

## Creativity as a Matter of Choice: Prior Experience and Task Instruction as Boundary Conditions for the Positive Effect of Choice on Creativity

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### ABSTRACT

This study investigates the effects of prior experience, task instruction, and choice on creative performance. Although extant research suggests that giving people choice in how they approach a task could enhance creative performance, we propose that this view needs to be circumscribed.

Specifically, we argue that when choice is administered during problem solving by varying the number of available resources, the high combinatorial flexibility conferred by a large choice set of resources can be overwhelming. Through two experiments, we found that only individuals with high prior experience in the task domain and given explicit instruction to be creative produced more creative outcomes when given more choice. When either of these two conditions is not met (i.e., low prior experience or given non-creativity instruction), more choice did not lead to more creative performance. Theoretical and practical implications of these findings are discussed.

Key Words: Choice, Experience, Task Instruction, and Creativity

*“Invention consists in avoiding the constructing of useless combinations and in constructing the useful combinations which are in infinite minority. To invent is to discern, to choose.”*

*Henri Poincare (1854-1912)  
French mathematician and theoretical scientist*

### INTRODUCTION

“To invent is to discern, to choose.” These words of Henri Poincare highlight an important feature of the creativity process. In many human domains, to be creative is not about creating an entity out of thin air (Campbell, 1960; Simonton, 1999a; 1999b). Rather, the creativity process involves combining existing ideas

and resources into something new and useful (e.g., Baughman & Mumford, 1995; Mobley, Doares, & Mumford, 1992; Hofstadter, 1985; Koestler, 1964). In more precise terms, according to the Darwinian perspective of creativity (Campbell, 1960), the creativity process involves the two steps of variation and selection. In the variation step, existing ideas or resources are subject to recombination and “mutation” to derive new ones. These new variants of ideas or products are then subject to the creator’s judgment. Only those that best address the problem at hand are selected for implementation. Inherent in this process is the need to contemplate and choose from among the myriad possible combinations. For instance, a chef has to choose from among different ways of combining a set of ingredients when creating a new dish. Similarly, a painter has to choose from among different ways of integrating a set of colors and images when creating a new masterpiece.

Of the two steps in the Darwinian model of creativity, the variation step is especially crucial to the generation of a creative outcome. In particular, the more combinations one can generate from the initial elements, the higher the chance that a new and useful product will emerge (Simonton, 1999b, p. 86). The larger the choice set of initial elements, the more flexibility there is in the generation of different combinations. This gives rise to a richer set of potential solutions from which one can later choose. For example, when a chef is given 10 possible ingredients from which to create a new dish, he or she will have greater combinatorial flexibility than when given just three ingredients. Such higher degree of flexibility will give the chef more potential solutions to choose from, thereby increasing his or her chance of producing something creative (Simonton, 1999a, 1999b). Thus, one would expect a positive relationship between creative performance and the size of the choice set of initial resources that one can choose from to generate possible solutions.

However, the process of contemplating and choosing from among a large set of combinatorial possibilities is not a simple one. This process becomes even more complex and difficult when the number of initial elements from which the potential solutions can be derived increases. While a master chef or painter may welcome the freedom and flexibility associated with an enlarged set of options, how does an average person fare given such complexity? Does giving people more choice during problem solving<sup>1</sup> necessarily lead to more creative performance? In this research, we investigate the circumstances under which the average person will produce creative outputs when given a large (versus small) choice set of initial resources during creative problem solving. Specifically, we examine both person (prior experience in task domain) and situational (type of task instruction) factors as boundary conditions for the positive effect of choice on creative performance to occur. In the ensuing paragraphs, we first review some relevant literature before developing our hypothesis.

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<sup>1</sup> We use the term “problem solving” broadly to denote not just the seeking of resolutions to problems, but also the accomplishment of tasks that involve creativity.

