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Business leaders, governments, and scholars are increasingly recognizing the importance of creativity. Recent trends in technology and education, however, suggest that many people are facing fewer opportunities to engage in creative thought as they increasingly solve well-defined (vs. ill-defined) problems. Using three studies that involve real problem-solving activities (e.g., putting together a LEGO kit), the authors examine the mindset created by addressing such well-defined problems. The studies demonstrate the negative downstream impact of such a mindset on both creative task performance and tendency to choose to engage in creative tasks. The research has theoretical implications for the creativity and mindset literature streams as well as substantive insights for managers and public policy makers.

*Keywords*: creativity, mindsets, problem solving, divergent thinking

*Online Supplement*: http://dx.doi.org/10.1509/jmr.13.0499

# The Downstream Consequences of Problem-Solving Mindsets: How Playing with LEGO Influences Creativity

Business leaders, governments, and scholars are increasingly recognizing the importance of creativity. In a recent poll of 1,500 chief executive officers, creativity was rated as the most important leadership quality needed by their institutions through 2015, trumping even integrity and global thinking (Carr 2010). Creative leaders, according to the IBM Global CEO survey (see http://www-935.ibm.com/services/us/ceo/ceostudy2010/), are those who embrace ambiguity and are committed to experimentation. Recent trends in technology and education, however, suggest that the opportunities to engage in this type of exploratory thinking may be declining for a number of people. Google provides immediate answers, teachers "teach to the test," and overscheduled lives leave fewer opportunities to discover or pursue new interests. Essentially, many of the problems we face on a daily basis are becoming increasingly more structured and well defined. Nowhere is this shift more evident than in the toy aisle. Boxes of loose LEGO bricks and pieces—a former staple of childhood—have been crowded out on store shelves by the company's themed kits. Rather than challenging consumers to solve an ill-defined problem (e.g., "Build something"), the kits present them with a well-defined problem along with the means to solve it (e.g., "Build this Imperial Palace using this set of bricks and pieces while following the sequence specified in these step-by-step instructions"). The double-digit growth in LEGO's revenues indicates that consumers have a strong desire to solve these types of well-structured problems (Hansegard and Burkitt 2013).

When consumers solve these well-structured problems, are there downstream implications for their creative performance on subsequent tasks? Our research addresses this question using three studies that examine the mindset created by solving well-defined (vs. ill-defined) problems. We demonstrate the downstream influence of problem-solving mindsets on consumers' creative performance as well as on their tendency to choose to engage in creative tasks.

Although consumer researchers have highlighted the influence of different mindsets on consumers' product

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ISSN: 0022-2437 (print)
1547-7193 (electronic)

*Journal of Marketing Research*
Vol. LIII (February 2016), 18–30
DOI: 10.1509/jmr.13.0499

evaluations (Monga and Gürhan-Canli 2012; Ülkümen, Chakravarti, and Morwitz 2010; Xu and Wyer 2012; Yang et al. 2011), decision processes (Levav, Reinholtz, and Lin 2012; Xu, Jiang, and Dhar 2013), and motivations (White, MacDonnell, and Dahl 2011; Wyer and Xu 2010), few studies have considered the influence of a consumer's mindset on creative task performance. Our research does just that by engaging participants in real problem-solving activities (e.g., putting together a LEGO kit) and identifying the negative influence that solving such well-defined problems has on a participant's creativity in a subsequent task. This finding is novel, given that the majority of research examining the determinants of creativity has focused only on the situational factors that enhance it, not on those that undermine it (e.g., Burroughs et al. 2011; Goldenberg, Mazursky, and Solomon 1999; Moreau and Dahl 2005).

Our research also considers the influence of consumers' problem-solving mindsets on whether they choose to engage in a task that requires creative thought. To date, little research in the mindset literature has focused on consumers' choices of subsequent tasks. Rather, the norm is to specify a given task and examine the effects of different mindsets on consumers' evaluation processes, decisions, and/or behaviors. Understanding the conditions under which consumers *choose* to think creatively is important, yet most experimental studies examining creativity simply assign participants to a given task (e.g., "Make a cookie"; Dahl and Moreau 2007).

## *PROBLEM-SOLVING MINDSETS*

Recent research on mindsets has demonstrated that people's behavior or thought processes in one situation can influence their thoughts and behaviors in later, unrelated tasks. These spillover effects are thought to occur because the judgmental criteria, goals, and/or cognitive processes activated in one setting are accessible and, therefore, likely to be recruited for use in later situations (Malkoc, Zauberman, and Bettman 2010; Smith 1994). We argue that the cognitive activities required for problem solving will create a mindset that endures over time and contexts.

What are the cognitive activities that occur during problem solving? Problem solving occurs within the context of a problem space, which is defined as "how a solver represents or structures a given problem" (Newell and Simon 1972; Stokes 2007, p. 108). These problem spaces are composed of three parts: (1) the problem itself (the initial state), along with (2) the set of operators (rules and strategies) that are deployed in sequence to move from the initial state to (3) the goal state (the solution; Stokes 2007, p. 108; see also Leighton and Sternberg 2012, p. 646; Newell and Simon 1972; Simon 1999; Sternberg 2009). The extent to which information is known or provided about these three different aspects of a problem determines how well the problem is structured and, thus, where the problem lies on the continuum from well defined to ill defined (Shin, Jonassen, and McGee 2003).

### *Well-Defined-Problem Solving*

Well-defined problems are characterized by full information in which the solver has access to a clearly specified initial state, a known goal state, and, importantly, a known set of processes that enable a person to progress toward the goal (Finke, Ward, and Smith 1992; Leighton and Sternberg 2012; Newell and Simon 1972; Reitman 1965; Stokes 2007). Well-defined problems tend to have "correct, convergent answers" (Jonassen and Kwon 2001, p. 36). Multiplication problems and jigsaw puzzles, for example, are prototypical of well-defined problems (Finke, Ward, and Smith 1992; Stokes 2007). Both have a clear initial state (i.e., two numbers that need to be multiplied together; a set of puzzle pieces that need to be assembled), a known set of processes or sequence of operations to achieve the goal (i.e., multiply the "ones" digit and carry if needed; identify and connect all the pieces with straight edges), and a predetermined goal state (i.e., the correct answer; a match with the picture on the puzzle box; Finke, Ward, and Smith 1992; Stokes 2007).

Convergent thinking is most effective in solving well-defined problems because it "emphasizes speed, accuracy, [and] logic" in pursuit of "the single best (or correct) answer to a clearly defined question" (Cropley 2006, p. 391). We argue that it is this aspect of convergent thinking—the search for the right solution—that defines the mindset associated with a well-defined problem. In his famous TED talk,[1] creativity expert Sir Ken Robinson argues that "schools kill creativity" by emphasizing performance on problems that have singularly correct answers. Robinson maintains that this focus creates a fear of failure that detracts from our willingness to take risks associated with creative thoughts. Thus, we define a well-defined-problem-solving mindset as one characterized by convergent thought processes deployed to find the correct solution as efficiently as possible (Cropley 2006).

### *Ill-Defined-Problem Solving*

At the other end of the spectrum lie ill-defined problems, which lack all or most of the information required to reach a solution (Simon 1973; Stokes 2007; Voss and Post 1988). Ill-defined problems (e.g., "How can recycling be improved?") have a myriad of potentially satisfactory solutions and means for achieving them (Finke, Ward, and Smith 1992). All three elements in the problem space may be ambiguous. The initial state may be understood or interpreted in several different ways, some of which make the problem easier or harder to resolve (Hélie and Sun 2010; Pols 2002). For example, one could interpret the recycling problem at various levels of magnitude (recycling efforts at our own home, in our city, in the United States, or across the globe) or scope (paper, metal, containers, batteries, electronics, or vehicles). The set of operators needed to move along the path from the initial state to the goal state may also be unclear, and the end goal itself may not be clearly defined. Consequently, divergent thinking is most effective in solving these problems because it involves experimentation to identify and develop multiple ideas, each of which could potentially serve as a solution (Cropley 2006).

