

Designing the Solution: The Impact of Constraints on Consumers' Creativity

C. PAGE MOREAU
DARREN W. DAHL*

Across a variety of domains, consumers often choose to act as the designer of their own solution, sourcing the necessary components and assembling the parts to meet their specific goals. While thinking creatively is an integral part in the daily life of every consumer, surprisingly little research in marketing has examined the factors influencing such processes. In our research, we examine how input and time constraints influence the way in which consumers process information during a creative task and how those processes, in turn, influence the creativity of the solution. Paradoxically, we find that input constraints encourage more creative processing, provided the individual is not under significant time constraints.

Almost exclusively, consumer behavior researchers have focused on understanding the ways in which consumers learn about, construct preferences for, and choose among existing products or services designed to meet their previously identified needs. However, in many situations, consumers' needs are more specific and unique, and thus require the consumers themselves to play an integral part in creating their own solution. While thinking creatively is an integral part in the daily life of every consumer, surprisingly little research in marketing has examined the factors influencing such processes. In our research, we employ theories from cognitive psychology to examine the factors influencing consumers' information processing strategies during a creative task and how those strategies, in turn, influence the creativity of the outcomes produced. We wish to begin to establish an initial theoretical basis for understanding this aspect of consumer behavior and to stimulate additional research in the area.

Our research focuses on the effects of both input and time constraints on consumer creativity. The importance of constraints in creative tasks has been identified by researchers in cognitive psychology (e.g., Costello and Keane 2000; Finke, Ward, and Smith 1992; Stokes 2001) who have found that, when constraints are active, the outcomes produced in

conceptual combination, in the development of new category instances, and in the production of art are deemed more creative than when constraints are inactive. However, an examination of how constraints influence individuals' cognitive processes in these situations has not been undertaken. Our contribution to the literature is threefold. First, we provide the first empirical evidence of the influence of constraints on the way people process information during a creative task. Second, we test the link between these process measures and the two key components of creative outcomes, novelty and appropriateness (e.g., Deci and Ryan 1987; Goldenberg, Mazursky, and Solomon 1999). To date, no work has attempted to determine whether or not these two distinct dimensions share common antecedents. Third, we examine the moderating influence of time on the effects of constraints within a creative task. To date, the literature reports equivocal findings on the influence of time on creative task performance. By isolating the effects of time from those of other constraints and by examining task performance at the processing level, our third study is able to address some of the inconsistencies in the literature.

In the next section, we develop the theoretical basis for understanding the influence of input constraints on consumers' information processing strategies during a creative task and how these strategies subsequently influence the creativity of the outcome. Developed hypotheses are empirically tested in our first and second experiments. We then expand our investigation in a third experiment, exploring the moderating effect of a time constraint.

THE INFLUENCE OF COGNITIVE PROCESSING ON CREATIVITY

While creativity is often viewed as a trait bestowed upon a chosen few, creative cognitive processes are fundamental

*C. Page Moreau is assistant professor of marketing, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO 80309; e-mail: page.moreau@colorado.edu. Darren W. Dahl is associate professor of marketing, Sauder School of Business, University of British Columbia, Vancouver, British Columbia, V6T 1Z2; email: darren.dahl@sauder.ubc.ca. Authorship order was determined by the flip of a coin, and each author contributed equally to this manuscript. The authors would like to thank Paul Herr, Amna Kirmani, Don Lehmann, and Art Markman for their helpful comments on earlier drafts of the manuscript. The financial support from SSHRC Canada is gratefully acknowledged.

for human functioning. As a part of daily survival, we construct language and use it flexibly, we combine simple ideas and thoughts to create more complex ones, and we construct solutions to problems faced (Barsalou 1991; Ward 2001). A unique aspect of creative problem solving, however, lies in the fact that the problem itself is often not well defined (Guilford 1950; Newell and Simon 1972). In contrast to studies of choice in which researchers tend "to consider problem representations as given by the structure of the task" (Bettman, Luce, and Payne 1998, 208), there may be an infinite number of satisfactory solutions to a creative challenge, depending upon how the individual constructs the problem representation. Further complicating matters is that, in any constructive process, a number of environmental or individual factors may constrain the structure and content of the plan.

For example, assume that a consumer has the need to put dinner on the table in 2 hr. To solve this problem requires either the retrieval of a previously constructed solution (e.g., call Dominos) or the construction of a new plan (e.g., check inventory and, based on the inputs available, prepare something suitable for dinner). If the latter constructive path is taken, the consumer will be constrained by factors such as ingredients in stock, time available, and equipment on hand. Our focus is on how such constraints influence the information processing that occurs during the construction of the solution and the creativity of the resulting outcome.

Creative Cognition

The work in creative cognition serves as our theoretical base for predicting the influence of constraints on consumers' information processing strategies during a generative task (Finke et al. 1992). The creative cognition approach is appealing in that it rejects the idea that "extraordinary forms of creativity are the products of minds that operate according to principles that are fundamentally different than those associated with normative cognition" (Ward, Smith, and Finke 1999, 191). As such, creative and noncreative thinking can be conceptualized along a continuum with no solid boundary delineating the two. This perspective enables the well-developed traditional concepts in cognitive psychology (e.g., encoding/retrieval, analogical thinking) to remain the basis for understanding creative thought. It is the extent to which creative cognitive processes are utilized in developing a solution that determines the likelihood that a more creative idea or product will result (Ward 2001).