## CHOICE AND CREATIVE PERFORMANCE

In contemporary creativity research, task flexibility has received considerable research attention and empirical support as an important situational factor that could influence human creativity. A large number of studies have demonstrated that creativity is enhanced when individuals are given flexibility in their work (e.g., Amabile, 1983; Smelt & Cross, 1984; Amabile & Gitomer, 1984; Amabile & Gryskiewicz, 1987, 1989; Witt & Beorkrem, 1989; Shalley, 1991; Greenberg, 1992; Zhou, 1998). Among the many approaches in giving people task flexibility (e.g., giving people freedom in the sequence they complete a task, Shalley, 1991), the most simple and direct approach is through the provision of choice (Amabile & Gitomer, 1984; Greenberg, 1992). For instance, Amabile and Gitomer (1984) found that children who were given choice in terms of which task materials to use in creating a collage, produced collages which were assessed to be more creative than those produced by children who were given no choice. Similarly, Greenberg (1992) found that subjects who had choice in selecting which problems to work on in a given task situation produced more creative outputs. The main psychological mechanism that underlies these findings is that choice confers self-determination and intrinsic motivation — key ingredients for creative performance (e.g., Deci & Ryan, 1985; Deci, 1975; Deci, 1981; Amabile, 1983, 1988, 1990).

However, past research that used choice as a way of providing task flexibility focused mainly on either giving people choice versus no choice during *problem selection*. Thus, it is unclear whether giving people more choice of resources during problem solving would necessarily lead to more creativity. In the current research, we move beyond the choice versus no choice manipulation and study the effect of the *extent* of choice given to people during *problem solving*. Specifically, we investigate the effect of the number of initial resources given to people on creative performance. This, in our view, constitutes yet another way to which task flexibility could be manifested in real life contexts. For instance, as illustrated by our example in the introduction, a chef may encounter a large versus small choice set of ingredients. In such a problem paradigm, the combinatorial flexibility that the problem solver has in generating potential solutions is positively related to the size of the choice set of given resources.

However, past research has also illustrated that selection, evaluation, and integration of information are affected by the number of options available. As the complexity of information processing increases, people tend to simplify their decision-making processes by relying on simple heuristics (Payne, 1982; Timmermans, 1993; Wright, 1975). For instance, in a study that examines the decision strategies of people encountering different number of alternatives, Timmermans (1993) found that as the number of alternatives increases, people were not only more likely to use an elimination strategy, they also made use of less information. More recently, studies by Iyengar and Lepper (2000) found evidence that people's ability to contemplate multiple combinations of solutions

may be limited as the number of options increases. These findings suggest that giving people a large number of options in a problem solving task can lead to information overload. In addition, recent choice research has also demonstrated that the provision of extensive choice can have detrimental consequences emotionally (Iyengar & Lepper, 2000). For instance, Iyengar and Lepper (2000) found that people given extensive choice reported more difficulty and frustration during the decision making process.

Extending these findings to the creative problem solving domain, we expect that the larger the choice set of initial resources given to people during problem solving, the more likely they are to be overwhelmed due to the increased number of possible combinations involving the given resources. Thus, giving people more choice during creative problem solving may *not* necessarily lead to more creative outcomes. In fact, the marginal increase in the choice set of initial resources need not even be large for this effect to occur. This is because every additional resource to a choice set of resources will have an exponential effect on the number of possible combinations involving the given resources (assuming that resources can be combined freely). Hence, in problems that involve choosing among combinatorial possibilities, even small differences in the number of initial resources given can have large effects in the size of the problem search space. So when will more choice lead to more creativity? In this research, we argue that the two critical boundary conditions are the person factor of prior experience in the task domain and the situational factor of whether explicit instruction to be creative is given.

### Prior Experience

Research in creativity and innovation has suggested prior experience in a given task domain to be an important predictor of creative performance (e.g., Martinsen, 1993; Amabile, 1983). For instance, Amabile (1983) argued that possession of domain relevant skills is an important component of individual creativity. Domain relevant skills include familiarity with the domain in question, having the technical skills to work with ideas and objects within the domain, and being knowledgeable about facts, principles, paradigm, and key evaluation criteria that are important to the domain.

The degree of domain relevant skills one possesses depends on formal and informal education, and on the individual's experience in the given domain (Amabile, 2001). Drawing on this argument, we propose that individuals with high prior experience in a task domain should be more likely to have the domain relevant skills to navigate the large search space conferred by a large choice set. Specifically, past experience would guide them in their search for a solution and help them avoid unnecessary experimentations. Thus, individuals with high prior experience in a given task domain are less likely to be overwhelmed when dealing with a large choice set of initial resources.