To produce these different candidate solutions, people's divergent thinking involves the use of the cognitive processes described by the Geneplore model (Finke, Ward, and Smith 1992; see also Cropley 2006; Hélie and Sun 2010). According to this model, two key cognitive components are involved in the construction of a solution: generative and

[1]The most downloaded TED talk to date: http://www.ted.com/talks/ken_robinson_says_schools_kill_creativity.html.

exploratory processes (Finke, Ward, and Smith 1992). First, people search for preliminary solutions and/or inputs to those preliminary solutions and generate ideas by "making unexpected combinations, recognizing links among remote associates, and transforming information into unexpected forms" (Cropley 2006, p. 391; see also Finke, Ward, and Smith 1992, p. 19; Hélie and Sun 2010). Once those candidate solutions are established, exploratory processes are used to interpret and evaluate the options and to attach meaning to them (Finke, Ward, and Smith 1992; Moreau and Dahl 2005).

Ambiguity is a hallmark of ill-defined problems. The initial state (the problem itself) is open to interpretation, the operators (the cognitive strategies needed to generate the solutions) are not stipulated, and the goal state (the solution) is reached only by developing and applying a set of evaluative criteria to select a candidate solution. Because creativity is considered a "special class of problem solving characterized by novelty, unconventionality, persistence, and difficulty in problem formulation" (Newell, Shaw, and Simon 1962, p. 66), solving an ill-defined problem can be considered an act of creative thinking. We argue that it is the cognitive activities of divergent thinking, exploration, and experimentation that define the mindset associated with an ill-defined problem. Table 1 summarizes the differences between ill-defined and well-defined problem spaces.

## *CONSEQUENCES OF PROBLEM-SOLVING MINDSETS*

Recently activated mindsets are easily accessible and therefore likely to be used in subsequent situations. Whether the activated mindset will be conducive to solving the subsequent problem depends on how appropriate the accessible cognitive strategies are for the subsequent task (e.g., Xu, Jiang, and Dhar 2013). In the case of problem-solving mindsets, subsequent task performance likely depends on where that subsequent task lies on the continuum of well-defined to ill-defined problems, and, importantly, how well it matches the problem-solving mindset activated in the initial task. If a match exists, there may be little effect on subsequent task performance. However, if a mismatch exists, there will likely be a decline in performance on a subsequent task if the solver carries over a set of procedures incompatible with those required for successful task completion. More formally,

$H_{1a}$: A well-defined-problem-solving mindset decreases performance on a subsequent ill-defined (creative) task but has little influence on performance in a subsequent well-defined task.

$H_{1b}$: An ill-defined-problem-solving mindset decreases performance on a subsequent well-defined task but has little influence on performance in a subsequent ill-defined (creative) task.

## *STUDY 1*

To test these hypotheses, we had 136 undergraduate students (57% male) participate in a 3 (problem-solving mindset: well defined vs. ill defined vs. control) × 2 (second task: ill defined vs. well defined) between-participant experiment in exchange for course credit. The experimental sessions lasted for 30 minutes and contained groups of five to ten participants. On entering the lab, participants were randomly assigned to one of the six conditions and sat at individual cubicles with three-foot-high dividers, providing them with a private space in which to complete the study. With the exception of those in the control condition, participants received an initial task designed to instantiate a problem-solving mindset before proceeding to a subsequent unrelated task that was either a well-defined or an ill-defined problem. Performance on this second task was the focal dependent measure.

### *Instantiating Problem-Solving Mindsets*

We gave participants in both the well-defined-problem-solving and ill-defined-problem-solving conditions the cover story that the LEGO company was interested in understanding how adult consumers reacted to their products. In the well-defined condition, participants were given a LEGO kit containing approximately 40 pieces and were asked to build it (see Web Appendix A). Step-by-step instructions described how to achieve the singular solution. In contrast, those in the ill-defined condition were given a bag of approximately 40 LEGO bricks and pieces and asked to "build something." Both groups spent 15 minutes engaged in the activity and then proceeded to the second task, either the Torrance Test of Creative Thinking or the Miller Analogy Task. We told participants in the control condition that the study related to college students' thoughts and opinions, and we asked them only to complete one of the second tasks, without participating in a LEGO activity.

### *Pretests*

We conducted two pretests to examine whether factors other than induced problem-solving mindset could influence performance on the subsequent task. The first pretest examined whether cognitive depletion could serve as a possible alternative explanation for observed results, given that the first tasks could leave participants with differing levels of available cognitive resources for the second tasks (Hamilton et al. 2011). The second pretest focused on additional factors that could potentially explain any observed differences in subsequent task performance: affect, a factor that has been known to influence creative performance (e.g., Isen, Daubman, and Nowicki 1987); tolerance

Table 1

DEFINITIONS OF ILL-DEFINED VERSUS WELL-DEFINED PROBLEM SPACES

| *Part of the Problem Space* | *Ill Defined* | *Well Defined* |
|---|---|---|
| Initial state | Ambiguous and open to interpretation | Clearly specified and unambiguous |
| Set of operators | Unclear and/or unspecified, requiring exploration and experimentation (divergent thinking) | Known and/or specified, emphasizing speed and accuracy (convergent thinking) |
| Goal state | Achieved by evaluating and selecting a solution from the generated candidates (no clear stopping point) | Achieved by reaching a correct answer (a clear stopping point) |

for ambiguity, a key individual difference variable that has been correlated with creativity (Tegano 1990); and sense of accomplishment and completion, feelings that have been shown to result from engaging in self-design tasks (e.g., Franke, Schreier, and Kaiser 2010).

*Pretest 1: cognitive depletion.* In exchange for course credit, 76 undergraduates participated in Pretest 1 and were randomly assigned to one of three initial task conditions: (1) the well-defined-problem-solving condition (LEGO kit), (2) the ill-defined-problem-solving condition (LEGO bricks), or (3) the control condition (no initial task). Following the initial task, participants solved a set of anagrams (Web Appendix B). Participants in the control condition simply began with the anagram task. The number of anagrams successfully completed served as the measure of task performance. We chose this type of depletion task because it tests for "a decrement in task performance" rather than persistence, thereby serving as a better indicator of depletion as a possible account for our performance results (Baumeister et al. 1998, p. 1258).

A one-way analysis of variance (ANOVA) was used to assess the influence of the initial task on participants' subsequent performance on the anagram task (M = 6.57, range: 1–15). The results revealed no significant influence of condition on anagram performance ($F(2, 73) = 1.66$, $p = .20$). On average, participants in the well-defined condition solved 7.39 anagrams, those in the ill-defined condition solved 6.11, and those in the control condition solved 6.10. None of the contrasts was significant.

*Pretest 2: affect, tolerance for ambiguity, accomplishment.* In Pretest 2, 148 undergraduates were randomly assigned to one of the three initial task conditions described in Pretest 1. Following the initial task, participants responded to measurement items assessing affect and tolerance for ambiguity. Participants in the control condition simply started with these items, and we counterbalanced the order in which these items were presented to each participant. Because no significant differences in order emerged, we collapsed across the counterbalanced conditions in the analyses. Affect was measured using six items, three positive and three negative. On nine-point scales (anchored by 1 = "not at all" and 9 = "very"), participants reported the extent to which they felt happy, excited, enthusiastic, frustrated, stressed, and nervous. In an exploratory factor analysis, the items loaded on the two expected factors. Thus, we created two affect indices by averaging the three positive items and the three negative items to form a positive and a negative affect measure ($\alpha = .89$ and .74, respectively). To assess the influence of the first task on participants' positive and negative affects ($M_{positive} = 5.62$, range: 2–9; $M_{negative} = 2.81$, range: 1–8.33), we used a one-way ANOVA, which revealed no significant influence of condition on affect (positive: $F(2, 145) = 1.27$, $p = .28$; negative: $F(2, 145) = .01$, $p = .99$; for the full set of results, see Table 2).

We measured tolerance for ambiguity using three items selected, based on relevance, from the Budner scale (1962), which is the most frequently used scale to measure the construct. On five-point scales, participants indicated the extent to which they agreed with the following statements: "I prefer jobs where the task to be accomplished is clear," "I get frustrated when people ask me to do tasks that are poorly defined," and "I feel that teachers or supervisors who give vague assignments provide a chance to show initiative." The first two items were reverse-coded, and the measures of the three were averaged to create an indicator of tolerance for ambiguity (M = 2.37, range: 1–4.33). A one-way ANOVA revealed a marginally significant influence of condition on tolerance for ambiguity ($F(2, 145) = 2.63$, $p = .08$), with participants in the control condition reporting a higher tolerance (2.60) than those in either the well-defined-problem-solving (2.31) or ill-defined-problem-solving (2.29) conditions. Recall that the control condition differed from the two problem-solving conditions in that the control participants answered these questions shortly after entering the lab, not after completing an initial task. It is possible that simply being under the experimenter's instruction for a period of time marginally reduced participants' ambiguity tolerance. Importantly, the well-defined and ill-defined conditions did not differ significantly from each other.

