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Facilitating and Rewarding Creativity During New Product Development

In an effort to improve creativity in the new product development process, many firms offer incentive programs, creativity training programs, or both. However, creativity continues to be a construct that is not well understood in marketing, and little research has examined the joint influence of such initiatives on creative outcomes. As a result, there is considerable variance in the way firms approach these issues. A qualitative study of 20 firms indicates that 15 offered some type of incentive program, whereas only 7 engaged in creativity training (a subset of the firms used both). Given that previous research has consistently found that extrinsic rewards offered in isolation actually undermine the creative process (by reducing intrinsic motivation), it seems that many firms may be unwittingly hampering their own creative efforts. However, two experiments demonstrate that the effect of rewards can be made positive if offered in conjunction with appropriate training. Specifically, product creativity was highest when the monetary reward was paired with a dedicated creative training technique. The training alters the influence of the reward such that it reinforces, rather than undermines, intrinsic motivation. Managers can improve the effectiveness of their creative efforts by leveraging the use of incentives and training in combination.

Keywords: creativity, creativity training, extrinsic rewards, intrinsic motivation, new product development

> Creativity has always been prized in American society, but it's never really been understood. While our creativity scores decline unchecked, the current national strategy for creativity consists of little more than praying for a Greek muse to drop by our houses. The problems we face now, and in the future, simply demand that we do more than just hope for inspiration to strike.
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> —Bronson and Merryman (2010, p. 49)

Corporations have a vested interest in promoting creativity among their employees and stakeholders. The success of new product development (NPD) efforts, for example, depends to a great extent on the creativity of the ideas underlying them (Scanlon and Jana 2007). In a recent IBM poll of 1500 chief executive officers (CEOs), creativity even edged out integrity as the most important leadership quality for business success (Carr 2010). Although business leaders broadly acknowledge the importance of creativity, the methods for achieving creative thought remain elusive.

Creativity is commonly defined as the production of something that is both original and useful (Amabile 1996; Bronson and Merryman 2010; Runco 1997; Smith, Ward, and Finke 1995; Sternberg 1999). For example, a creative new product would be one that differs from existing products in a novel way but is still effective (or even more effective) in accomplishing the purpose for which it was intended. Although this definition of creativity is widely accepted, Hauser, Tellis, and Griffin (2006) argue that marketing academics must do much more to provide insights that help firms achieve their creative aims. In their influential review of innovation in marketing, Hauser, Tellis, and Griffin name creativity in the "fuzzy front-end" of NPD as a critical research priority. Specifically, they call for more research on such issues as how to structure incentives to motivate employees to be more creative and how to develop tools to facilitate creativity.

Our research directly addresses these issues by first examining firms' actual approaches to encouraging and rewarding creative thought. In this initial qualitative study, we interview senior executives at 20 firms to understand the role of creativity in their organizations and how it is fostered. We then conduct two experiments to test the effectiveness of two key managerial tools, rewards and creativity training, in enhancing an individual's creative performance.

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These studies find that the interaction of these two variables matters when producing creative product outcomes. Namely, we find that creativity training alters the reward influence such that it turns a typically neutral or negative effect into a positive one. Although previous work has examined the influence of extrinsic rewards and the influence of creativity training independently, little research has considered their joint influence. This is an important oversight, given the prevalence of training and incentive programs in industry.

Our studies contribute to the marketing literature in two ways. Managerially, our qualitative study establishes the variance in approaches and beliefs that firms have in encouraging creative thought. Our experiments then demonstrate how rewards and creativity training, both of which are easily implemented, may enhance the creative thinking of those engaged in the fuzzy front-end of NPD.

Theoretically, our experimental results introduce an important moderating factor in the relationship between rewards and creative product outcomes. The effect of extrinsic incentives (e.g., rewards) on creativity has been a point of long-standing debate within both marketing and psychology (see, e.g., Cameron and Pierce 1994; Deci, Koestner, and Ryan 1999a, b; Eisenberger, Pierce, and Cameron 1999; Eisenberger and Shanock 2003; Lepper, Green, and Nisbett 1973; Lepper, Keavney, and Drake 1996; Ryan and Deci 1996). The majority of these studies find that rewards undermine the creative process by diminishing intrinsic motivation (i.e., the motivation to engage in an activity for its own sake; see Collins and Amabile 1999; Csikszentmihalyi and Getzels 1973; Deci, Koestner, and Ryan 1999a; Ryan and Deci 2000).

A few empirical studies using schoolchildren, however, find that rewards can enhance creativity when some form of creativity training accompanies them (e.g. Eisenberger, Armeli and Pretz 1998; Eisenberger and Selbst 1994). The training cues children that creativity is expected (and rewarded) by others (e.g., teachers, parents), and therefore, they exert greater effort in this direction. Our findings are novel, however, because they demonstrate that rewards, when accompanied by appropriate training, can enhance (not diminish) intrinsic motivation, which in turn facilitates creative outcomes. Intrinsic motivation is particularly important in complex and effortful creativity tasks such as NPD.

Study 1

The goal of this study was to better understand managers' strategies for obtaining and rewarding creative thought in their organizations. We recruited respondents by using a snowball technique, in which we began with our own university contacts and relied on informants to identify additional people who would be particularly knowledgeable about this topic. This technique produced 20 interviews with a variety of marketing and NPD executives (for company and contact profiles, see Table 1). Our sample was diverse and included firms with annual revenues ranging from $25 million to $79 billion; in industries ranging from chemicals to natural foods; and in countries in North America, Europe, and Asia. Interviews lasted from 25 to 75 minutes (the average duration was 40 minutes). Each interview was recorded and transcribed (with the exception of two interviews with informants who declined to be recorded).