When a problem exists, and no preexisting solution is readily available or salient, consumers must construct a solution. Although it has not been empirically tested using process measures, theoretical work summarized in the descriptive Geneplore model suggests that there are two key cognitive inputs involved in such a construction: generative and exploratory processes. In the initial stage of a creative task, generative processes are thought to be used to create preliminary mental representations of a solution, called "preinventive structures," that serve as a precursor to the final creative product (Finke et al. 1992, 19). These prein-

ventive structures may include representations of three-dimensional objects, category exemplars, and mental models of physical or conceptual systems (Ward 2001). In the dinner example given above, the ingredients (e.g., peanut butter, spaghetti noodles, carrots, and a can of tuna) may serve as the primary elements that form a preinventive structure for the dinner solution.

The generative processes used to construct these representations have received extensive attention in both psychology and marketing: the retrieval of existing structures from memory (e.g., Perkins 1981), the creation of associations and combinations among the retrieved structures (e.g., Murphy 1988), and analogical transfer (e.g., Gentner 1989). In the dinner example, simple aided recall (e.g., opening the pantry door) could act as the primary generative process. Once a preinventive structure has been generated, people then search for different meanings to attach to and/or to interpret the rudimentary solution. One basic way of interpretation is to search for potential functions. Other exploratory processes often used to attach meaning to these novel forms include evaluating the structure(s) from different contexts or perspectives, interpreting it as a possible solution to a salient problem, and/or searching for limitations suggested by the structure's form. In the dinner example, one could examine the subset of ingredients and search for interpretations of the collective grouping (e.g., the makings of an Asian stir-fry).

If the exploration yields a satisfactory interpretation of the preinventive structure, the constructive path to a creative product or idea is relatively short. Alternatively, the exploration may not be successful. For example, one could start with the subset of ingredients listed above and have trouble seeing a possible satisfactory dinner outcome emerging. When the exploration yields such an incomplete interpretation of the structure, new knowledge bases may need to be retrieved to modify and augment the preinventive structure to meet the desired goal. This could involve a more thorough search of the pantry that might yield the discovery of a new input (e.g., sun-dried tomatoes), which in turn, might trigger an Italian food interpretation.

As this example indicates, creative processes involve cycling between generation and exploration, with the preinventive form altered and updated with each cycle until a satisfactory product is achieved. This cycling often occurs spontaneously, with little conscious or observable demarcation between the two processes. Thus, we deem evidence of constructive processes, in which interpretations of functionality follow from the form(s), to be an indicator of creative cognitive processes with both generative and exploratory processes subsumed under this label.

The Influence of Constraints on Creative Processes

If creative processes are thought to significantly enhance the likelihood of achieving a creative outcome, it is critical to understand the factors that prompt their use. We propose

that, when certain constraints are active during a creative task, more creative processes will be employed. When constraints are not operating, a consumer can often recall an existing solution to the active problem (Barsalou 1991; Park and Smith 1989). Ward (1994) refers to this top-down process as following the "path-of-least-resistance," or POLR strategy, where the default approach in creative tasks is to implement the first solution that comes to mind, either based on a previous solution or a category exemplar. Only when constraints are operating are people likely to stray from the POLR because to do so requires more cognitive resources and creates more uncertainty in the outcome. Thus, the unconstrained consumer could successfully implement the pre-existing Dominos plan, using few creative processes to solve their problem. Alternatively, a consumer operating under constraints may have to construct a dinner solution. What types of constraints are likely to throw consumers off the path of least resistance?

Input Restrictions. One key constraint in a creative task may be the set of inputs available to solve the problem. When following a POLR, consumers will first retrieve a specific solution and begin the process of identifying the set of inputs required to implement it. If consumers are operating without constraints, they can simply collect or purchase each of the identified inputs and, without interruption, execute the well-known plan. More typically, however, consumers will find themselves limited to the inputs they have on hand by either acquisition costs (if they are unable or unwilling to leave the house to shop) or by budgetary constraints (if they cannot afford to purchase one or more of the identified inputs). Thus, under certain conditions described below, input restrictions may force consumers to deviate from their top-down POLR strategy in favor of a more constructive creative processing approach.

Input Requirements. A second type of constraint that may be operating in a creative problem solving context is the requirement to include specific types of inputs in a given solution. For example, in order to meet a family's nutritional needs, inputs from basic food groups may be required. Alternatively, there may be an input on hand that a consumer may feel compelled to include in the solution (e.g., chicken that has an approaching expiration date). In these situations, the identified input(s) may not be consistent with a well-known solution, and the consumer, again under certain conditions, may have to move off the POLR and use more creative processing to explore new meanings and/or roles for that input.