We measured participants' sense of accomplishment using nine-point scales on which they indicated their agreement with the following statements: "I felt like I had accomplished a lot when I completed the task," "I felt a strong sense of completion when I had finished the task," and "I was proud of what I made out of the LEGOs." We averaged the three items to form an index of accomplishment (M = 5.37, range: 1–9; $\alpha = .87$). Participants in the control condition did not respond to these items. A one-way ANOVA revealed no significant influence of condition on participants' sense of accomplishment ($M_{well\ defined} = 5.59$ vs. $M_{ill\ defined} = 5.15$; $F(1, 114) = 1.41$, $p = .24$).

### *Second Tasks*

*Ill-defined (creative) task.* As we have argued, solving an ill-defined problem can be considered an act of creative thinking because people often use divergent thinking "to create, invent, discover, imagine, suppose, or hypothesize" (Sternberg 2006, p. 325). A common test to assess creative ability is the Torrance Test of Creative Thinking, a measure

Table 2

STUDY 1: PRETEST RESULTS

| *Initial Task* | *Cognitive Depletion: Number of Correct Anagrams* | *Negative Affect (1–9 Scale)* | *Positive Affect (1–9 Scale)* | *Tolerance for Ambiguity (1–5 Scale)* | *Sense of Accomplishment (1–9 Scale)* |
|---|---|---|---|---|---|
| Well defined | 7.39 (2.88) | 2.80 (1.74) | 5.69 (1.51) | 2.31 (.62) | 5.59 (1.69) |
| Ill defined | 6.11 (3.19) | 2.81 (1.38) | 5.73 (1.40) | 2.29 (.56) | 5.15 (2.14) |
| Control | 6.10 (2.77) | 2.84 (1.59) | 5.24 (1.41) | 2.60 (.77) | N.A. |

Notes: Values are means, with standard deviations in parentheses. N.A. = not applicable.

that has been used to identify a downward trend in creativity among U.S. schoolchildren (Torrance 1974). The Torrance test has been taken worldwide by millions of people and consists of a set of discrete tasks that involve divergent thinking (Bronson and Merryman 2010; Cramond et al. 2005). The tasks on the Torrance test are designed to identify general mental abilities that are both involved in and predictive of creative achievements (Cramond et al. 2005; Kim 2006; Runco et al. 2010; Torrance 1974). Scoring the test requires judges to assess responses on the basis of their originality, fluency, and elaboration (Runco et al. 2010). The predictive validity of the test has been verified by longitudinal studies that assess creative achievement (Cramond et al. 2005; Kim 2006).

In this study, we used two of the "incomplete figures" activities from the Torrance test for the creative (i.e., ill-defined) task and presented them on two separate pages. Participants received the following instructions: "In the space below (and on the next page), you will see two incomplete figures. Your task is to complete each of these figures by adding lines, curves, and any other details you'd like. Give your picture a title. You will have 4 minutes to complete each figure" (see Web Appendix C). The experimenter timed the two tasks. Importantly, participants were not explicitly told to be creative in their drawings.

This task conforms with the definition of an ill-defined problem in that (1) the initial state is somewhat ambiguous, given that it may be interpreted in a number of different ways, (2) the set of operators that will move the problem solver from the initial state to the goal state is not established, and (3) the goal state does not involve a "single, correct, predetermined" solution (Stokes 2007, p. 108). Rather, there are an infinite number of solutions and a notable absence of a criterion for knowing when (or whether) the goal has been met (Stokes 2007).

*Well-defined task.* In this study, we chose the Miller Analogy Test as the well-defined task. This test has been used in making admissions decisions by educational institutions and hiring or promotion decisions for high-level jobs in industry (Kuncel et al. 2004). We gave participants in this condition 25 analogy questions (see Web Appendix D), along with the following instructions: "This is a study on college students' reasoning by analogy. You'll be given 8 minutes to answer as many of the following as you can." The experimenter timed this task as well.

This task conforms much more closely than the creative task to the definition of a well-defined problem in that the initial state is quite clear and the goal state involves a single, correct solution. However, it is not as well defined in terms of the operations required to achieve the goal state. In fact, analogical thinking has been identified as cognitive process underlying creative thought (e.g., Dahl and Moreau 2002). Thus, although this task is much closer to the well-defined end of the problem-solving continuum than the tasks drawn from the Torrance test, it does contain some ambiguity in the processes needed to achieve the goal state.

### *Dependent Measures*

*Performance on ill-defined (creative) task.* To assess performance on the creative task, we followed the guidelines established by Torrance (2003). The Torrance test items are designed to reflect different indicators of creative potential (Runco et al. 2010; Torrance 2003), and the relevant dimensions for the "incomplete figures" component of the test are (1) originality (the rarity/uniqueness of the drawing), (2) the abstractness of the title, and (3) elaboration (the amount of detail in the drawing; see Runco et al. 2010; Torrance 2003).

Six sets of eight judges rated the drawings, with each judge rating only one of the three dimensions (originality, elaboration, and abstractness) for one of the two incomplete figures. The judges had completed a semester-long course on creativity and therefore had prior knowledge and experience related to the Torrance test. Judges rated each drawing on a five-point scale (with 5 indicating the highest level of the rated dimension), and their interjudge reliabilities were high (all $\alpha$s > .81). To form the dependent measures, we first averaged the ratings on each dimension across judges for each of the two incomplete figures, yielding six average scores per participant (three per drawing). We then averaged across the two replicates. Because Torrance intended the dimensions to be relatively independent indicators of creativity, we used each of the three dimensions as a dependent variable (Torrance 2003).[2] However, we also converted each of the measures of originality, elaboration, and abstractness to a z-score and added them together for an overall creativity score, following the procedure described in Runco et al. (2010; M = .10, range: −4.65 to 4.59).

*Performance on well-defined task.* Assessing participants' performance on the analytical test was more straightforward. We used two performance measures: (1) the number of correct responses (M = 17.1, range: 8–24), and (2) the percentage of correct responses out of the number attempted (because not all participants completed the test within the allotted time frame; M = 73%, range: 32% −100%).

### *Results*

*Performance on ill-defined (creative) task.* A one-way ANOVA revealed the main effect predicted by $H_{1a}$ ($F(2, 55) = 5.38$, $p < .01$). Participants in the well-defined condition received a lower creativity score (M = −.91) than either those in the the ill-defined condition (M = .87; $F(1, 55) = 9.87$, $p < .01$) or those in the control condition (M = .44; $F(1, 55) = 6.03$, $p < .05$). When we analyzed the separate dimensions of creativity (originality, elaboration, and abstractness of the title) independently, the results indicated that originality and abstractness were the main contributors to the overall effect. The main effect of the problem-solving mindset on each of these dimensions was significant (originality: $F(2, 55) = 7.2$, $p < .01$; abstractness: $F(2, 57) = 3.2$, $p = .05$), although the main effect of the problem-solving mindset on elaboration was not ($F(2, 55) = 1.4$, $p > .10$). Consistent with the pattern found for overall creativity, participants in the well-defined condition scored lower on both originality and abstractness than either their counterparts in the ill-defined condition ($M_{\text{originality, well defined}} = 2.4$ vs. $M_{\text{originality, ill defined}} = 3.2$; $F(1, 55) = 11.63$, $p < .01$; $M_{\text{abstractness, well defined}} = 1.7$ vs. $M_{\text{abstractness, ill-defined}} = 2.3$; $F(1, 55) = 6.15$, $p < .05$) or those in the control condition

[2]The correlations among the constructs were .34 (originality/elaboration), .33 (originality/abstractness), and .56 (elaboration/abstractness).