The interviews followed a semistructured format in which we used an initial set of prepared questions to guide the interview, supplemented with specific follow-up questions based on each informant's individual responses. We drew this

TABLE 1
Firm Descriptions

Company	Industry	Informant	Annual Revenue (in US$)
1	Consumer products	North American category director	$79 billion
2	Foods/snack foods	Asia Pacific president	$48 billion
3	Consumer electronics	Product market research manager	$43 billion
4	Household appliances	Vice president of innovation and global product development	$19 billion
5	Specialty chemicals	President of marketing: Asia Pacific and Middle East	$15 billion
6	Medical devices/supplies	Vice president of research and development	$10 billion
7	Hotels/hospitality	Global director of luxury and lifestyle brands	$9 billion
8	Confectionary	Global chocolate director	$8 billion
9	Retail apparel	Business integration manager	$8 billion
10	Energy	Project director	$6 billion
11	Foods and cereals	Brand manager	$5 billion
12	Industrial products	Director of product development	$5 billion
13	Fragrances/beauty products	Regional managing director—Far East	$4 billion
14	Processed foods and meats	Director of product development and innovation	$2 billion
15	Liquor distribution	Director of human resources	$900 million
16	Natural foods	Vice president of marketing and product innovation	$300 million
17	Railway travel	President	$200 million
18	Network software	Vice president of marketing	$50 million
19	Children's apparel	President and CEO	$30 million
20	Apparel design	President and CEO	$25 million

approach from grounded theory and selected it because, of the major qualitative techniques, it is among the most amenable to mixed-method research (Corbin and Strauss 2008; Creswell 2008). It has also been used successfully in numerous past marketing studies (see, e.g., Dahl and Moreau 2007; Flint, Woodruff, and Gardial 2002; Fournier and Mick 1999; Keaveney 1995; Noble and Mokwa 1999). The three general questions that guided the interviews were as follows: (1) In what areas or functions within your company is creativity deemed important and valuable? (2) What structures or programs are in place to encourage creative thinking among your employees? and (3) Do you use any type of incentive programs to enhance the creativity of your employees?

The first of the three questions yielded relatively consistent results across the diverse set of firms. Of the 20 respondents, 17 mentioned product innovation and NPD as the areas in which creativity was most critical to their organization, and 11 also mentioned that marketing benefited greatly from creative thought. Six respondents mentioned internal processes and operations as key areas, and one interviewee mentioned that creativity had been critical in the cost-cutting initiatives his firm had taken. The second two questions, however, yielded significantly more variance across the firms, and responses to each of those questions are described in greater detail in the following section.

How Firms Obtain Creative Insights

As Table 2 highlights, the firms in our sample used a wide variety of methods to obtain creative insights. Some of these firms outsource many of their creative tasks and rely on outside consultants to assist them in their creative endeavors. This practice is used much more heavily by the larger firms in our sample (firms are numbered in reverse order of size). When asked why they outsource their creative activities, one respondent explained that it is because "it's difficult, and there are people over time who build a great amount of expertise in the innovation area." That said, an executive from one large firm with whom we spoke said that the company started out relying heavily on consultants but decided that creativity and innovation were too critical to outsource completely. Thus, the company now relies on a balanced model in which consulting firms are used to enhance its own internal innovation efforts.

Respondents from two firms reported that they either do their own internal creativity training (e.g., TRIZ) or encourage their employees to follow their proprietary approach to creativity (e.g., Converter; see Table 2). Five of the firms reported using informal brainstorming sessions on an ad hoc basis, whereas six firms did nothing to enhance the creativity of their employees. A respondent from one of the larger firms in this "no-strategy" category explained that "you can't teach creativity." However, this belief stands in direct contrast to a great deal of previous research noting just the opposite (for a review and meta-analysis see, e.g., Carr 2010; Scott, Leritz, and Mumford 2004a).

How Firms Incent and Reward Creative Insights

We observed similar variance in how the firms in our sample approach and use extrinsic incentives for rewarding creativity (see Table 3). Seven of our respondents, across firm size and industry, reported using some type of public recognition to identify and appreciate employees' and/or team contributions of creative ideas. Most of these rewards were described as nonfinancial (e.g., a plaque presented in a public forum such as an annual banquet). Similarly, five other firms reported using prizes as recognition for employees' or teams' creative accomplishments. These prizes tended to be small. One respondent described receiving "cheesy" retailer gift cards

TABLE 2
How Firms Approach Creative Insights

Approach to Creativity	Explanation	Firms Engaged	Key Quotes
Outsource	Hiring an outside ideation/innovation firm (e.g., Eureka Ranch, Strategos) for creative activities	1, 2, 4, 7, 8, 9, 11	"It's difficult, and there are people over time who build a great amount of expertise in the innovation area." – #8
Internal training: TRIZ	Training in a known method for generating innovative ideas; TRIZ provides tools for problem definition, system analysis, and an algorithmic approach to creativity	6	"We're training our six sigma people to be TRIZ facilitators so that we can do our training in-house. Typically, the engineers and scientists from R&D and manufacturing are the ones that go."
Internal approach: Converter	Using cross-functional teams that respond to a "catalyst stimulus" with a brainstorm followed by a fun, two-day excursion	14	"The last thing that we want people to do if we're going to improve our number-one branded product is to start thinking about our number-one branded product."
Internal activities: Informal brainstorming	Using product-focused ideation sessions	3, 5, 10, 16, 18	"We look for trends in different industries and brainstorm about how it is relevant to ours." – #16
None	Using no formal or informal approach for obtaining creative ideas	12, 13, 15, 17, 19, 20	"You can't teach creativity." – #13

Notes: Firm numbers refer to those listed in Table 1.