The Conditions under Which Input Constraints Force Consumers off the POLR. When inputs are restricted or required, consumers may find themselves unable to implement the first solution they retrieve. At this point, they may attempt to retrieve another solution to the problem, one which utilizes the set of inputs on hand, and follow a top-down processing strategy along a second POLR. Alternatively, they may begin constructing a solution using creative

processing to assemble and interpret the set of inputs that are on hand and must be used. Which of these two options will be chosen is likely to be determined by the extent to which other constraints are also operating. Specifically, if inputs are not restricted but some input requirements are constraining the outcome, consumers may use the required inputs as cues to activate a well-known solution. The activated solution would then guide the selection of inputs from the nonrestricted set, and consumers would still follow a top-down processing strategy, remaining on a POLR, and implement a well-known solution. Conversely, if inputs are restricted but no input requirements are constraining the outcome, consumers will be free to select any subset of the inputs that are available and include them in the solution to the problem. In this case, one or more of the available inputs may activate a well-known solution. The solution, in turn, can be used to guide the consumer's decisions on which inputs to include or exclude, and the activated POLR can then be implemented. Again, consumers are likely to process in a top-down fashion.

When inputs are both restricted and required, we expect that the constraints' synergy will compel consumers' use of creative processes in constructing a solution. In this highly constrained situation, the likelihood of a known solution matching the inputs designated for the solution is extremely low. Thus, consumers will be forced off of any known POLR, having to mentally combine the inputs in different ways, to search for a satisfactory interpretation, and to cycle back and forth until they have reached an acceptable solution. More formally, we predict:

- H1:** When inputs are both restricted and required, participants will deviate from the path of least resistance, showing more evidence of creative cognitive processing than participants for whom one or both of the constraints are relaxed.

The Influence of Creative Processing on the Judged Creativity of the Outcome

Two factors are considered to be critical components in the assessment of a product's creativity: its novelty (e.g., originality, uniqueness) and its appropriateness (e.g., usefulness, effectiveness) (Gardner 1993; Sternberg and Lubart 1999). While theoretical support for these two underlying dimensions is widespread, there is only a limited amount of psychometric study on measurement of creativity (Amabile 1996). In most cases, the two dimensions are rated using external judges, and creativity is determined by simply summing the ratings on each of the two dimensions (Plucker and Renzulli 1999). However, this technique implicitly assumes that overall creativity is a simple linear combination of novelty and appropriateness and that both dimensions are similarly influenced by situational or individual factors. In this research, we examine the two dimensions separately for both practical and theoretical reasons.

Practically, the novelty dimension is "the most widely

respected" of the two traits (Barron 1995; Dahl and Moreau 2002; Runco and Sakamoto 1999, 64), and as such, we have an incentive to isolate its unique antecedents. Theoretically, we expect that creative cognitive processes are likely to be positively related to novelty. Recall that these creative processes are most likely to occur when an individual is forced off a POLR and employs more exploratory, flexible, and divergent thinking (Finke et al. 1992). This type of thinking is likely to lead to more variable, and thus more novel, interpretations and outcomes (Stokes 2001). Work by Dahl, Chattopadhyay, and Gorn (1999, 21) suggests that, when the individual remains on a POLR, basing designs "on previous experiences reduces the diversity of images generated, and therefore, the originality of the design solutions." Thus, we make the following formal prediction:

H2a: Creative cognitive processes will be positively related to the judged novelty of the outcome produced.

The same creative processes that are expected to produce more novel outcomes, however, are also likely to result in ideas that have never been tested or implemented. While a diverse and variable set of images is likely to lead to more original ideas, the type of thinking that produces them may "lead to fanciful design ideas that have little relevance to the customer" (Dahl et al. 1999, 21; see also Jansson and Smith 1991). As such, ideas produced when an individual is off a POLR may result in ideas that are neither predictable nor appropriate.

H2b: Creative cognitive processes will be negatively related to the judged appropriateness of the outcome produced.

STUDY 1

Method

Creative Task. Under the guise of a "new products study," we gave all participants the same final goal, "to design a toy, anything a child (age 5–11) can use to play with." Following this instruction, all participants saw 20 shapes (fig. 1) that, subject to the manipulations described below, could serve as components for their toy idea (see Finke et al. 1992, 66).

Design and Procedure. Two factors were manipulated between subjects: input restrictions and input requirements. To manipulate input restrictions, participants either selected five component parts to be used in the toy idea ("they choose") or were randomly assigned the five parts ("we choose"). To manipulate input requirements, the participants were either allowed to use as many of the selected five parts ("use as many") or they were told that they must use all five of the parts ("use all"). Two aspects of the second manipulation are important to note: first, it occurred after the set of five parts was finalized; second, it represents the extreme case with all parts required.