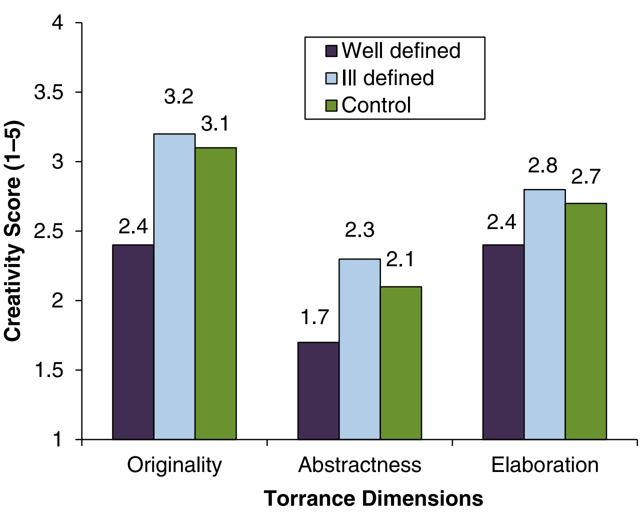
($M_{originality}$ = 3.1; F(1, 55) = 10.18, $p < .01$; $M_{abstractness}$ = 2.1; F(1, 55) = 2.77, $p$ = .10). A similar pattern emerged for the elaboration dimension, but it did not approach significance ($M_{well\ defined}$ = 2.4 vs. $M_{ill\ defined}$ = 2.8 vs. $M_{control}$ = 2.7; see Figure 1).

*Performance on well-defined task.* We used one-way ANOVAs to test $H_{1b}$, which predicted that an ill-defined-problem-solving mindset would impair performance on a well-defined task. However, neither the model predicting the total number of correct answers nor the one predicting the percentage correct revealed a significant effect of condition on performance in the analogy task (total correct: F(2, 75) = 1.20, n.s.; percentage correct: F(2, 75) = .09, n.s.). Participants in the ill-defined condition answered an average of 17.2 analogies (74.1%), a performance that was not significantly different from either the 16.1 correct analogies (72.2%) answered by those in the well-defined condition or the 17.6 correct (73.8%) in the control condition. Thus, $H_{1b}$ is not supported. In hindsight, this result is not completely surprising, given that for the second tasks, the well-defined task did not fully conform to all three criteria that define such a task. Although the initial state and the goal state were well defined in the analogy task, the process required to get from the initial state to the goal state was not stipulated. Because analogical thinking has been shown to underlie creative thought (e.g., Dahl and Moreau 2002), the mismatch between the analogy task and the loose LEGO task was likely lower than the mismatch between the Torrance task and the LEGO kit task.

*Discussion*

This study demonstrates that a well-defined-problem-solving mindset can carry over to diminish performance on a subsequent ill-defined, creative task. Participants who had put together a LEGO kit scored significantly lower on items from the Torrance Test of Creative Thinking than either those who had built free-form creations with the LEGO bricks or those who had not participated in a LEGO activity. Results from the two pretests indicate that differences in cognitive depletion, affect, tolerance for ambiguity, and sense of accomplishment are all unlikely to explain the observed effects. Notably, the problem-solving mindset exerted its most significant influence on the dimensions of originality and title abstractness. Both of these dimensions result from novel patterns of thinking, whereas elaboration reflects greater persistence (Almeida et al. 2008; Kim 2006; Torrance 1974). Thus, the effect of the problem-solving mindset on creative performance appears to be more directly related to the carryover of cognitive processes rather than motivation. We test this explanation more directly in Study 2.

Figure 1
STUDY 1: THE INFLUENCE OF PROBLEM-SOLVING MINDSETS ON TORRANCE TEST PERFORMANCE




As we better specify the processes underlying a problem-solving mindset, it is also crucial to identify which elements of problem structure are most influential on subsequent task performance. Given that the problem space contains three parts (the initial state, the set of operators, and the goal state), one or more of these factors may differentially contribute to the mindset and its carryover effects. In Study 1, both the goal state and the set of operators were fixed for those solving the LEGO kit problem, whereas neither was fixed for those given the bag of loose LEGO bricks. Thus, it is unclear whether the presence of a single correct answer (a clearly specified goal state) or a set of step-by-step instructions (a known set of operators) was responsible for the observed decline in creative task performance among those who solved the LEGO kit problem. In Study 2, we manipulate these two factors independently to observe their distinct effects.

A known set of operators can help facilitate the speed and accuracy with which a person moves toward a goal. However, if the goal state itself is unknown, there is ambiguity concerning where the person is headed. Conversely, when the goal state is known, but there is no known set of operators to facilitate its achievement, there is ambiguity concerning the process of goal attainment. Thus, ambiguity can enter the problem-solving space in two ways. We propose that it is knowledge of the goal state in a well-defined task, rather than knowledge of the set of operators, that influences the cognitive processes associated with a problem-solving mindset and is, therefore, responsible for the decline in performance in a subsequent creative task.

The rationale for this proposition is that goals focus attention, and in the process, objects that are unrelated to the goal are devalued (Brendl, Markman, and Messner 2003). This finding suggests that the presence of a clear goal state discourages divergent thinking because exploration and experimentation (i.e., attention focused on unrelated objects) are detrimental to efficient goal attainment. However, the knowledge of a known set of operators (in the absence of a known goal state) is less likely to diminish divergent thinking because the singular solution emerges only at the end of the process. Until that point, any number of solutions could emerge, and curiosity about the goal state likely facilitates mental exploration as one considers a number of different possible outcomes. Thus,

$H_{2a}$: The presence of a known goal state (i.e., a target outcome) in the initial task diminishes creative performance in a subsequent task.

$H_{2b}$: In the absence of a known goal state, the presence of a known set of operators (i.e., instructions) has little influence on subsequent creative performance.

## *STUDY 2*

### *Design and Procedure*

To test $H_2$, we had 137 undergraduate students participate in a 2 (instructions: present vs. absent) × 2 (outcome: present vs. absent) between-participants experiment. The experimental sessions lasted for 30 minutes and contained groups of 10–15 participants. When the participants entered the lab, we informed them that they would be engaging in two different activities. As a cover story, we told all participants that the first study examined "how current college students respond to experiences that they had when they were younger" and that they would be engaging with LEGO toys. We then told participants that they would be given a bag of LEGO pieces and would be asked to make something out of them (the initial state).

*Instructions.* We manipulated the instructions construct by either providing participants with the step-by-step instructions that came with the LEGO kit or withholding them.

*Outcome.* Participants were either given a picture of the outcome (i.e., the completed structure) shown on the LEGO box or were not. Providing a picture of the outcome made the initial state more clearly specified.

### *Dependent Measures*

To separate the independent effects of motivation and divergent thinking, we used Guilford's Unusual Uses Test, which asks participants to generate as many uses as possible for a common household object (Guilford, Merrifield, and Wilson 1958). This measure of creativity is particularly useful because task performance is assessed based on both fluency (the number of uses generated) and originality (the novelty of the uses). The determinants of these two outcomes, however, are likely to be different. Fluency is "an excellent measure of the motivation to be creative" because it reflects the effort participants devote to generating a set of alternative uses (Fitzsimons, Chartrand, and Fitzsimons 2008, p. 25). The originality of the uses, however, is more indicative of participants' divergent thinking (Finke, Ward, and Smith 1992).

In this study, all participants received the same second task—they were asked to generate as many uses for a paper clip as possible. We assessed fluency and originality using the scoring procedures outlined by Guilford (1967). We measured fluency by counting the number of uses generated by each person (M = 5.79, range: 2–17). One participant generated 22 uses, a count that was approximately six standard deviations above the mean ($\sigma = 2.71$) and a significant outlier relative to the overall distribution. We removed this response from subsequent analyses. We measured originality by comparing each response to the frequency of its occurrence across participants. Specifically, a use that was mentioned by only 5% of the group was deemed "unusual" and received a single point, and a use mentioned by only 1% of the group was considered "unique" and received two points. Uses generated by more than 5% of respondents received zero points (Guilford 1967). We created each participant's originality score by adding the points earned from each of the uses generated. Two judges independently computed these originality scores, and their correlation was high (r = .91). For the few cases in which the scores diverged, a third judge recomputed the scoring, and the score agreed on by two of the three judges was used in the analysis (M = 1.41, range: 0–10).