TABLE 3
How Firms Incent/Reward Creative Insights

Type of Incentive	Explanation	Firms Engaged	Key Quotes
Public recognition	Recognize individuals at public events (e.g., annual banquets) with nonfinancial awards	2, 5, 7, 8, 12, 15, 18	"We give nonfinancial awards across the organization… 'Best Product of the Year.'" – #8
Inclusion in the job description	Innovation and creativity are built into certain job descriptions; employees' evaluations reflect performance on these dimensions, and merit increases are affected by them	4, 5, 10, 17	"The innovation side is written into certain positions, so those people have incentives for innovation and creativity." – #10
Prizes	Employees or teams of employees receive gift certificates, trips, or dinners	3, 10, 14, 16, 18	"People with the highest scores on their ideas get gifts in ideation sessions." – #3
Financial bonus based on firm or team performance	Employees receive a bonus when the firm hits its financial or performances metrics for innovation	3, 5, 18	"Unless it gets business results, nothing gets monetary innovation awards." – #5
Financial bonus for individual	Employee receives a bonus when he or she obtains a patent or makes other significant NPD creativity contribution	1, 6	"You can get money for patent disclosure and a patent award… Disclosure is $1,000 and award is $10,000." – #6
None	No formal or informal extrinsic incentives for creative performance	9, 11, 13, 19, 20	"It [creativity] is in the culture and it's expected." – #19

Notes: Firm numbers refer to those listed in Table 1.

given for the "wackiest" ideas in a new product ideation session. However, in another firm the prize was much more substantial: a trip to Paris for the development team, awarded in conjunction with the launch of a promising new product.

Some firms used rewards with even more significant repercussions. At four firms in our sample, innovation and creativity were formal expectations of certain employees. The annual merit raises for these people depended in part on their performance in these areas. Three firms also used financial bonuses to reward a team's creative accomplishments, and two reported using bonuses to reward individual achievements. In one case, the reward approached $10,000 (for securing a patent). Interestingly, five of the firms in our sample reported using no extrinsic rewards. As one respondent explained, "Creativity is in the culture and it's just expected."

Innovation Consultants

One of the more interesting findings to emerge from these interviews is the large firms' reliance on outsourcing their creative efforts. Although this decision to outsource is consistent with the increased specialization characteristic of these large firms, it is also surprising, given their significant access to vast internal resources. To better understand how these innovation consultants develop and contribute creative ideas, we sought principals at three respected innovation consulting firms who, according to one of the CEOs, "teach people to fish." All three of these firms made heavy use of creativity training. As summarized by the president of one firm: "Creativity is 94% process and system; it's 6% employee. Most firms get it exactly backwards."

Not surprisingly, all three consulting firms were systematic in their approach to creativity. One firm trains its people in analogical thinking and visualization to improve ideation results. The second firm trains people to structure their ideation sessions into three levels of opportunities from which they start the ideation process. The third firm recognizes the value that constraints play in the creative process. To them, the key is combining discipline and processes to achieve creativity. Consultants either work with the firms' employees during ideation sessions or they do the creative development themselves with guidance from the firm.

The consultants did not have a great deal to offer regarding advising firms on the use of incentives and rewards. Two of the three respondents did not comment specifically on the role of extrinsic rewards. The third respondent came down solidly against them: "Just take away the extrinsic incentives."

Discussion

Overall, our findings from this qualitative study are consistent with research showing that firms overwhelmingly recognize the importance of creative thought in innovation and NPD (see Scanlon and Jana 2007). However, our results also show surprisingly little consistency across firms in obtaining and rewarding creative insights from their employees. Firms follow a variety of approaches for facilitating and rewarding creativity, and our findings reveal relatively extreme perspectives on whether creativity could be taught. However, considering the historical challenges involved in teaching creativity and the equivocal results reported in the academic literature, these extreme attitudes seem less surprising.

Although some firms believed in combining creativity training (e.g., TRIZ) with substantial extrinsic rewards (e.g., $10,000 for a patent filing), others believed that creativity could not be taught and/or that rewards were detrimental to creative efforts. Thus, to provide more clarity on the

relationship between extrinsic rewards and different types of creativity training, we used an experimental approach with creative tasks that closely approximate the types of challenges firms face in the early stages (e.g., the fuzzy front-end) of their NPD processes. In the following sections, we first review the literature on extrinsic rewards, training, and creativity and then describe our tests of the theories.

Extrinsic Rewards and Creativity

A considerable body of evidence now suggests that rewards undermine creativity (see Amabile 1996; Deci, Koestner, and Ryan 1999a). Rewards are believed to erode creativity by reducing intrinsic motivation (i.e., a person's inherent interest in the task or activity for its own sake). Intrinsically motivated people are often described as becoming absorbed in a task and deriving enjoyment from the challenge it provides. Conversely, those who experience low intrinsic interest find an activity to be tedious and boring. Because creativity is mentally taxing and often requires sustained effort, intrinsic motivation is considered critical to this process (see, e.g., Amabile 1996).

How do rewards diminish intrinsic motivation for creative tasks? The provision of a reward is believed to cause an interpretive shift in the person's reason for engaging in the activity. Effort shifts from being put forth out of sheer interest to being supplied strictly as a trade for compensation (Amabile 1996). Essentially, the provision of the reward causes the task to be "defined more narrowly (simply as a means to an extrinsic end, rather than as an opportunity for exploration and cognitive play)" (Amabile and Cheek 1988, p. 60). Again, because creativity usually requires sustained effort, this loss of intrinsic motivation is believed to more than offset whatever benefits the reward otherwise provides. Some of the earliest evidence of this effect came from the field of education, in which educators found that their attempts to rechannel children's natural curiosity into academic exercises (replete with grades, stars, and so forth) resulted in a sharp loss of interest (Lepper, Greene, and Nisbett 1973).