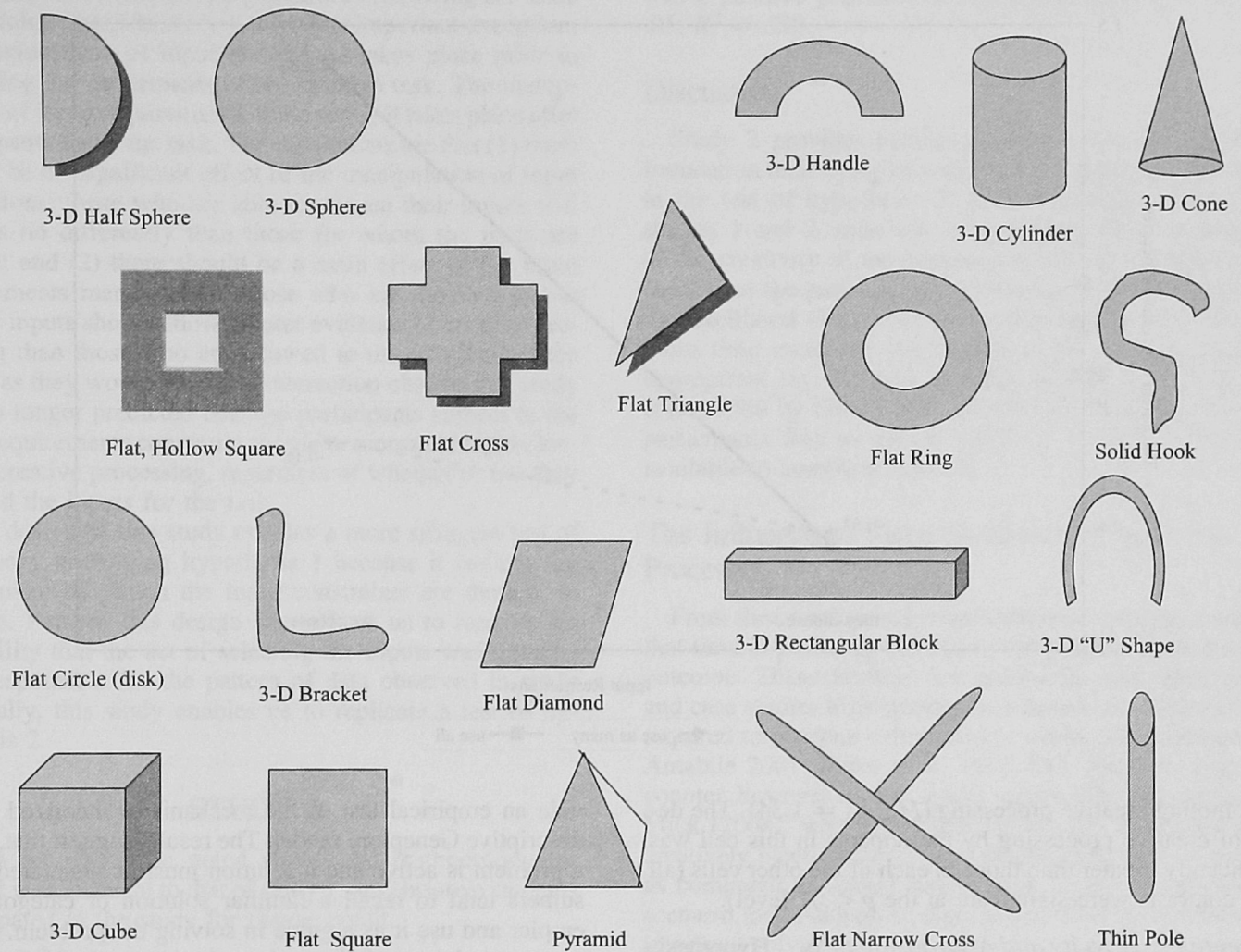
Participants were 96 undergraduates from a midwestern university who were randomly assigned to one of the four experimental conditions. Participants were run in groups of two to five, given the cover story, and read the description of the task. Once they knew that they were to create a toy, participants were each given the two pages containing the shapes (fig. 1). For participants in the "we choose" condition, a 20-sided die was used to randomly preselect five shapes. Participants in the "they choose" condition were simply asked to select five shapes for their idea.

Once the five parts were selected, participants were either instructed to "use as many or as few of the 5 selected parts" or to "use all 5 selected parts" to come up with their toy idea. Participants could only use each part once and were not allowed to use any of the nonselected parts. Scrap paper was handed out, and when they had a final design, they were asked to draw it on the first page of the experimental booklet. No time limit was imposed.

Dependent Measures. To assess the degree to which creative cognitive processes (generative and exploratory) were operating during the development of the toy idea, we asked all participants, upon completion of the task, to describe the process they had used to come up with their design. Two research assistants, blind to the conditions of the participants, coded the resulting written protocols. Since no prior research based on the Geneplore model has employed process measures, we constructed a scale based on the model. This six-item scale was designed to capture the degree to which participants followed a top-down process, retrieving a known exemplar and fashioning the parts to fit the model, or followed a bottom-up constructive strategy employing creative processes. The coders responded to the following items (using seven-point scales): "At what stage did the participant get the primary idea for the toy and its use? (at the beginning vs. at the end)"; "Did the participant initially try to make a specific type of toy (e.g., a boat, a doll)? (not at all vs. very much)"; "Shapes vs. known toys dictated the final idea (not at all vs. very much)"; "The process was top-down vs. bottom-up (not at all vs. very much)." The coders also indicated the degree to which they agreed with the following statements: "The idea came first and guided the way the shapes went together (not at all vs. very much)"; "form followed function vs. function followed form (not at all vs. very much)." The correlations between the coders on each item were all positive and significant, ranging from .56 to .87 (all p 's < .01). Responses were standardized within judge and then averaged for each item. Factor analysis indicated all six items loaded on the same factor. Thus, the items were summed to form an index capturing the extent of generative and exploratory processes ($M = 0$, range: -4 to 3.5).