*Control measure.* The independent factors manipulated in this study were similar to those in a study by Dahl and Moreau (2007), who found that participants enjoyed a cookie-making task to a greater extent when either a goal state (a target cookie) or a set of operators (step-by-step instructions) was present. Thus, we measured process enjoyment in this study to understand and to control for its potential influence on subsequent task performance. Following Dahl and Moreau (2007), we asked participants to indicate how much they enjoyed the LEGO task and the extent to which they had a good time during the process, were satisfied with it, and were frustrated by it (reverse-coded). We averaged the four items to create an index of enjoyment (M = 6.81, range: 1–9; $\alpha = .86$).

### *Results*

*Creative task performance.* We used two 2 (instructions: present vs. absent) × 2 (outcome: present vs. absent) ANOVAs to assess the effects of the independent factors on each of the two creative performance measures, originality and fluency. For originality, a significant main effect of only outcome emerged ($F(1, 132) = 5.57$, $p < .05$). Consistent with $H_{2a}$, participants who received a picture of the outcome in the first task produced less-original uses for the paper clip compared with those who did not receive a target outcome in the first task ($M_{outcome} = 1.26$ vs. $M_{no\ outcome} = 2.06$). Consistent with $H_{2b}$, the presence of instructions in the first task had no significant influence on the originality of the uses produced ($F(1, 132) = .19$, n.s.). For fluency, no significant effects emerged (for a full reporting of the results, see Table 3).

*Control measure.* A 2 (instructions: present vs. absent) × 2 (outcome: present vs. absent) ANOVA with task enjoyment as the dependent measure revealed significant main effects of both instruction and outcome. Participants given step-by-step instructions enjoyed the process more than those who did not receive instructions ($M_{instructions} = 7.38$ vs. $M_{no\ instructions} = 6.26$; $F(1, 132) = 18.44$, $p < .01$). However, those who received a picture of the outcome enjoyed the process less than those who did not ($M_{outcome} = 6.42$ vs. $M_{no\ outcome} = 7.22$; F(1, 132 = 9.19, $p < .01$). These main effects were qualified by an interaction ($F(1, 132) = 8.52$, $p < .01$) that demonstrated that a lack of step-by-step instructions was more detrimental to enjoyment when a target outcome was provided ($M_{instructions,\ target\ outcome} = 7.37$ vs. $M_{no\ instructions,\ target\ outcome} = 5.48$; $F(1, 132) = 17.70$, $p < .01$) than when it was not ($M_{instructions,\ no\ target\ outcome} = 7.40$ vs. $M_{no\ instructions,\ no\ target\ outcome} = 7.04$; $F(1, 132) = .95$, n.s.). Despite the significance of these findings, a 2 (instructions: present vs. absent) × 2 (outcome: present vs. absent) analysis of covariance with originality as the dependent measure and task enjoyment included as a covariate revealed a main effect only of outcome on originality ($F(1, 132) = 3.98$, $p < .05$). Task enjoyment did not significantly predict originality ($F(1, 132) = 1.29$, n.s.).

Table 3

STUDY 2: PERFORMANCE ON A CREATIVE TASK AFTER COMPLETING AN INITIAL TASK WITH OR WITHOUT OUTCOME AND INSTRUCTIONS

| | *Instructions Present* | | | *Instructions Absent* | | |
|---|---|---|---|---|---|---|
| | *Fluency: Number of Uses Generated* | *Originality Score* | *Enjoyment (1–9 Scale)* | *Fluency: Number of Uses Generated* | *Originality Score* | *Enjoyment (1–9 Scale)* |
| Outcome present | 5.59 (1.96) | 1.21 (1.27) | 7.37 (1.43) | 5.29 (2.39) | 1.32 (1.79) | 5.48 (2.06) |
| No outcome present | 6.38 (2.86) | 1.97 (2.48) | 7.40 (1.15) | 5.44 (1.96) | 2.15 (2.11) | 7.04 (1.31) |

Notes: For the creative task, participants were asked to generate as many uses for a paper clip as possible. We assessed fluency and originality using the scoring procedures outlined by Guilford (1967). Values are means, with standard deviations in parentheses.

*Discussion*

The results of this study offer additional insights into the process underlying problem-solving mindset carryover effects. First, by using the Unusual Uses Task as a dependent measure, we were able to provide further empirical support for our claim that well-defined problems create a mindset that carries over to impair divergent thinking, rather than motivation. Across the four conditions in the LEGO kit task (received outcome and instructions, received outcome only, received instructions only, received neither outcome nor instructions), there was little difference in the number of uses participants generated for a paper clip in the subsequent task. However, there were significant differences in the originality of those ideas. Specifically, participants who were given a clear goal state in the first task (i.e., a picture of the completed LEGO kit) produced significantly less-original ideas in the second task than those for whom the goal state in the first task was uncertain.

Second, this study helps isolate the part of the problem-solving space responsible for the observed effects. Giving participants instructions (a known set of operators) in the first task did not significantly influence their creative performance on the second task. However, giving them a picture of the outcome (a clear goal state) was detrimental to creativity. Together, these findings support our initial claim that the search for the "right" solution diminishes divergent thinking, thereby reducing creative performance on a subsequent task. A third insight that emerges from these findings is that process enjoyment of the first task, although influenced significantly by our manipulations, had no significant influence on creative performance in the second task. When we control for these affective responses to the first task, the influence of the clear goal state remains significant.

In both Studies 1 and 2, we assigned all of the participants to a second task rather than giving them a choice of tasks to complete. The primary focus of these studies was the effect of the activated problem-solving mindset on subsequent task performance. Essentially, participants were concentrating on *how* to complete the given task rather than *why* they were engaged in it. Lewin et al. (1944) describe this distinction as the difference between "goal setting" and "goal striving" (Gollwitzer, Heckhausen, and Steller 1990). In goal striving, people focus on how to implement the established goal and rely on information that is useful for task completion (Gollwitzer 1990). Therefore, activated procedures or strategies that are potentially relevant for task completion (e.g., convergent thinking) are likely to be implemented.

In goal setting, however, people select among different types of actions in which to engage. In these choice situations, the emphasis is on deliberation rather than implementation as people weigh the pros and the cons of engaging in different tasks or activities (Gollwitzer 1990; Gollwitzer and Moskowitz 1996). The desirability of the different possible outcomes and the feasibility of achieving those outcomes are the most significant criteria used to determine choice (Gollwitzer 1990). How, then, do activated problem-solving mindsets influence a person's choice of a subsequent task? We address this question in Study 3.

## *PROBLEM-SOLVING MINDSETS AND TASK CHOICE*

Although researchers have consistently demonstrated that activated behavioral mindsets can affect choice within the context of a subsequent task, the subsequent task itself is typically held constant across participants (see Wyer and Xu 2010). As such, research on behavioral mindsets and choice has largely examined goal striving, not goal setting. For example, Ülkümen, Chakravarti, and Morwitz (2010) manipulate participants' exposure to broad versus narrow categories and examine the effect of this manipulation on a subsequent task (sorting fruit into groups), finding that participants initially exposed to broad categories subsequently created fewer groups of fruit (Study 1). In contrast, our focus is on the effects of an activated problem-solving mindset on participants' goal setting. We examine the mindset's influence on the type of task in which the participant subsequently chooses to engage (well defined vs. ill defined).

In reality, consumers often find themselves in a position of goal setting when choosing between ill-defined problems and well-defined ones. For example, a consumer who is planning to prepare dinner can choose between cooking from scratch (solving an ill-defined problem) and microwaving a frozen dinner (solving a well-defined problem). Increasingly, firms are offering a range of products to assist consumers with either choice. The General Mills brand portfolio, for example, includes both Gold Medal flour and Macaroni Grill frozen meals. The way the consumer chooses between these different goals is by evaluating both the desirability and the feasibility associated with the outcomes of each option (Gollwitzer 1990).

As we have argued, well-defined-problem-solving mindsets are characterized by a search for a single, correct, and/or appropriate answer. Consequently, people with that mindset activated are likely to place significant weight on the feasibility dimension of a task, focusing on the certainty with which they expect to accomplish a goal. Given their established procedures and defined ending points, well-defined problems are likely to rate higher on the feasibility dimension than ill-defined problems.

In addition to an activated mindset, consumers' chronic orientations can influence the goals they choose to pursue. For example, a consumer's self-perceived creativity could influence judgments of both the desirability and the feasibility of different tasks. Specifically, people with higher self-perceived creativity are likely to find the ill-defined task more desirable than those with lower self-perceived creativity because actively choosing the more creative task can reinforce their identities as creative people (Dahl and Moreau 2007; Dhar and Wertenbroch 2012). Self-perceived creativity could also influence the perceived feasibility of ill-defined tasks because consumers who consider themselves to be more creative may have greater confidence in their ability to satisfactorily complete a creative task (Burroughs and Mick 2004). Thus, we propose that a negative relationship exists between consumers' self-perceived creativity and their tendency to choose a well-defined task.