However, people do work for compensation, even in creative fields. Thus, researchers began to wonder whether extrinsic rewards must always undermine creativity. The "immunization studies" program, conducted by Hennessey and colleagues (Hennessey, Amabile and Martinage 1989; Hennessey and Zbikowski 1993), was one of the first studies to challenge this premise. These researchers speculated that people might be buffered against the demotivating effects of rewards, depending on their interpretation of the role of the reward in the creative process. They reasoned that a reward can be interpreted either as constraining (i.e., as an attempt to exert external control) or as informational (i.e., providing useful information). If perceived as informational, the reward could contribute to a positive affect and intrinsic motivation (Hennessey, Amabile, and Martinage 1989).

To test their premise, Hennessey and colleagues showed some students a videotape in which the intrinsic aspects of performing well in school were emphasized (e.g., how enjoyable it is to learn something new, the sense of accomplishment a person feels from working hard). Students in a control condition were shown no such video. Similarly, some students were offered an extrinsic reward as part of the study, whereas others were offered no such reward. Students were then asked to compose a brief story that was later evaluated for creativity. Consistent with their prediction, students who were shown the video *and* were offered a reward exhibited higher levels of creativity than students who had only been exposed to one condition or the other.

However, when Hennessey and colleagues attempted a more comprehensive replication of the original findings, they were unable to reverse the negative influence of extrinsic rewards, only to neutralize it (Hennessey and Zbikowski 1993). Given the difference between something beneficial versus something benign, they cautioned researchers not to be "too quick to abandon our original notions" of the negative influence of extrinsic rewards on creativity and to seek out new moderators of this relationship (Hennessey and Zbikowski 1993, p. 304). We propose that creativity training is one such moderator.

Creativity Training

A substantial body of creativity research has focused on whether it is possible to train ordinary people to be more creative (e.g., Basadur, Graen, and Green 1982; Gordon 1968; Khatena 2000; Osborn 1963; Renzulli 1986). The results from this research (conducted largely outside the business realm) show that creativity training can make a substantive difference. A meta-analysis by Scott, Leritz, and Mumford (2004a) reveals an average effect size of .68 for creativity training programs, whereas Ma (2006) reports an even higher effect size of .77. Indeed, research has shown that even a single training session can enhance creative abilities and outcomes (Clapham 1997; Dahl, Chattopadhyay, and Gorn 1999). Although early training programs were hit or miss, as research has uncovered the essential elements of the creative process (e.g., lateral connection, analogical reasoning, divergent and convergent thought), training techniques have become even more refined (e.g., Baer 1997; Khatena 2000; Parnes 1999).

Although a variety of approaches to creativity training have been developed over the years, two of the most prominent approaches are creative idea production training and creative imagery training (Scott, Leritz, and Mumford 2004b). Although these two forms vary in terms of objectives and approach, both make use of different types of visualization, and both have been shown to be effective in enhancing creativity (Scott, Leritz, and Mumford 2004b).

Creative Idea Production Training

Creative idea production training emphasizes the use of idea generation and elaboration in response to concrete and realistic problems and situations. This approach encourages the person to visualize how someone might experience a problem and new ways in which it can be solved (Finke 1997). A goal of creative idea production training is to leverage and enhance the mind's capacity for mental image manipulation (Newell and Simon 1972). An example of this type of training in the marketing literature comes from Dahl, Chattopadhyay, and Gorn (1999), who use the technique to induce young

engineers to think more empathetically about challenges that the elderly face while driving, particularly when trying to change a flat tire. By seeing a problem and its potential solutions through the eyes of another, engineers who received the training were able to substantially improve on the design of a traditional car jack, compared with their untrained counterparts. Creativity inherently involves a certain amount of trial and error; therefore, being able to mentally manipulate various solutions (without having to actually implement them all) can be of tremendous benefit to creative problem solving (Jay and Perkins 1997; Newall and Simon 1972).

Creative Imagery Training

In contrast, creative imagery training is less specific than idea production training. This family of techniques relies heavily on free association, with the goal of enhanced lateral thinking (i.e., making connections across distal conceptual planes) and, as such, tends to be more imaginative in emphasis. For this reason, unrealistic or improbable scenarios are often used to leverage the mind's capacity for visualization and conceptual manipulation. For example, Khatena's (2000) "divergent-symbolic" production task (one of the better-known creative imagery training techniques) asks participants to imagine a set of inanimate objects contained in a box coming to life. Participants are asked to write a story about these objects coming together to play. Although this exercise is highly improbable and not problem specific, it is designed to stimulate imaginative thinking and push conceptual boundaries with the understanding that such thinking may benefit creativity in subsequent unrelated tasks by helping participants break free of fixation (Scott, Leritz, and Mumford 2004b). Therefore, imagery training is designed to overcome mental blockages and produce moments of insight (Scott, Leritz, and Mumford 2004b).

Interaction Between Extrinsic Rewards and Creativity Training

There has been little research examining how extrinsic rewards influence the effectiveness of creativity training. As noted previously, training can positively influence creative outcomes, but why it does so remains an open question. The one marketing study that examines the relationship between creativity training and product outcomes (Dahl, Chattopadhyay, and Gorn 1999) does not include intrinsic motivation or extrinsic influences on the creative process. Therefore, the authors are unable to comment on how training influences intrinsic motivation or how extrinsic incentives might alter the equation. Does training work because it increases intrinsic task motivation, or does it work simply because it helps people work smarter at a creative task?

Training may do both: People may work smarter because they have better skills, and they may work harder because they are more intrinsically motivated (i.e., people are more naturally interested in things they believe they are good at doing). The answer to this question has implications for managers' strategies for facilitating creative thought. If training at least partly enhances intrinsic motivation, the provision of a reward could serve to further reinforce task engagement. This would coincide with the reality that people who work in creative fields do so because they are highly motivated and because they expect to be well compensated for their efforts. Therefore, managers who understand how to combine tools to maximize creative performance stand to enhance their firms' NPD efforts.