Following the methodology that Goldenberg et al. (1999; see also Dahl and Moreau 2002) employed, we invited three senior design professionals to participate as expert judges in the evaluation of the novelty and appropriateness of the resulting designs. All three professionals held positions as product designers and had extensive training and experience

FIGURE 1
CHOICE OF SHAPES USED IN THE STUDIES



in consumer product design. The judges were blind to the identity of the students, to one another, and to the purpose of the experiment. Three separate booklets were prepared, each with a different random order of the 96 designs. Judges completed three seven-point scales measuring novelty (not at all original/very original, not at all innovative/very innovative, not at all creative/very creative) and three scales measuring appropriateness (not at all practical/very practical, not at all effective/very effective, not at all useful/very useful) for each of the toy ideas. A factor analysis confirmed the existence of two distinct dimensions. Each set of three items was then averaged to form a novelty and an appropriateness index for each design solution, and each judge's index was standardized and averaged to form overall indices of the two dimensions (all α 's > .80).

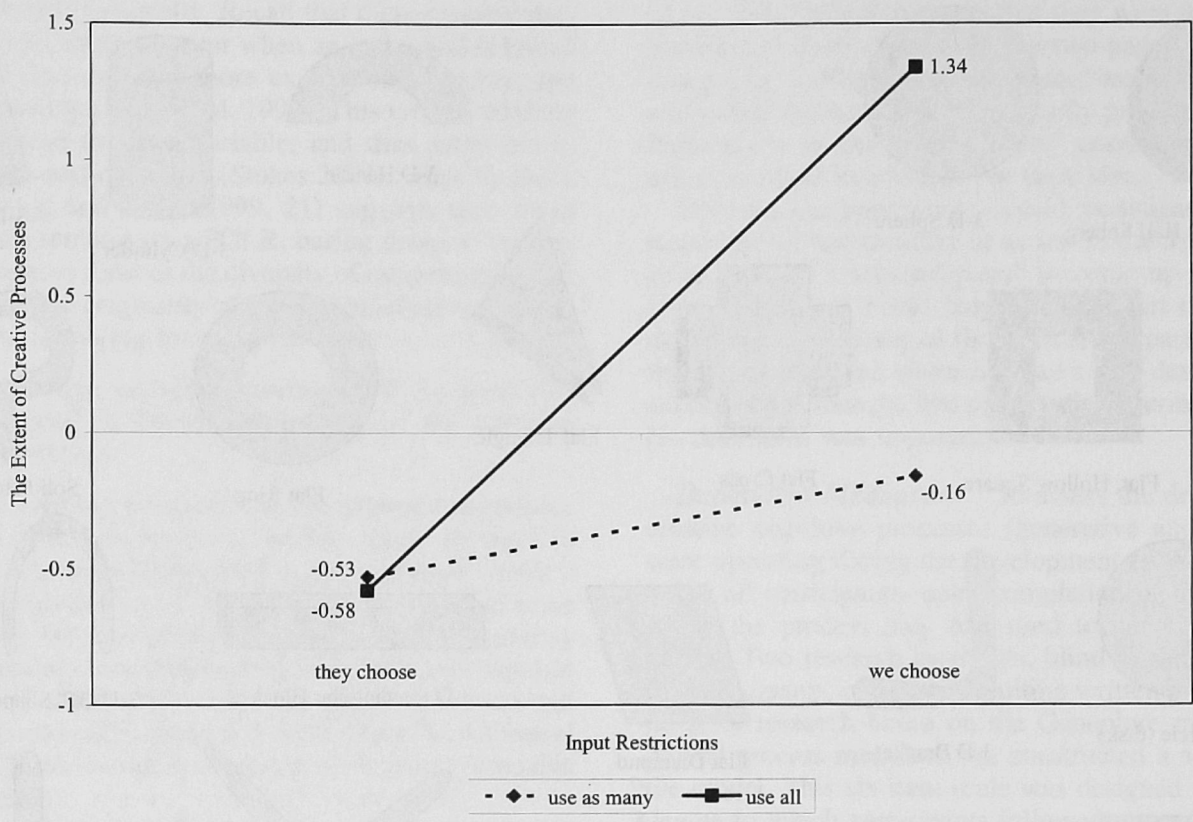
The experimenter noted the amount of time the participant spent doing the creative activity, from the time they began until they handed in the final design. Thomas Edison stated that "genius is 1% inspiration and 99% perspiration," and most creativity researchers acknowledge that hard work mat-

ters (Amabile 2001). Thus, we control for time in the first two studies, and in study 3 we manipulate it to better understand its role in the creative process.