The effect of a problem-solving mindset and that of a chronic orientation may not occur independently of each other. A consumer's self-perceived creativity could moderate the effect of the problem-solving mindset on the consumer's choice of a subsequent task or overwhelm it completely. People with higher levels of self-perceived creativity may be less influenced by the mindset carry-over effects than those with lower perceived levels of the trait because their identities as creative people would be activated by the decision-making process. Essentially, the choice itself may be more identity-relevant to those with higher levels of self-perceived creativity, and therefore the mindset would exert less influence on the choice between a well-defined and an ill-defined problem. More formally,

> $H_{3a}$: A well-defined-problem-solving mindset increases consumers' tendency to choose a well-defined task, compared with an ill-defined-problem-solving mindset or no prompted mindset.

> $H_{3b}$: Consumers' self-perceived creativity attenuates this effect.

## *STUDY 3*

### *Design and Procedure*

To test $H_3$, we manipulated the type of problem-solving mindset between participants (problem-solving mindset: well defined vs. ill defined) and measured participants' self-perceived creativity. To ensure against any sequencing effects, we counterbalanced the order of the dependent measures between participants (order: choice first vs. control measures first). This manipulation also allowed for a test of the endurance of the effect because the latter condition introduced a time delay between the induction of the mindset and the task choice. The experimental sessions were 30 minutes long and each contained groups of 5–20 participants. A total of 124 undergraduate students (49% male) participated in exchange for course credit.

*Problem-solving mindset.* We manipulated participants' problem-solving mindsets in a different manner than that used in the first two studies. Specifically, participants completed a series of four timed tasks that were each three minutes long. In the well-defined condition, each of the four tasks had a single, correct solution to encourage convergent thinking: a word search, a letter find (i.e., circle all of the *e*'s in an article), a number find (i.e., circle all the *7*s in a data set), and a coloring task that required participants to color in a series of shapes without going outside of the lines. In the ill-defined condition, each of the four tasks was taken from the Torrance Test of Creative Thinking and encouraged divergent thinking. In the first of these tasks, participants saw a picture of a stuffed bunny and were asked to try to improve it by making it more fun to play with. The second task asked participants "what might be some of the things that would happen" if "people could transport themselves from place to place with just a wink of the eye." The third task was identical to the "incomplete figures" task used in Study 1, and the fourth task asked participants to take a series of diamond shapes and augment them to create a story (see Web Appendix E).

Because the sets of tasks differed significantly across these two conditions, the manipulation also had the potential to influence factors other than participants' mindsets. Thus, we measured positive affect, using the items used in the pretest for Study 1, and self-reported effort as controls. Furthermore, we counterbalanced the order in which these measures were presented. Half of participants responded to the questions immediately after the mindset manipulation, whereas the other half of participants first made their choice of a subsequent task and then responded to the control measures.

We used two 2 (problem-solving mindset: well defined vs. ill defined) × 2 (order: choice first vs. control measures first) ANOVAs to determine whether the manipulated factors influenced either effort or positive affect. The results revealed a main effect of problem-solving mindset on both measures. Participants in the well-defined condition reported expending less effort and experiencing less positive affect than those in the ill-defined condition (effort: $M_{well\ defined} = 2.72$ vs. $M_{ill\ defined} = 3.67$; $F(1, 121) = 9.39$, $p < .01$; positive affect: $M_{well\ defined} = 5.51$ vs. $M_{ill\ defined} = 6.13$, $F(1, 121) = 3.59$, $p < .10$). Thus, we control for both of these measures when testing $H_3$. Counterbalancing had no significant influence on either control measure.

*Self-perceived creativity.* On a nine-point scale, participants reported the extent to which they agreed with the following statement: "I consider myself to be a creative person." Importantly, this measure occurred after the counterbalancing manipulation, with all participants having completed both the control measures and the choice task. The measure was mean-centered, and a 2 (problem-solving mindset: well defined vs. ill defined) × 2 (order: choice first vs. control measures first) ANOVA revealed that neither of the manipulated factors significantly influenced participants' self-reported creativity (all $F < 1$).

### *Dependent Measures*

The focal dependent measure in this study was participants' choice between a well-defined and an ill-defined subsequent task. Specifically, we gave participants a choice between the two LEGO options used to manipulate problem-solving mindsets in Study 1. Participants were given the following instructions: "Take a look at the two options below and think about which one you would prefer to work on. Both activities would take about 15 minutes" (see Web Appendix F). Although participants were not actually required to engage in the chosen activity, that information was not explicitly stated before they made their choice. A pretest was conducted to determine baseline preferences for the two LEGO options. One hundred participants were recruited through Amazon's Mechanical Turk marketplace in exchange for a small monetary reward. Participants were presented with the choice of either the LEGO kit activity or the LEGO free-form activity. One participant failed to complete the study, and of the 99 remaining participants, 39% selected the kit.

*Results*

We used logistic regression to determine the independent and interactive influences of problem-solving mindset and self-perceived creativity on participants' choice of a well-defined or ill-defined task. The model also included the control variables as well as both the main and interactive effects of the counterbalancing factor. Because the counterbalancing effects were all nonsignificant (all $\chi^2 < 2.8$), we collapsed over this factor.

The results reveal main effects of both problem-solving mindset and self-perceived creativity on choice. Consistent with $H_{3a}$, participants who had engaged in well-defined-problem-solving tasks were more likely to choose the LEGO kit as a subsequent activity (67%) than those whose prior tasks had been ill defined (44%; $\beta = .45$, $\chi^2(1) = 4.75$, $p < .05$). Recall that the pretest suggested a baseline preference of 39% for the kit, a figure close to the one observed in participants in the ill-defined condition.

Self-perceived creativity had a significant negative influence on the likelihood of choosing the kit as well ($\beta = -.31$, odds ratio [OR] = 1.36, $\chi^2(1) = 6.43$, $p = .01$). However, this individual difference exerted its influence independent of the participant's mindset; no interaction between the two factors was observed, and $H_{3b}$ was not supported. Self-perception of creativity influenced choice (OR = 1.36), but it notably did not overwhelm the effect of the induced problem-solving mindset, which had a higher effect size (inverted OR = 1.56; see Osborne 2006). Neither the influence of effort nor that of affect was significant (affect: $\beta = .05$, $\chi^2(1) = .66$, n.s.; effort: $\beta = .06$, $\chi^2(1) = .60$, n.s.).

*Discussion*

The results from this study demonstrate that a well-defined-problem-solving mindset can enhance the likelihood that a consumer will choose to engage in a subsequent well-defined problem, and it appears to do so by emphasizing the feasibility and predictability of the solution. Furthermore, the results show that the effect of this mindset on consumers' choice is rather robust—it occurs even when we control for the effect of a chronic individual-difference factor (self-perceived creativity) and endures after a delay (i.e., as demonstrated by the order manipulation).

## GENERAL DISCUSSION

Over the past 25 years, there has been a proliferation of consumer products designed to meet our increasingly heterogeneous preferences, our desire for convenience, and our appetite for the latest technologies (Schwartz 2004). An overlooked benefit that many of these products provide is that of predictability—in both the process and the outcome of use. Rather than using a map along with trial and error to find our next destination, we can now ask Apple's Siri computer program to guide us seamlessly to that location; instead of following an Italian recipe, we can now sauté a Bertolli ready-to-cook frozen meal for dinner; and instead of struggling to retrieve an answer to a question from our memory, we can instantaneously Google the information. The marketplace essentially offers more products that engage us in well-defined-problem solving. The goal of this article is to provide a better understanding of the downstream consequences of engaging in this type of behavior.

By considering the effects of a well-defined-problem-solving mindset on both goal striving and goal setting, our studies suggest that the consequences of such a mindset could be significant. With their emphasis on goal striving, Studies 1 and 2 demonstrate that solving well-defined problems can diminish performance on subsequent creative tasks. Study 2 indicates that the presence of a clear goal state, rather than a known set of operators, is largely responsible for this decline. Furthermore, this study suggests that the effects are driven not by a person's motivation to be creative but by a reduction in the extent of divergent thinking in which the person engages. Study 3, then, highlights the influence of a problem-solving mindset on goal setting by demonstrating that engaging in a well-defined-problem-solving exercise increases the likelihood that a consumer will choose a subsequent task that is similarly well structured.