Overall, the lack of research on this interaction is surprising, especially with respect to NPD. The limited research into the joint influence of rewards and training on creativity (e.g., Eisenberger, Armeli, and Pretz 1998; Eisenberger and Selbst 1994) has occurred in the field of education. These studies reveal that incentives can be used to get children to produce more creative drawings, but only if the children are first primed to think of unusual uses for common objects. They suggest that the priming task cues children that creativity is expected and will be rewarded by others such as parents or teachers. Although such extrinsic influences may be sufficient to promote creativity in a children's drawing task (for which the mere choice to make a free drawing instead of copying one was sufficient to be deemed "creative"), the question remains whether they would be sufficient to sustain creative effort in more challenging tasks (Deci, Koestner, and Ryan 1999b). Given this, the applicability of these findings to a NPD context is probably limited.

Our view is that training could reverse the otherwise negative or neutralizing influence of rewards on creativity in an NPD task by bolstering intrinsic motivation. Because creativity training emphasizes divergent thinking, visualization, and exploration, it provides people with two distinct but important gifts: (1) the cognitive tools to actually work smarter and (2) a feeling of increased competence during the creative task. Research shows that when people feel more competent, their task enjoyment is increased (Dahl and Moreau 2007; Deci, Koestner, and Ryan 1999a). We propose that training may not only give people a tool to be more creative, it may also enhance their level of intrinsic motivation. In such cases, rewards and training would become mutually reinforcing (not offsetting), because the reward affirms a person's own internal creative efforts. Conversely, for those who do not receive training, a reward is likely to be interpreted as a type of bribe used to induce someone to do something that he or she may otherwise be reluctant to do, and, as past research has shown, this is generally not a sustainable way to increase creative effort (Deci, Koestner, and Ryan 1999a).

We test this proposition in Studies 2 and 3. To enhance the generalizability of our findings, we test our ideas using the two types of creativity training described previously. Study 2 examines the relationship between creative idea production training and extrinsic rewards, and Study 3 focuses on creative imagery training and those same rewards. To better understand the mechanism by which the results are achieved, the second study also assesses the role of intrinsic motivation explicitly.

Study 2

Research Design

Two experimental factors (extrinsic rewards and creative idea production training) were manipulated in a 2 × 2

between-subjects design. Participants in the study were 122 undergraduate engineering students at a major midwestern university who were given nominal compensation in exchange for their participation. All participants had also completed their required design course work at the time of the experiment. A form of creative idea production training (specifically customer-focused visualization) was the creative-thinking skill made accessible in the study (Dahl, Chattopadhyay, and Gorn 1999).

To ensure that no unintended confounding factors influenced task performance, participants completed the study individually. As another control, one research assistant conducted all 122 sessions over a three-week period. On arrival at the session, the participant was randomly assigned to one of the four treatment cells. If the participant had been assigned to one of the creativity training conditions, the research assistant provided it at the beginning of the session. After the training manipulation (if provided), all participants received a description of the design task. The product design task was the same as that used by Dahl, Chattopadhyay, and Gorn (1999)—namely, to devise a new car jack for use by elderly adults (i.e., people aged 60 years or older) to change a flat tire. The specific description was as follows:

> You are asked to develop an innovative and effective car jack design for elderly adults (age 60+). Please produce a thumbnail sketch of your design and include any brief written comments that are necessary to explain your design. Please disregard any economic, material, or regulatory constraints as you develop your idea. You have up to one hour to complete your design.

For participants in the monetary rewards condition, a description of those rewards then followed (see the following section). The research assistant next indicated that the participant should first spend some time using scratch paper to sketch out initial design ideas and then draw the final design on special bond paper. After the participant had finished the design task, he or she completed a questionnaire that contained background measures and a set of manipulation checks.

Independent Variables

Creative idea production training. Participants who received creative idea production training were provided with the following information:

> In solving design problems, many designers find that forming visual images (pictures in the mind) can help them produce innovative and effective designs. One visualization strategy that has been shown to aid in the design process involves visualizing the *potential customer of the product*. Seeing in your mind a product user being involved and interacting with a proposed product design can facilitate the development of design solutions.

After these initial instructions, the designers were given a brief training task (for the full training regimen, see the Appendix). The training task used a guided-visualization procedure in which participants read a short story about a young adult putting together a television stand. As the participants read the short story, they were instructed to stop after reading each sentence in the story and try to picture in their minds the events about which they had just read. The idea was to sequentially break down the assembly process and recognize the specific challenges and problems customers would face at each step.

Extrinsic rewards. Participants in the conditions offering extrinsic rewards for the design task received the following information:

> Three cash prizes will be awarded to the students producing the first-, second-, and third-rated designs ($250, $100, and $50, respectively). Outside judges from the target market for the product will evaluate the designs, and the winning designs will be selected from these evaluations.

No such information was provided to participants in the no-extrinsic-reward condition. To ensure the effectiveness of the manipulation, we performed a pretest, which confirmed that the judges' evaluations and the monetary rewards were believable and not seen to limit the way the designer performed the task. After the experiment was complete, the three highest-rated designs were then selected from the designs produced across all conditions, and the winners were notified and given their prizes.

Dependent Variable

Two consumer judges from the target market (i.e., drivers over the age of 60 years) were recruited to evaluate the creativity of each product design (Dahl and Moreau 2002; Goldenberg, Mazursky, and Solomon 1999). Each judge received a booklet containing the 122 designs. The order of the designs was randomized across the booklets. The judges were blind to the identity of the participants, to one another, and to the purpose and conditions of the experiment. They were each paid $100 for their services.