Results

Creative Processes. A two-way ANCOVA was used to test the influence of constraints on creative processes. Input restrictions (we choose [we] vs. they choose [they]), input requirements (use as many [as many] vs. use all [all]), and one covariate (time) served as the independent factors. The analysis revealed a main effect of input restrictions ($F(1, 95) = 9.20, p < .01$), showing that, when we selected the parts, participants had a tendency to process more in a constructive, creative fashion than in a top-down, goal-directed one ($M_{we} = .64$ vs. $M_{they} = -.56$). Inspection of the means, however, highlights the significant interaction between the two constraints predicted by hypothesis 1 ($F(1, 95) = 3.96, p < .05$). This interaction, shown in figure 2, demonstrates the synergistic effects of the two constraints

FIGURE 2
THE INFLUENCE OF INPUT CONSTRAINTS ON CREATIVE PROCESSES (STUDY 1)



in promoting creative processing ($M_{we, all} = 1.34$). The degree of creative processing by participants in this cell was significantly greater than those in each of the other cells (all three contrasts were significant at the $p < .01$ level).

Creativity: Novelty and Appropriateness. Hypothesis 2 predicts, first, that creative processes will be positively related to the judged novelty of the outcome produced but, second, will be negatively related to its appropriateness. To test this hypothesis, we ran two regression analyses using novelty and appropriateness as the dependent measures. Both models included as predictors the two experimental factors, their interaction, one covariate (time), and the creative processing index. The results support hypothesis 2a but not 2b. For the novelty of the outcome, both the creative processing index (standardized $\beta = .28, p < .05$) and time ($\beta = .27, p < .05$) were significant positive predictors ($R^2 = .26$). For the appropriateness of the outcome, however, there were no significant predictors, and the overall model was not significant. This finding suggests that deviating from a POLR enhances the novelty of the outcome but does not significantly improve or detract from the appropriateness of the solution.

Discussion

By capturing and evaluating participants' processing strategies during a generative task, this study is the first to pro-

vide an empirical test of the mechanisms theorized in the descriptive Geneplore model. The results suggest that, when a problem is active and a solution must be generated, consumers tend to recall a familiar solution or category exemplar and use it as a guide in solving the problem. While many creativity techniques (e.g., brainstorming) encourage unconstrained thinking, our results paradoxically suggest that placing constraints on the generative task may increase the amount of creative processing. Only when inputs were both restricted and required were participants more likely to process creatively, constructing different forms and searching for possible "toy" interpretations from the fixed set of inputs.

Our theory explains this result by suggesting that, in the conditions where one or both constraints were relaxed, participants were able to retrieve a known toy exemplar and to select or eliminate inputs to conform to the known solution. If no known solution or relevant exemplar was available to guide the selection or elimination of the inputs, our theory would predict that the input constraints would not have a significant influence. For example, if the participants who were able to choose their inputs were asked to do so prior to being introduced to the problem "to make a toy," no path of least resistance could be followed. These participants would use some decision rule to guide their selection of the five inputs, but the rule would likely be irrelevant to the actual problem (once it was revealed). Thus, we would expect that,

when participants select their inputs in the absence of a known solution, their creative processes should be no different from those for whom inputs were randomly chosen.

In study 2, we test this proposition by following the same methodology used in study 1, with one important exception: the manipulation of input restrictions takes place prior to informing the participants of the creative task. The manipulation of input requirements, however, still takes place after participants know the task. The predictions are that (1) there should be no significant effect of the manipulation of input restrictions: those who are able to choose their inputs will process no differently than those for whom the parts are chosen; and (2) there should be a main effect of the input requirements manipulation: those who are required to use all five inputs should show greater evidence of creative processing than those who are allowed to use as many of the inputs as they would like. The interaction observed in study 1 is no longer predicted because participants subject to the input requirements constraint should demonstrate higher levels of creative processing, regardless of whether or not they selected the inputs for the task.

The design of this study enables a more stringent test of the theory underlying hypothesis 1 because it isolates the mechanism by which the input constraints are thought to operate. Further, this design also allows us to remove the possibility that the act of selecting the inputs was in some way responsible for the pattern of data observed in study 1. Finally, this study enables us to replicate a test of hypothesis 2.

STUDY 2

With the exception noted above, the methodology for study 2 was identical to that of study 1. Seventy-two students participated in the study for course credit.

Results

Creative Processes. A two-way ANCOVA was used to test the influence of constraints on creative processes. Input restrictions (we choose [we] vs. they choose [they]), input requirements (use as many [as many] vs. use all [all]), and one covariate (time) served as the independent factors. As predicted, the analysis revealed only a main effect of input requirements ($F(1, 71) = 6.63, p < .05$) with those who were required to use all five inputs showing more evidence of creative processing than those who were able to use as many of the five parts as they chose ($M_{\text{all}} = .99$ vs. $M_{\text{as many}} = -.94$). The input restriction manipulation did not significantly influence creative processing, and there was no evidence of synergy between the two input constraints.

Creativity: Novelty and Appropriateness. Recall that hypothesis 2 predicts that creative processes will be positively related to the judged novelty of the outcome produced but will not be significantly related to its appropriateness. Using the exact same regression models used in study 1, we again find support for hypothesis 2a but not 2b. The

creative processing index positively predicted the novelty of the outcome (standardized $\beta = .36, p < .01; R^2 = .22$) but was not significantly related to its appropriateness. Time was a positive predictor of appropriateness ($\beta = .25, p < .05; R^2 = .20$).