*Theoretical Contributions and Opportunities for Further Research*

*Goal striving.* In the mindset literature, the focus has primarily been on goal striving—identifying the influence of different behavioral mindsets on how people perform in a given task. Our first two studies fall into this category and demonstrate that the cognitive procedures invoked by differently structured problem-solving tasks carry over to influence divergent thinking in subsequent tasks. To date, problem solving has not been considered as a potential mindset, nor has creativity been considered as an outcome. Our findings demonstrate that the cognitive procedures needed to solve a well-defined initial problem, when activated, can inhibit performance on a subsequent ill-defined task.

However, it is important to note that we did not observe a similar effect when an ill-defined problem preceded one that was well defined. As we speculated in the discussion of Study 1, this null finding may have occurred because what we call the "well-defined" second task was not strictly well defined, in that the set of operators required to solve the analogies was not clearly specified. Thus, further research is needed to determine whether the mindset invoked by solving an ill-defined problem could inhibit performance on a subsequent task that was fully well defined as described in Table 1. More generally, because problem-solving activities lie on a continuum from well to ill structured, there are ample opportunities to examine problem-solving mindset effects in task pairs lying at different points along this spectrum. It is possible that the process of solving an initial problem may enhance, rather than inhibit, performance on a subsequent task if, for example, that initial task made accessible a set of relevant cognitive strategies that would ordinarily not have been prompted by the second task.

*Goal setting.* Our third study examines consumers' goal setting and the influence that a mindset can have not on subsequent task performance but on a consumer's choice of the subsequent task itself. By focusing on the *why*, and not the *how*, this study is unique in the mindset literature. The study finds that inducing a well-defined-problem-solving mindset can reduce a person's willingness to engage in a task requiring creative thought. We argue that this effect occurs because the initial well-defined task influences consumers' perceptions of both the feasibility and desirability of possible outcomes of a subsequent task. However, we offer no direct process evidence to support this claim, and thus, further research is needed to examine how and why a given problem-solving mindset influences the type of problem that a consumer decides to subsequently tackle.

More generally, there are substantial research opportunities in the broader mindset literature to illuminate how and why different mindsets influence the types of goals that consumers choose to set for themselves. The initial task, for example, might influence the way in which consumers calculate and/or trade off the anticipated effort and reward offered by the different subsequent tasks, and this influence might be conscious or unconscious. There are also several moderators of these effects that would be worthwhile to examine. For example, does a person's success or failure (whether self-perceived or objective) on the initial task alter or override the type of mindset that it induced? If so, a study designed to manipulate success or failure could examine whether performance mitigates mindset carryover effects.[3]

*Creativity.* Our research contributes to the literature on creativity by identifying a factor that diminishes rather than enhances consumers' divergent thinking ability. Although there have been several studies that examine the conditions under which people think more creatively, the majority of this research identifies actions that can be taken to enhance divergent thinking. For example, firms aiming to enhance the creativity of their new product development ideas can require the use of templates (Goldenberg, Mazursky, and Solomon 1999), provide training coupled with extrinsic rewards (Burroughs et al. 2011), or encourage the use of analogical thinking during the ideation process (Dahl and Moreau 2002). Few studies have identified the situational factors that influence creative performance independently of the creative task itself, but our research does so in Studies 1 and 2. Identifying these conditions is important because they are likely to be far more pervasive in peoples' day-to-day lives.

Furthermore, the majority of the studies on creativity in the marketing literature have focused either on the outcomes produced during a creative task or on the process by which people engage in or experience the creative task. Few studies, however, have examined when or why people choose to engage in creative tasks. In Study 3, we demonstrate that both a consumer's problem-solving mindset and that person's self-perceived creativity predict the likelihood that the consumer will choose to engage in a well-defined versus an ill-defined task.

### *Substantive Contributions*

Our results have diverse implications for both managers and public policy makers. For managers with oversight into their firms' new product development processes, our findings provide empirical support for the widespread belief that corporate culture influences innovative outcomes. Disney, for example, distinguishes between employees who do "routine work" (e.g., cast members at their theme parks) and those who engage in imaginative work (e.g., "imagineers" who "dream up wild ideas about new things a guest might experience"; Sutton 2001, p. 96). Routine work entails well-defined-problem solving, whereas imaginative work requires engagement in ill-defined-problem solving. Employees rarely switch from one type of work to the other, and our findings suggest that this separation is a good one. Individual differences aside, the results from Studies 1 and 2 suggest that employees consistently engaged in routine work would produce less-creative ideas than those who were not so engaged.

For managers who oversee product lines that invite cocreation with consumers, the results from Study 3 have implications for the design and positioning of their offerings. Specifically, our findings suggest that managers should consider the type of problem-solving mindset that a consumer is likely to be in when either shopping for or using their products. IKEA's furniture offerings, for example, invite consumers to engage in well-defined-problem solving by using step-by-step instructions to put together a product displayed on the showroom floor. When are its target consumers most likely to be receptive to such an opportunity? Our findings suggest that it is when they have recently been engaged in other well-defined tasks. Thus, advertising IKEA products to consumers on their drive home from work might be more effective than advertising to them on the weekend.

Products inviting consumers to self-design and self-produce products for their own use, such as, for example, cooking kits and online customization, are becoming increasingly popular. In some instances, marketers may want the consumer to be as creative as possible when dealing with these products, while in other instances, the marketer may want to have as much control as possible over the end result. Findings from Studies 1 and 2 suggest that when offering self-design options involving multiple stages, marketers can influence degree of creativity in the outcome products by carefully designing the structure of the tasks at the different stages in the self-design process to accommodate either a well-defined-problem-solving or an ill-defined-problem-solving mindset.

At a broader level, our research has implications for the policy makers who design the educational system and spearhead educational reforms. The growing emphasis on standardized testing influences how teachers teach and how students learn. By rewarding students, schools, and teachers for correct responses on these tests, the system encourages the assignment of well-defined problems. The results of our research suggest that such an emphasis can have a negative influence on both creative performance and students' proclivity to engage in activities that carry less structure.

[3]We thank two of our anonymous reviewers for these suggestions.

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**WEB APPENDIX**

**The Downstream Consequences of Problem-Solving Mindsets: How Playing with Legos Influences Creativity**

C. Page Moreau and Marit Gundersen Engeset

# Web Appendix A

*THE LEGO KIT*

# Web Appendix B

*ANAGRAM TASK*

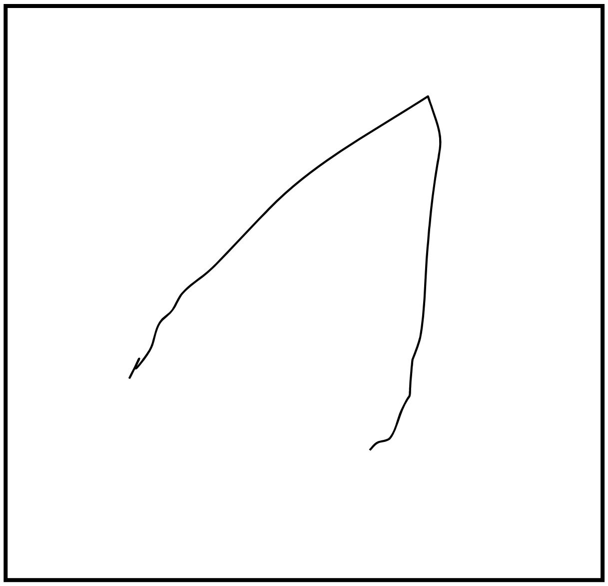
Anagram Task

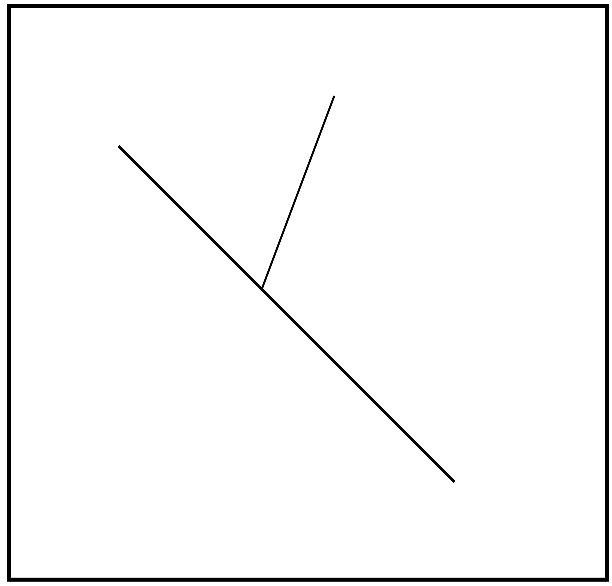
For each of the words below, rearrange the letters to form another word in English. For example, the word “early” can be transformed into the word “layer.”

