nonconformity, and persistence involved in truly creative work. We view these speculations as a lucrative starting point for future research. The notion that people could improve their creative performance by simply adjusting their judgments and beliefs about creativity is enticing, particularly given the vast resources that organizations invest in promoting the creativity of their employees. We believe our studies contribute to the study of creativity judgments and beliefs by demonstrating how people's judgments about the value of persisting, a key determinant of creative performance, are miscalibrated. Our studies suggest that people may underestimate their creative potential in everyday creative tasks and that people may leave creative ideas on the table by failing to invest in persistence. A deeper understanding of these judgments and beliefs may help people better navigate the creative process and improve their performance.

Conclusion

Scholars and practitioners have long been interested in factors that improve creative performance, creating long lists of prescribed and proscribed behaviors. Rather than searching for new creative remedies, our results suggest the value of understanding whether people's beliefs about creativity are calibrated. We found that people consistently underestimate the value of persisting on creative tasks and provided evidence that the disfluency of creative thought accounts for this effect. This suggests that adjusting beliefs about the value of persistence may promote creativity by reducing the possibility that people quit too early, leaving their best ideas undiscovered.

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