Discussion

Study 2 provides additional support for the theoretical foundation underlying hypothesis 1 and replicates the results in the test of hypothesis 2. It is interesting that, in both studies 1 and 2, time was a significant, positive predictor of the creativity of the outcomes produced. In study 1, the more time the participant spent on the task, the higher was the likelihood of producing a more novel toy; in study 2, more time increased the likelihood of producing a more appropriate toy. In both of these studies, time was only constrained by the 50 min. allocated to each session, with participants free to use as much or as little of the time available to complete the task.

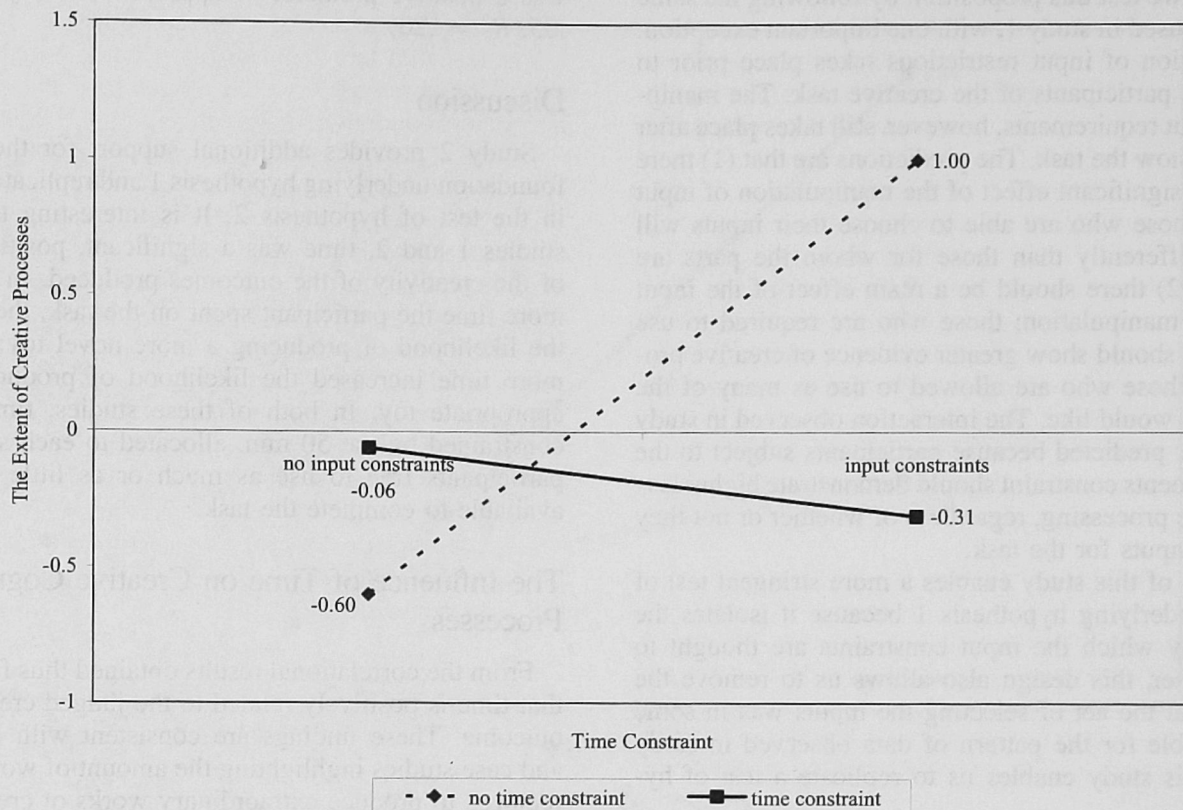
The Influence of Time on Creative Cognitive Processes

From the correlational results obtained thus far, it appears that time is positively related to the judged creativity of an outcome. These findings are consistent with observations and case studies highlighting the amount of work and effort required to produce extraordinary works of creativity (e.g., Amabile 2001; Finke et al. 1992, 84). These findings run counter, however, to the results reported by Burroughs and Mick (2004), who found that individuals responded more creatively when facing a "non-debilitating" time constraint, as compared to having ample time. These authors used a scenario methodology to demonstrate that participants who imagined solving a wardrobe problem (scuffed shoes) in a 3 hr. period produced less creative solutions than those who imagined solving the same problem in only 2 min. In motivating the hypothesis predicting this finding, Burroughs and Mick (2004) cite work by Ridgeway and Price (1991) that suggests that time pressure often restricts access to products and markets, which in turn, may enhance creativity by inhibiting conventional responses. In an attempt to reconcile this apparent contradiction between our findings and the current literature, we designed a third study to try to isolate the influence of time pressure, independent of its influence on input constraints. This design enabled us to subject participants to actual time constraints and to observe the effects on their cognitive processing.

During any creative task, individuals distribute their time between the cognitive construction of the solution and its realization. Thus, individuals who spend the same total amount of time completing a creative task may devote different amounts of that time to the cognitive construction of the solution. As evidenced in our earlier results, time and creative cognitive processing independently influenced the judged novelty of the outcome. The highly constrained participants, who showed more evidence of creative processing,

FIGURE 3

THE INTERACTION BETWEEN TIME AND INPUT CONSTRAINTS ON CREATIVE PROCESSES (STUDY 3)



were likely to have allocated a greater portion of their total task time to constructing rather than realizing (i.e., drawing) their toy idea than the other participants. Because construction necessarily precedes realization, a time constraint should therefore differentially affect the amount of creative processing engaged in by those who are highly constrained as compared to those who are not. More formally, we predict the following:

- H3:** When inputs are constrained, participants with unlimited time will show more evidence of creative processing than those for whom time is constrained. When inputs are not constrained, participants' creative processing will not be significantly influenced by a time constraint.