### Task Instruction

Another important consideration is the presence of explicit instructions to be creative during problem solving (Katz & Poag, 1979; Chen, Kasof, Himsel, Dmitrieva, Dong, & Xue, 2005; O'Hara & Sternberg, 2001; Goncola & Staw, 2006). Past research has found that individuals' creativity test scores improved when they were told that they were taking a creativity test<sup>2</sup> (e.g., Manske & Davis, 1968; Harrington, 1975). More recent work by O'Hara and Sternberg (2001) suggests that, in the context of essay writing, the provision of creativity-specific instructions could lead to more creative performance. In a similar vein, Shalley (1991) found that a creativity goal primed an individual's attention and effort to be creative. Thus, when people are explicitly instructed to be creative, they will tend to engage in more exploration and experimentation because the aim is to find a solution that is not only useful but also novel. This is likely to result in an expansive search strategy of experimenting and attempting different ways of combining the given resources.

Conversely, when no explicit creativity instruction is given, the aim is to find a solution that maximizes some criteria that do not necessarily include novelty or newness as a feature. For instance, people could be given instructions that are totally unrelated to creativity, e.g., be practical. People could also be given instructions that might imply creativity but the creativity element was not explicitly stated, e.g., to come up with a persuasive product advertisement. In this latter case, even though creativity might be implied, it was not explicitly expressed. Thus, people's effort and motivation may not be geared toward exploring novel solutions (e.g., an advertisement could be persuasive without being new or novel). As a result, although people may still engage in considerable search while formulating a solution, the search is likely to be comparatively less expansive because the *emphasis* is on the functionality (e.g., get customers persuaded) rather than both functionality and novelty aspects of the solution. In other words, if not explicitly instructed to be creative, people will be less concerned about whether the solution is new or novel, as long as it works well. The less expansive search strategy used when no explicit creativity task instructions are given does not take full advantage of the large search space conferred by the large choice set of initial resources.

In this research, we argue that both conditions of high prior experience and explicit instructions to be creative must be met for high choice to lead to more creative performance. Without prior experience, individuals will likely lack the domain relevant skills to effectively and efficiently navigate the large combinatorial search space. Without explicit instructions to be creative, even if individuals have the domain relevant skills to navigate the search space, they may not be motivated to expend additional effort and cognitive resources to explore and experiment with new ideas. It is only when individuals have high prior experience

<sup>2</sup> It is debatable whether achieving higher creativity test scores means that one will be more creative in actual problem solving. It is likely that the enhanced test scores captured attempts to be creative during the test and may have little to do with actual creative performance.

in a given task domain and told explicitly to be creative that they would make use of their domain relevant skills to efficiently and expansively search the large combinatorial search space conferred by a large choice set of initial resources. In sum, we propose a three way interaction such that high choice would lead to more creative performance *only* when an individual has high prior experience in the given task domain and given explicit instructions to be creative.

*Hypothesis: Only individuals with high prior experience in the given task domain and given explicit instructions to be creative will produce more creative outcomes when given high (versus low) choice in tasks involving combinatorial search. When individuals have low prior experience or not given explicit instructions to be creative, they are not likely to produce more creative outcomes when given high (versus low) choice.*

We do not have specific hypotheses regarding the main effects of domain experience and task instruction because each alone is unlikely to be sufficient to produce a positive impact on creative outcomes. Just because a person is experienced in a task domain does not necessarily render him or her more creative. This is because although experience could guide one in exploring an extensive search space, it could potentially work in the opposite direction of constraining one to routine thinking. Explicit instructions to be creative may increase a person's *effort* or *attempt* to be creative but that does not necessarily translate into actual creative outcomes. In other words, creativity requires a "perfect storm" of high choice, high prior experience, and explicit creativity instructions.

Next, we describe two laboratory experiments conducted to test our above hypothesis. We chose an experimental approach so that we could manipulate the choice variable and thus draw conclusions about the causality between choice and creative performance.

## STUDY 1

We conducted an experiment using a 2 (low versus high choice) x 2 (non-creativity versus creativity instruction) x 2 (low versus high prior experience in task domain) between-subjects design to test our hypothesis. In this study, we used a gift-wrapping task because it is one that most people can relate to and do not have to be specially trained before they can do.

## METHOD

### Participants

A total of 100 students (38% males, mean age 21) from a large east coast university participated in this study. Students were recruited through flyers posted in the campus and compensated \$8 for their time and effort.