1) Drier ______________________
2) Flesh ______________________
3) Defer ______________________
4) Toned ______________________
5) Tacit ______________________
6) There ______________________
7) Omits ______________________
8) Night ______________________
9) Ruled ______________________
10) Satin ______________________
11) Silence ______________________
12) Spots ______________________
13) Praised ______________________
14) Tough ______________________
15) Dashed ______________________
16) Artist ______________________
17) Ideals ______________________
18) Marines ______________________
19) Danger ______________________
20) Endive ______________________
21) Terrain ______________________
22) Traipse ______________________
23) Saltier ______________________
24) Parsley ______________________
25) Trout ______________________

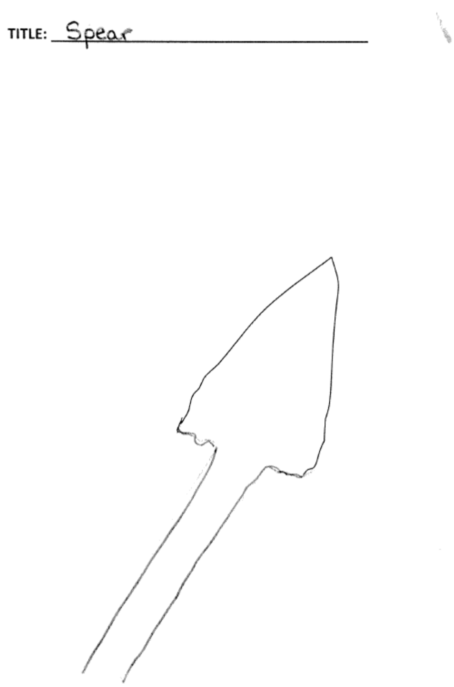
# Web Appendix C

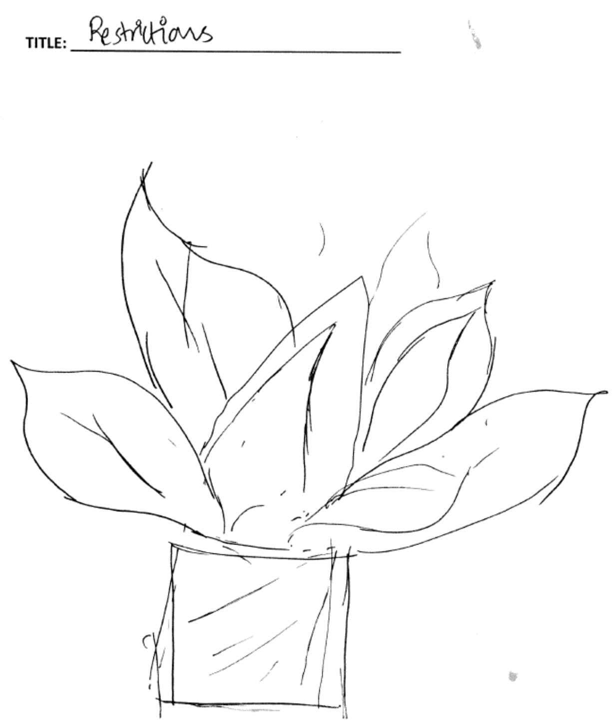
*STUDIES 1 AND 3: THE INCOMPLETE FIGURES TASK*





*EXAMPLES OF COMPLETED FIGURES:*



# Web Appendix D

*STUDY 1: SAMPLE QUESTIONS FROM THE MILLER ANALOGY TEST*

1) War is to destruction as germ is to:
    a. Influenza
    b. Warfare
    c. Disease
    d. Dirt

2) Comrade is to friend as recollect is to:
    a. Memoirs
    b. Remember
    c. Memory
    d. Enemy

3) Arrival is to departure as invasion is to:
    a. Evacuation
    b. Approach
    c. War
    d. Reception

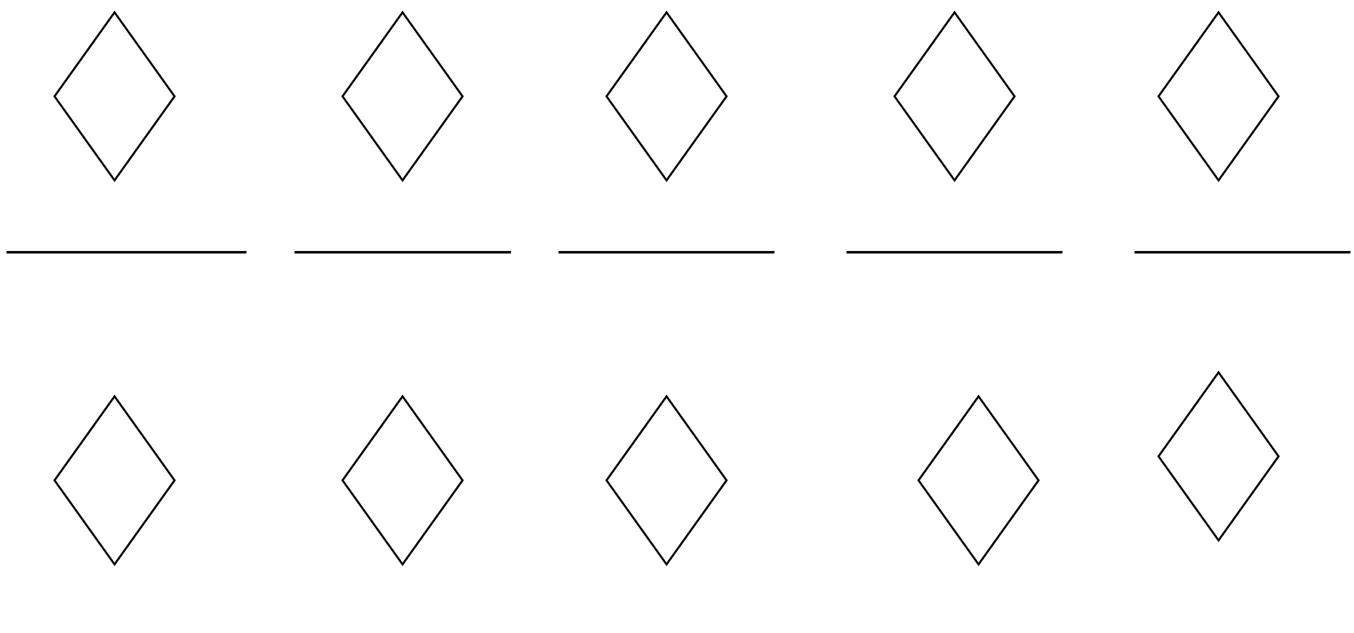
4) Control is to order as anarchy is to:
    a. Chaos
    b. Discipline
    c. Power
    d. Government

5) Law is to citizen as constitution is to:
    a. Rights
    b. Democracy
    c. Regulation
    d. Government

# Web Appendix E

*STUDY 3: A TASK IN THE ILL-DEFINED PROBLEM-SOLVING CONDITION*

Add details to the shapes below to make pictures out of them. Make the diamond a part of any picture you make. Try to think of pictures no one else will think of. Add details to tell complete stories with your pictures. Give your pictures titles. You have 4 minutes.



# Web Appendix F

*STUDY 3: CHOICE MEASURE*

Take a look at the two options below and think about which one you would prefer to work on. Both activities would take about 15 minutes.

Option 1

Put together a Lego kit like the one shown below. There are step-by-step instructions for you to follow that will help you put the product together.


Option 2

Put together something (or things) of your own choosing by playing with a box full of Legos like the one shown below.