Each judge completed an established six-item measure of the creativity of each design (see Moreau and Dahl 2005). Because creativity is commonly defined as the production of ideas considered both novel and useful (Burroughs, Moreau, and Mick 2008; Lubart 1994; Sternberg 1988), we used three items to capture each of the two dimensions (Moreau and Dahl 2005). The items (on a seven-point scale) were "not at all original/very original," "not at all innovative/very innovative," "not at all novel/very novel," "not at all useful/very useful," "not at all effective/ very effective," and "not at all sensible/very sensible." Because we were interested in overall creativity, we summed across all six items rather than keeping the novel and useful dimensions separate. This process is in keeping with a considerable amount of previous research on creativity that argues that both dimensions must be considered simultaneously, because one dimension without the other is not creative (see, e.g., Lubart 1994; Plucker and Renzulli 1999; Smith, Ward, and Finke 1995). The combined approach has also been used in past marketing studies of creativity (Andrews and Smith 1996; Burroughs and Mick 2004; Sethi, Smith, and Park 2001).

Following established procedures for assessing the validity of a measure involving multiple judges (Cicchetti 1994), we made a two-step assessment of our creativity scale. First, we calculated the coefficient alpha for each judge. Alpha estimates for the judges individually were high (Judge A $\alpha = .88$, Judge B $\alpha = .79$); therefore, second, we examined the level of agreement across judges by calculating

the intraclass correlation coefficient (ICC). Using the ICC is appropriate for research that involves multiple judges (compared with the Pearson product-moment correlation), because it accounts not only for the degree to which rater judgments covary (i.e., move up or down in unison) but also for the level of absolute agreement in the raters (i.e., high/high, medium/medium, low/low creativity; Cicchetti 1994). This is a more stringent test because it ensures that independent evaluators are viewing the creativity of the design at approximately the same level. The ICC was also high (.86). Thus, we averaged across the judges' ratings to create a composite score for the creativity of each design in the study (M = 3.8, range: 2.0 to 5.8) (Burroughs and Mick 2004; White and Smith 2001).

Results

Participants were told that they would have up to an hour to complete the design task, though the research assistant did not stop them after they began working. The sessions were as short as seven minutes and as long as 119 minutes. The average session lasted 38 minutes.

In addition to the focal variables of interest in the research, several manipulation checks were included in the experiment. We assessed the effectiveness of the extrinsic reward manipulation by measuring the level of reward recall at the end of the study. We also assessed the effectiveness of the creativity training process. Two scale items assessed the extent to which participants visualized the customer and used images while developing their designs (1 = "did not visualize," "use images of the customer," and 7 = "visualized," "used a lot of customer images"). In addition, in an open-response question, participants listed and described the customer images, if any, that they used during the design task. Two research assistants, blind to the purpose of the study, assessed each designer's list and description of their customer images and reported the number of times the participant reported visualizing an elderly person using a jack. Agreement between the research assistants was high (ICC = .87); therefore, their responses were averaged. Each of the three measures (two self-report + one rated) was then standardized and summed to form an index of customer visualization ($\alpha = .96$).

The awareness check for the reward manipulation showed that the procedure had made the award salient to participants as intended. In addition, a two-way analysis of variance (ANOVA) revealed that, as intended, only the training manipulation significantly predicted the extent to which the participant visualized the consumer during the design task ($M_{training} = .43$ vs. $M_{no\ training} = -.32$; $F(1, 121) = 4.67$, $p < .05$). Given this confirmation of our manipulations, we turned to examining their effect on our primary variable of interest, creativity.

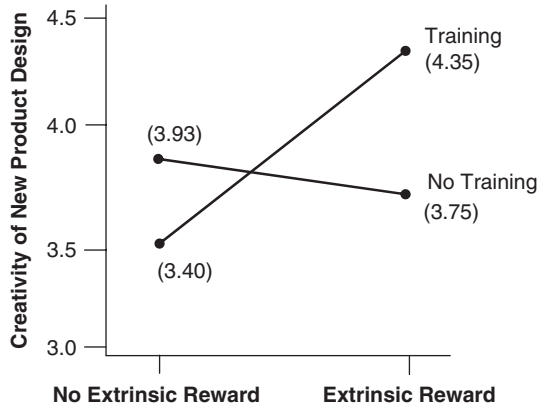
We used a two-way ANOVA to assess the influence of the manipulations on design creativity. The results reveal a main effect of extrinsic rewards on creativity; designs created in conjunction with extrinsic rewards are rated as more creative than those produced in the absence of such incentives ($M_{reward} = 4.03$ vs. $M_{no\ reward} = 3.66$; $F(1, 121) = 6.63$, $p < .01$). However, as predicted, the influence of extrinsic rewards is contingent on whether the participants had also received creativity training (interaction $F(1, 121) = 14.72$, $p < .001$). Follow-up contrasts show that the designs created when both training and extrinsic rewards were provided were significantly more creative than those developed under any of the other three conditions in the experiment. In the absence of training, the provision of the reward actually causes creativity to go down slightly albeit not significantly. Figure 1 provides a full depiction of the interaction, and the relevant contrast statistics are as follows: $M_{training,\ reward} = 4.35$ vs. $M_{no\ training,\ reward} = 3.75$; $F(1, 60) = 8.09$, $p < .01$; $M_{training,\ reward} = 4.35$ vs. $M_{training,\ no\ reward} = 3.40$; $F(1, 60 = 20.17$, $p < .001$; and $M_{training,\ reward} = 4.35$ vs. $M_{no\ training,\ no\ reward} = 3.93$; $F(1, 60) = 3.87$, $p < .05$.

Discussion

The results of this study demonstrate that by combining creativity training with an extrinsic reward, it is possible to enhance the creativity of the outcomes produced in a new product design task. In this study, we used creative idea production training to help participants visualize the potential customer (an elderly person) engaged in the task (changing a flat tire). This type of training emphasizes concrete, problem-specific processing and task-relevant visualization. Again, the results show that this type of thinking, when combined with extrinsic rewards, enhanced the creativity of the designs produced.