### Materials

At the beginning of the task, participants were presented with a set of gift-wrapping materials consisting of various types of wrapping papers and ribbons. A set of five other materials typically unrelated to gift-wrapping namely, newspaper, kitchen aluminum foil, metal wires, sponge, and cotton twine, were

also provided. The task was to wrap a square gift box (dimensions: 6 cm x 6 cm x 2 cm). Stationery such as tape and scissors were also provided.

### Procedure

*Choice Manipulation.* We manipulated choice by varying the number of types of wrapping papers and ribbons given to the participants. In the high choice condition, we gave participants four types of wrapping paper (different colors) and six types of ribbon. In the low choice condition, we gave participants two types of wrapping paper and two types of ribbons. The types of wrapping paper and ribbons given in each low choice condition were chosen from the larger set of materials and counter-balanced. In effect, the high choice condition gave participants more combinatorial flexibility in wrapping the gift-box than the low choice condition. The difference in combinatorial flexibility between these two conditions is exponentially large given that each additional gift-wrapping material could be used with the existing materials in infinitely many ways.

To keep the overall quantity of materials constant across both conditions, we also paid attention to the quantity per gift-wrapping material in the low choice condition. Specifically, since only two types of wrapping paper were given (compared to four in the high choice condition), we gave twice as much of each type. This keeps the total number of pieces of wrapping paper constant across the two conditions. Likewise, we gave thrice as much of each type of ribbon, thereby keeping the total amount of ribbons constant across the two conditions. In both conditions, equal amounts of each of the five unconventional gift-wrapping materials were provided.

*Task Instruction Manipulation.* In the explicit creativity instruction condition, participants were told that the objective of the task was to come up with as creative a gift-wrap as they could. In the control condition (non-creativity instruction), participants were simply told to do their “best” in the gift-wrapping task. Although a “do your best” instruction in a gift-wrapping context may connote the need to be creative, the need for novelty is not explicitly expressed. For instance, in the current task, participants may search for gift-wrap ideas that result in a nice looking or attractive gift-wrap which may not necessarily be novel or new.

*Prior Experience.* This variable was assessed using a two-item five-point scale (1 = strong disagree, 5 = strongly agree). The items were “I often wrap the gifts that I give to my friends and family myself,” and “I have a lot of experience in gift wrapping.” The correlation between these two items is 0.58 ( $M = 3.31$ ,  $\min = 1$ ,  $\max = 5$ ,  $SD = 0.99$ ).

At the start of the experiment, the participants were randomly assigned to the experimental conditions and given a set of materials in a brown envelope. The materials in the envelope varied according to the choice condition. Instructions were given on a separate sheet of paper and they varied according to the task instruction condition. Because all the materials were pre-sealed in the brown envelopes, the person conducting the experiment was blind to the experimental conditions. Participants were seated separately and told to complete the task individually. They could use as much or as little of the materials as they wished,

with no restriction on how the gift was to be wrapped. We gave the participants up to 40 minutes to complete the gift-wrapping task. To motivate the participants to take the task seriously, we told the participants that the creator of the most creative (or “best” in the control condition) gift-wrap would win a \$80 cash prize.

### Measures

*Dependent variable.* The key outcome of interest is creative performance on the gift-wrapping task. To assess the creativity of a gift wrap, we adopt the Consensual Assessment Technique (Amabile, 1982) in which judges assess creative performance based on their own subjective definition of creativity. Specifically, we recruited another 50 participants who did not participate in the prior study to independently evaluate all the 100 gift wraps in a separate setting, ostensibly framed as a “gift shopping” study. Recent research by Kaufman, Gentile, & Baer (2005) suggests that creativity ratings by peers are highly correlated with that of experts, justifying the use of peer raters.

The participants rated the gift wraps in random order using a nine-point scale (1: not at all creative, 9: extremely creative). Raters used their own subjective judgment during the evaluation. This enabled us to derive a consensus creativity rating for each gift wrap based on the judgment of a relatively large group of individuals instead of a small number of “experts”. Inter-rater agreement (intraclass correlation) was found to be 0.94, justifying aggregation of the ratings. The mean creativity rating of the gift-wraps is 5.31 (min = 2.39, max = 7.44, SD = 0.96). The average creativity ratings of these 50 raters were later used for analysis.