STUDY 3

To build on our earlier findings, we employed the same task and the same basic methodology that was used in study 1. Two factors were manipulated between subjects: (1) input constraints (both [IC] vs. no input constraints [NIC] and (2) time constraints (5 min. [TC] vs. 50 min. [NTC]).

Results

Manipulation Check. Participants provided a self-reported measure of the time they spent working on the creative task (independent of the time they spent being introduced to the study and the time they spent executing the manipulations and completing the final questionnaire). A two-way ANOVA confirmed that only the time manipulation significantly influenced the actual time spent on the task ($F(1, 130) = 56.42, p < .0001$), with those subject to the constraint spending an average of 2.9 min. on the task compared to the 8.6 min. average of those who were unrestricted.

Creative Processes. A two-way ANOVA was used to test hypothesis 3, which predicted the interactive influence of time and input constraints on creative processes. The only significant effect was the hypothesized interaction ($F(1, 130) = 5.02, p < .05$), which is shown in figure 3. Consistent with hypothesis 3, when inputs were constrained, the time constraint significantly decreased the amount of creative processing ($M_{IC, NTC} = 1.00$ vs. $M_{IC, TC} = -.31, F(1, 65) = 4.95, p < .05$). However, when inputs were unconstrained, the time constraint did not significantly influence creative processing ($M_{NIC, NTC} = -.60$ vs. $M_{NIC, TC} = -.06, F(1, 65) = .86, NS$).

Creativity: Novelty and Appropriateness. Two regression models were again used to test hypothesis 2. With

novelty and appropriateness as the dependent measures and the two experimental factors, their interaction, and the creative processing index as the independent measures, we again find support for hypothesis 2. The creative processing index positively predicted the novelty of the outcome (standardized $\beta = .17, p < .05$) but was not significantly related to its appropriateness. In this case, the effects of the input constraints were also significant and positive in predicting both novelty (standardized $\beta = .35, p < .01$) and appropriateness (standardized $\beta = .31, p < .05$; $R^2 = .16$).

By separating the effects of time and input constraints, this study enabled us to better understand the equivocal results found in the existing literature on creativity. In consumption situations, time pressure may restrict the types of inputs that are available for the consumer to use in solving a problem, but it appears to be the restriction of the parts, and not the time pressure itself, that increases the creativity of the judged outcomes. If consumers have limited time, even when inputs are restricted, their ability to process creatively is also reduced.

GENERAL DISCUSSION

The creativity literature supports the theoretical argument that constraining certain aspects of a generative task increases the creativity of the output. However, to date, the mechanisms by which the constraints are thought to operate are not well specified, and no empirical work has attempted to document the intervening cognitive processes. Thus, the primary contribution of our research is showing how and under what conditions constraints influence the type of information processing strategy employed in a generative task. Overall, we find that the tendency to follow a path of least resistance is quite robust. Only when participants were highly constrained did they abandon a top-down, exemplar-driven approach in exchange for more constructive, creative processes. While these creative processes require more time to complete, as shown in study 3, they consistently predicted the judged novelty of the outcome in all three studies.

Our process measures were able to distinguish top-down processes from more constructive, creative processes, and thus, to show when participants had departed from a path of least resistance. However, these creative processes theoretically subsume two distinct types of cognitive activity: generative and exploratory thought. Because our process measures were designed to make a higher-level distinction (on a POLR vs. off a POLR), they were not sensitive enough to distinguish between the two types of creative processes. Future research could focus only on those participants who are operating off a path of least resistance, with the goals of (1) distinguishing generative from exploratory activities and (2) discerning whether these two types of processes have different antecedents and consequences.

An opportunity for future research also lies in further distinguishing the role of time in producing creative outcomes. Across our first two studies, time was shown to be inconsistent in its benefits for producing novel and appropriate toy designs. An analysis that parses how time is al-

located across the creative process or one that focuses exclusively on a sample of highly creative individuals could help in resolving this inconsistency. More broadly, future research might also examine the role and importance of incubation time in realizing creative ideas.

Our research has focused solely on cognitive processes, a decision that enabled us to understand the fundamental mechanisms underlying generative thought. Many other factors, both at the situational and the individual level, are also likely to influence the creativity of an outcome in a given task. For example, motivation, involvement, confidence, knowledge, and intelligence are all likely moderators of the creative process (e.g., Amabile 1996, Boden 1994; Weisberg 1999). However, we believe that these important factors will exert their influence through or in conjunction with the cognitive processes examined here. These additional factors have received significant attention in the marketing literature because they are both theoretically and managerially relevant to consumers' decision-making processes. We assert that they are also highly relevant to the creativity that consumers demonstrate in many consumption situations, and we hope that our work will stimulate such additional research in consumer behavior.

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