However, our results do not tell us how these two managerial tools combined to enhance participants' creativity. Neither the extrinsic reward nor the creativity training influenced the amount of time spent on the creative task in this study. Thus, it is not a story of pure task persistence. Rather, the story seems more complex. In Study 3, we test the proposition that rewards and training will be mutually reinforcing to intrinsic motivation as an intermittent factor in the creative process. For those who receive creativity training, the rewards may encourage the people who are already working smarter to also work harder, and when they do so, their intrinsic motivation may increase because they feel more competent in approaching the task. The next study is also designed to help generalize the findings to a different type of creativity training.

FIGURE 1
Creative Idea Production Training × Extrinsic Reward Interaction



Study 3

Research Design

This study used a 2 × 2 between-subjects experimental design, with the two manipulated factors being extrinsic rewards and creativity training. This time, however, training took the form of creative imagery training. Otherwise, to maintain continuity with the first experiment, the conditions and procedures were the same. The new product context was again the design of a car jack for an elderly person. Study participants were engineering students (n = 110) at a major West Coast university who received nominal compensation for their participation. Participants completed the study individually under the administration of a research assistant.

Independent Variables

Creative imagery training. Participants assigned the training manipulation again went through a creativity training session, only this time they were trained by using Khatena's (2000) divergent-symbolic production technique. Whereas participants in the first study went through a customer-visualization exercise that was focused on the specific problem at hand, Khatena's program uses mental imagery in a more generalized way. Although the process is somewhat involved (for a full description, see Khatena 2000, chap. 8), it essentially takes participants through a series of visualization steps. First, participants are asked to imagine that there is a box in a corner of the room. They are then asked to close their eyes and imagine what is inside the box. They write down as many of the objects they can recall thinking of and then group them together according to common properties. They are then instructed to once again close their eyes, visualize one of the object groupings, and imagine them coming to life. Specifically, participants must imagine the objects as characters in a play and write their story. Although Khatena's training programs were originally formulated to enhance the creativity of gifted children, they have been used widely in adult populations (Khatena 2000). The technique is designed to stimulate imaginative thinking and facilitate mental image production and manipulation.

Extrinsic rewards. As with the first experiment, half the participants in the study were told that their designs would be judged for creativity and that cash prizes of $250, $100, and $50 would be awarded to the top three designs. No such prize was offered to participants in the no-extrinsic-reward condition. When the full experiment was complete, prize winners were selected from all experimental conditions, and the winners were given their prizes.

Dependent Variables

Creativity. Two consumer judges (different from those used in the first study but also over the age of 60 years) judged the creativity of the car jack designs. Judges were each provided a booklet containing all the designs along with a set of rating forms (containing the same creativity scale as that in Study 2). Judges were paid $100 for their services. When the judges completed their task, we ascertained the internal consistency and level of interrater agreement in the creativity ratings. Alpha for the scale for Judge A was .84, and for Judge B it was .78. The ICC coefficient between the judges was .87, which indicates high agreement in their assessments (Cicchetti 1994). Thus, as with Study 2, the ratings were averaged across judges to form an overall creativity score (M = 3.6, range: 1.0 to 5.6).

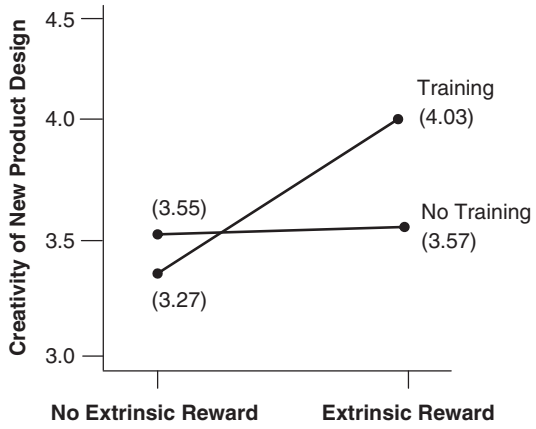
Intrinsic motivation. Because intrinsic motivation is at the center of the controversy over the effect of extrinsic rewards on creativity, we included it as a second dependent variable in the design. Intrinsic motivation can be ascertained at either a general level—such as for a hobby or job (Amabile et al. 1994)—or for a specific task. Given that our interest was in how the provision of a reward would influence creativity in a new product task, we focused on the latter form of intrinsic motivation. We could identify no measure of intrinsic motivation specific to new product design; therefore, we constructed a new measure guided by the literature (Amabile et al. 1994; Harackiewicz, Sansone, and Manderlink 1985; Shalley and Perry-Smith 2001). Recall that intrinsic motivation reflects inherent task interest (Amabile 1996; Csikszentimihalyi 1996) and is indicated by such things as the extent to which the person finds the activity exciting, interesting, and challenging (Amabile 1996). It is also characterized by the extent to which a person becomes engrossed in what he or she is doing and finds the activity fulfilling (Csikszentmihalyi 1996). Using these as our guiding concepts, we constructed a five-item measure of task intrinsic motivation that study participants completed after doing the design task. Using a seven-point semantic differential format, this measure assessed the extent to which they found the new product design task interesting, exciting, challenging, engrossing, and fulfilling (vs. uninteresting, boring, annoying, shallow, and unfulfilling). The results of factor analysis suggest that the scale was unidimensional (all item loadings > .60; the first factor accounted for 51% of the variance). Reliability for the scale is $\alpha = .75$.

Results

To validate the extrinsic reward manipulation, designers again indicated their recall of the reward offered at the conclusion of the study. The creativity training manipulation was validated by ensuring that the designer completed Khatena's divergent symbolic production task as a first step in the experimental process and that all the participants met these criteria respective to their condition. Given this, we turned to analyzing the effects of our independent variables on design creativity.