## RESULTS

### Preliminary Analysis

*Manipulation checks.* To verify the effectiveness of our choice manipulation, we counted the number of unconventional materials (e.g., newspaper, metal wires, etc) used in a given gift wrap. The number of unconventional materials being used should be higher when there is less choice of conventional gift-wrapping materials available. Indeed, we found that participants given low choice made use of significantly more unconventional materials ( $M = 1.37$ ,  $SD = 0.87$ ) than those given high choice ( $M = 1.00$ ,  $SD = 1.04$ ) [ $t = 1.95$ ,  $p = 0.05$ ].

### Hypothesis Testing

We first performed a median split on the prior experience variable to divide subjects into two groups: low versus high prior experience in gift-wrapping. We then conducted analyses of variance (ANOVA) on creativity rating as the dependent variable with choice, task instruction, and prior experience as predictors. ANOVA results and cell means are presented in Table 1A and 1B respectively. The results indicate a significant three-way interaction among choice, task instruction, and prior experience [ $F(1,96) = 6.32$ ;  $p < 0.05$ ; partial  $\eta^2 = .06$ ]. Subsequent analyses showed that for participants with high prior experience and given explicit instruction to be creative, giving them high choice (as opposed to low choice) resulted in outputs that were judged as more creative [ $t = 1.73$ ;  $p < 0.05$ ; partial  $\eta^2 = .13$ ]. When either one of these two conditions is not met,

giving participants high choice did not led to more creative outputs. Within the high choice condition, creativity rating was higher in the high experience and creative instruction cell than those in the other cells. Although the difference in creativity ratings in the high choice/high experience/creative instruction cell and that in the high choice/low experience/non-creativity instruction cell was not significant, the means were in the expected direction. Thus, our hypothesis is, in general, supported in study 1.

TABLE 1A. ANOVA Results for Prior Experience, Task Instruction, and Choice on Creativity Rating (n = 100).

(STUDY 1)

Variable and Source	df	MS	F	Partial $\eta^2$
Prior Experience <sup>a</sup>	1	0.84	0.94	0.010
Task Instruction <sup>b</sup>	1	0.08	0.09	0.001
Choice <sup>c</sup>	1	0.27	0.31	0.003
Prior Experience x Instruction	1	2.16	2.43	0.026
Prior Experience x Choice	1	0.00	0.00	0.000
Instruction x Choice	1	0.30	0.34	0.004
Prior Experience x Instruction x Choice	1	5.61	6.32*	0.064
Error	92	0.89		

\*  $p < 0.05$

<sup>a</sup> 1 = high prior experience, 0 = low prior experience

<sup>b</sup> 1 = creativity instruction, 0 = non-creativity instruction

<sup>c</sup> 1 = high choice, 0 = low choice

TABLE 1B. Cell Means for Creativity Rating<sup>1</sup> of Gift-wraps.

(STUDY 1)

	Low Prior Experience		High Prior Experience	
	Non-creativity Instruction	Creativity Instruction	Non-creativity Instruction	Creativity Instruction
Low Choice	5.07 (1.36)	5.20 (0.84)	5.44 (0.81)	5.20 <sub>a</sub> (1.13)
High Choice	5.55 (0.62)	4.94 <sub>c</sub> (1.11)	4.95 <sub>b</sub> (0.90)	5.90 <sub>a,b,c</sub> (0.80)

Note: Means sharing the same subscript are significantly different at  $p < 0.05$ . The mean creativity rating of all gift-wraps is 5.31 (min = 2.39, max = 7.44, SD = 0.96).

Numbers in bracket are standard deviations.

<sup>1</sup> 9-point scale (1: not at all creative, 9: extremely creative)

## STUDY 2

To retest our hypothesis in a different context, we conducted another experiment using the same 2 (low versus high choice) x 2 (non-creativity versus creativity instruction) x 2 (low versus high prior experience in task domain) between-subjects design. In this second study, we told the participants that as part of a marketing study, they were required to generate as many ideas as possible on how to advertise a new drink product called “Icy Soda.” Participants were told to write down their ideas in one or two sentences.

## METHOD

### Participants

A total of 114 students (48% males, mean age 23) from the same east coast university participated in this study. Students were recruited through flyers posted in the campus and compensated \$8 for their time and effort.

### Materials

A short description of the “Icy Soda” drink was provided. Participants were also given paper and pens to write down their ideas.

### Procedure

*Choice Manipulation.* We manipulated choice by giving participants either two (low choice) or 10 (high choice) themes from which they can use as starting point to generate ideas for the advertisement. Specifically, participants were told that the manufacturers of the drink *preferred* the given set of themes for their advertisement but would also consider any other ideas that participants had. Participants were further told that they were free to combine themes when generating ideas. Examples of themes include: — “movies”, “romance”, “sports”, “music”, and “school.” In the low choice condition, participants were randomly given two out of the 10 possible themes. All 10 themes were featured in the low choice condition and counter-balanced.

*Task Instruction Manipulation.* In the creativity instruction condition, participants were told that the objective of the task was to come up with as many creative ideas for the advertisement as they could. In the control condition (non-creativity instruction), participants were told to create as many “persuasive” ideas as they could. Although a “persuasive” instruction in an advertising context may connote the need to be creative, the need for novelty is not explicitly expressed. For instance, participants could aim for a persuasive advertisement without being overly concerned about its level of novelty.

*Prior Experience.* This variable was assessed using two items, measured on a 5-point scale (1 = strongly disagree, 5 = strongly agree). The items were “I have previous experience in designing advertisements” and “I have experience in marketing.” The correlation between these two items is 0.77 ( $M = 2.05$ ,  $\min = 1$ ,  $\max = 5$ ,  $SD = 1.0$ ).

At the start of the experiment, participants were randomly assigned to the experimental conditions and given a set of instructions and writing paper in an envelope. Instructions varied according to the experimental conditions. The person conducting the experiment was blind to these conditions. Participants were seated separately and told to complete the task individually. We gave the participants up to 40 minutes to complete the task. To motivate the participants to take the task seriously, we told the participants that the creator of the most creative (or “most persuasive” in the non-creativity instruction condition) ideas would win a \$80 cash prize.

### Measures

*Dependent variable.* The key dependent variable is the number of ideas judged as creative. To derive this measure, we first have four raters independently evaluate every idea generated by the participants. On average, each participant generated eight ideas, resulting in a total of 1059 ideas. Each idea is evaluated for creativity on a 7-point scale (1 = not at all; 4 = to some extent; 7 = to a great extent). As in study 1, raters used their own judgment and criteria for the creativity evaluation. The inter-rater agreement (intraclass correlation) among the four raters is 0.72, justifying aggregation. Hence, we used the ratings of these four raters to compute an average creativity rating for each idea. We then classified each idea as either creative (rating of 4 or above, i.e., rated as at least “to some extent creative”) or uncreative (rating of below 4, i.e., rated as below “to some extent creative”). Finally, we counted the number of creative ideas (i.e., those judged as above median in creativity with respect to the total set of ideas generated) for each participant. The mean number of creative ideas is 4.12 (min = 0, max = 9, SD = 2.54).

## RESULTS

### Preliminary Analysis

*Manipulation checks.* To verify the effectiveness of our choice manipulation, we counted the number of ideas that involved themes outside those that were given. Specifically, we asked two raters to independently assess whether a given idea conforms to the given set of themes. For instance, if a participant was given the themes of “romance” and “school” but generated an idea about sports, then this idea was coded as one involving an outside theme. From this, we counted the number of ideas involving outside themes generated by each participant. The correlation between the two raters was 0.91, an indication of high inter-rater reliability. The number of ideas involving outside themes from both raters was then averaged. Since participants were told that the manufacturer of the soft drink preferred the given themes, to explore outside themes is an indication that the given themes were deemed somewhat insufficient. Indeed, we found that participants given high choice generated significantly less ideas involving outside themes ( $M = 3.62$ ,  $SD = 2.49$ ) than those given low choice ( $M = 5.46$ ,  $SD = 2.76$ ) [ $t = 3.74$ ,  $p < 0.01$ , partial  $\eta^2 = .11$ ]. This suggests that participants in the high choice condition have more options at their disposal and thus have less need to explore outside themes.

TABLE 2A. ANOVA Results for Prior Experience, Task Instruction, and Choice on Number of Creative Idea (n = 114).

(STUDY 2)

Variable and Source	df	MS	F	Partial $\eta^2$
Prior Experience <sup>a</sup>	1	0.63	0.11	0.001
Task Instruction <sup>b</sup>	1	1.10	0.19	0.002
Choice <sup>c</sup>	1	0.01	0.00	0.000
Prior Experience x Instruction	1	6.76	1.16	0.011
Prior Experience x Choice	1	32.05	5.49*	0.049
Instruction x Choice	1	15.00	2.57	0.024
Prior Experience x Instruction x Choice	1	22.88	3.92*	0.036
Error	106	5.84		

\*  $p \leq 0.05$

<sup>a</sup> 1 = high prior experience, 0 = low prior experience

<sup>b</sup> 1 = creativity instruction, 0 = non-creativity instruction

<sup>c</sup> 1 = high choice, 0 = low choice

TABLE 2B. Cell Means for Number of Creative Ideas.

(STUDY 2)

	No Prior Experience		Some Prior Experience	
	Non-creativity Instruction	Creativity Instruction	Non-creativity Instruction	Creativity Instruction
Low Choice	5.00 (2.34)	4.88 (3.23)	4.17 (2.76)	3.19 <sub>a</sub> (2.56)
High Choice	4.09 <sub>d</sub> (2.26)	3.61 <sub>c</sub> (2.45)	3.60 <sub>b</sub> (2.03)	6.00 <sub>a,b,c,d</sub> (1.78)

Note: Means sharing the same subscript are significantly different at  $p < 0.05$ . Mean number of creativity ideas across all cells is 4.12 (min = 0, max = 9, SD = 2.54).

Numbers in bracket are standard deviations.

### Hypothesis Testing

As in study 1, we first performed a median split on the prior experience variable to divide subjects into two groups. Because of the generally low level of experience ( $M = 2.05$ ) among our participants in the advertising domain, it was more appropriate to interpret our results in terms of no versus some experience in advertising, instead of low versus high prior experience in advertising. We then conducted analyses of variance (ANOVA) on number of creative ideas as the

dependent variable with choice, instruction, and prior experience as predictors. ANOVA results and cell means are presented in Table 2A and 2B respectively. The results indicate a significant three-way interaction among choice, task instruction, and prior experience [ $F(1,106) = 3.92$ ;  $p = 0.05$ ; partial  $\eta^2 = .04$ ]. Subsequent analyses showed that for individuals with some prior experience and given explicit instruction to be creative, giving them high choice (as opposed to low choice) resulted in more creative ideas [ $t = 3.46$ ;  $p < 0.01$ ; partial  $\eta^2 = .27$ ]. When either one of these two conditions is not met, giving participants high choice did not lead to more creative ideas. Thus, our hypothesis is supported in study 2.

## DISCUSSION

Both conventional wisdom and extant research suggest that task flexibility during problem solving is conducive for human creativity. Through two laboratory experiments, we found that giving people high choice of initial resources during creative problem solving, and hence high combinatorial flexibility, does not always lead to more creative outcomes. Two boundary conditions appeared to be critical – prior experience in the given task domain and explicit instruction to be creative. When either one of these conditions is not met, giving people more choice of initial resources is not likely to result in more creative outcomes.

### Theoretical Implications

This current research has several theoretical implications. First, it highlights the limits of human cognition in contemplating extensive possibilities. Although this notion is not new, it is seldom discussed in creativity research. Most creativity scholars advocate the importance of freedom, flexibility, and autonomy in creative problem solving without considering that there could be a limit as to how far people could benefit under these conditions. It is likely that this strategy can be beneficial for creativity only under certain circumstances. This is because giving people extensive freedom, flexibility, and autonomy in a task could be overwhelming, given the expanded search space. Hence, only people with high prior experience in the task domain and given explicit instructions to be creative would benefit by effectively and expansively navigating this search space to arrive at creative solutions.

The current study is, to our knowledge, one of the first which shows that task flexibility may not always be desirable for creativity. Clearly, while task flexibility, as embodied by an extensive choice set of initial resources, can be motivating, too much of it can have potential detrimental effects. For instance, in study 2, we noticed that in the experiment conditions whereby the prior experience and creativity instruction requirements were not met, low choice (as opposed to high choice) seems to lead to more creative ideas (see Table 2B). In study 1, we also noticed similar patterns, with the exception of the low prior experience and non-creativity instruction condition. Although these effects are not statistically significant, it is possible that high choice not only will not lead to more creative performance, it could have potential detrimental consequences.

## Practical Implications

Our research also has practical implications for organizations given that choice is a readily available tool for managers to promote employee creativity. For example, our findings highlight to managers the potential pitfalls in the notion that giving employees more choices in terms of initial resources or ideas would necessarily lead to more creative performance. Specifically, our results suggest that managers want to pay attention to whom they give more options. If these options were given to an employee with high prior experience in the given task domain, one could potentially see the desired results if this employee was also instructed to be creative. A potentially dangerous situation could arise when a manager gives an employee with limited prior experience in a domain extensive choice or latitude when solving a creativity-related problem. Not only will the employee be not likely to deliver a creative output, he or she might actually perform worse!

In the management literature, there are two main bodies of research that inform managers on how to harness creativity at the workplace. The first employs the situational perspective and advocates the importance of situational factors in affecting workplace creativity (e.g., Amabile & Conti, 1999, Oldham & Cumming, 1996, Shalley 1991). This body of work suggests that managers can do much to improve creativity at the work place by creating the right context or environment. The second stream of research employs the person perspective and advocates the importance of individual difference such as personality (e.g., Barron & Harrington, 1981; Eysenck, 1993) and cognitive ability (e.g, Guilford, 1959, 1977, 1983; Sternberg & O'Hara, 1999). This body of research suggests to managers that in order to build a creative organization, one must hire the right people through proper selection and recruitment. Our study reiterates the view that both person and situational factors have a role in influencing creativity and should be considered jointly (e.g., Woodman, Sawyer, & Griffin, 1993; Oldham & Cumming, 1996; Runco, 2004). For instance, it is not enough to give an experienced employee extensive choice in problem solving and expect creative performance. Rather, the experience of the employee needs to be coupled with the right instruction (i.e., to be creative) in order for high choice to achieve its purported effects.

## Limitations and future research

The current research is not without limitations. First, our methodology is experiment-based using fictitious tasks. Hence, the generalizability of our findings to real-world organizations remains to be ascertained. However, we argue that our tasks are not completely detached from real-world creative problem solving. For instance, although the gift-wrapping task is not directly translatable into organizational settings, it has relevance and parallels in the arts, cultural, and fashion domains. Our second task on advertising is more marketing oriented but need not be restricted to the marketing context. Specifically, the second task involves idea generation and could be extended to many organizational and business contexts that involve working with ideas. Nevertheless, future research should attempt to test our hypothesis in a more realistic organizational setting.

Second, in both our studies, we gave participants external inducements to perform the respective task (chance to win \$80). The aim was to motivate participants to take our tasks seriously. However, various scholars (e.g., Jordan, 1986; Deci & Ryan, 1985; Ross, 1975) have noted that external reward could undermine intrinsic motivation, an important predictor of creative performance. Hence, it would be important to see if our findings would stand if no external rewards were given. Yet, we also wonder to what extent is creative performance cleanly separated from reward in real life settings. At least in the current business/organizational context, creators are likely to be cognizant of the vast rewards that come along with highly acclaimed creative performance.

Future research should also further probe other boundary conditions of task flexibility on creativity. In particular, it would be important to consider the influence of other individual difference variables besides prior experience (e.g., cognitive ability, personality, creativity relevant skills, and creative self-efficacy). For example, it is possible that individuals' level of self-efficacy in creative problem solving (Tierney & Farmer, 2002) may moderate the effect of task flexibility on creativity. Perhaps individuals who have high confidence in their creative ability may not find a large number of combinatorial possibilities overwhelming. Individuals with high cognitive ability should also be better equipped to deal with a large combinatorial search space.

Other situational boundary conditions such as time pressure could also play a role. With enough time, people might be more likely to explore more alternatives and search more extensively, with the potential result of finding a creative solution. With too little time, people might settle for a satisficing strategy and avoid extensive search even though more choice confers a large combinatorial search space. Finally, future research could explore different ways to which choice is administered. For instance, research could move beyond the mere act of choosing, and examines situations in which the effects of choice could cascade into other aspects of decision making and problem solving.

## Conclusion

In closing, we contemplate the role of choice in creative problem solving. The traditional paradigm of choice in creativity research (i.e., choice versus lack of choice) is, in our view, useful but does not fully capture the effects of choice. According to the Darwinian model of creativity, the *extent* of choice should also have a significant impact on creativity. After all, to invent is to choose from a large pool of combinatorial possibilities. By studying how the extent of choice in initial resources can influence creative performance, we have expanded current investigations of the effects of choice on creativity. We also questioned the well-established knowledge that task flexibility and autonomy is necessarily conducive to creative performance. Results from the current research suggests that giving people high combinatorial flexibility through the provision of an extensive choice set of initial resources is only beneficial for creativity under very specific circumstances.

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