Creativity. We used ANOVA to test the effects of extrinsic rewards, creativity training, and their interaction on the creativity of the product designs. Training exhibited no main-effect influence on creativity, whereas extrinsic rewards exhibited a significant positive influence, as it had in Study 2 ($F(1, 106) = 5.50$, $p < .02$). However, like Study 2, this main effect is qualified by a significant interaction between the two independent factors ($F(1, 106) = 5.01$, $p < .03$). As Figure 2 shows, when no training was provided, extrinsic rewards did nothing to improve the creativity of the outcomes produced. However, among participants who received training, the story is markedly different. Here, as in

FIGURE 2
Creative Imagery Training × Extrinsic Reward Interaction



the previous study, there is a pronounced increase in the creativity of the designs among those who received an external reward compared with their unrewarded counterparts (contrast: $M_{training, reward} = 4.03$ vs. $M_{training, no\ reward} = 3.27$; $F(1, 54) = 10.13$, $p < .002$). Moreover, participants who received training along with an extrinsic reward exhibited significantly higher levels of creativity than in any of the other conditions of the study (contrasts: $M_{training, reward} = 4.03$ vs. $M_{no\ training, reward} = 3.57$; $F(1, 54) = 4.92$, $p < .03$; $M_{training, reward} = 4.03$ vs. $M_{no\ training, no\ reward} = 3.55$; $F(1, 55) = 4.89$, $p < .03$).

Intrinsic motivation. This study was also designed to examine the role of intrinsic motivation in the creative process. To investigate this variable, we performed the following analyses. First, we ran the same two-way ANOVA as for our creativity measure but substituted intrinsic motivation as the dependent variable. The results support an important role for intrinsic motivation and reveal a significant interaction ($F(3, 104) = 7.20$, $p < .01$). Among participants who were untrained, the provision of an extrinsic reward had a negligible effect on intrinsic motivation ($M_{no\ training, no\ reward} = 3.92$ vs. $M_{no\ training, reward} = 3.91$; $F(1, 53) = .01$, not significant). Although not the significant decline in intrinsic motivation that has been reported in the creativity literature, it does little to refute this position. More important, for participants who received creativity training, the results are quite different: The provision of an extrinsic reward produces a pronounced *increase* in intrinsic motivation ($M_{training, no\ reward} = 3.66$ vs. $M_{training, reward} = 4.34$; $F(1, 51) = 21.49$, $p < .001$). In fact, training and rewards in combination produced the highest levels of intrinsic motivation in the study by a significant margin (contrasts: $M_{training, reward} = 4.34$ vs. $M_{no\ training, reward} = 3.91$; $F(1, 53) = 6.03$, $p < .02$; $M_{training, reward} = 4.34$ vs. $M_{no\ training, no\ reward} = 3.92$; $F(1, 54) = 5.93$, $p < .02$).

The provision of an external reward is accepted and interpreted differently among participants who had first received creativity training than among those who had received no such training. This finding affirms the important role of intrinsic motivation in the creative process; however, contrary to the prevailing view that extrinsic rewards necessarily undermine intrinsic motivation, our results show that extrinsic rewards can actually increase intrinsic motivation in certain conditions (i.e., when people are also given proper training).

It is worth noting the similarity of the pattern of effects between intrinsic motivation and the creativity of the new product designs. The patterns are highly consistent despite one measure (intrinsic motivation) coming from self-reports of the participants themselves, whereas the other (creativity) came from independent judges blind to conditions of the study. This separation makes it unlikely that the findings are a result of common method variance or some other study artifact.

Mediation analysis. The previous analysis examined intrinsic motivation separately from creative outcomes. However, we were also hoping to show evidence that these constructs are linked through the creative process. In other words, we were interested in investigating the set of mediated relationships within the context of the creativity training moderator. Therefore, we also conducted a multiple group analysis. This analysis involves splitting our study participants into two groups (training/no training) and then using structural equation modeling to compare the paths of extrinsic rewards to intrinsic motivation to creative outcomes between the two groups (Edwards and Lambert 2007). To avoid problems created by a high item-to-sample ratio, we first created composite indicants of our measures through a partial disaggregation confirmatory factor analysis model (Bagozzi and Heatherton 1994). The principal advantage of this technique is that it reduces the number of parameters to be estimated in the model and helps reduce measurement error.

When this analysis is undertaken, an interesting set of relationships emerges. Extrinsic rewards are positively related to intrinsic motivation, which in turn is positively linked to creative product outcomes, but only for participants who had first completed the creativity training regimen (extrinsic reward–intrinsic motivation [$\beta = 1.05$, $t = 4.54$, critical $t = 1.96$]; intrinsic motivation–creative outcomes [$\beta = .47$, $t = 2.17$, critical $t = 1.96$]). Among our untrained participants, there is no relationship between extrinsic rewards, intrinsic motivation, or creative outcomes (extrinsic reward–intrinsic motivation [$\beta = -.02$, $t = -.06$, critical $t = 1.96$]; intrinsic motivation–creative outcomes [$\beta = -.02$, $t = -.12$, critical $t = 1.96$]; overall model fit statistics: $\chi^2 = 56.37$, comparative fit index = .93, nonnormed fit index = .90, and root mean square error of approximation = .09). This additional analysis further supports our contention that extrinsic rewards can enhance creative product outcomes, but only when they are used in conjunction with appropriate training. It also supports the notion that this process flows through intrinsic motivation. It seems that the combination of training and rewards enables designers to work both smarter and harder. This is, to our knowledge, the first time creativity training, extrinsic rewards, intrinsic motivation, and creative product outcomes have all been linked simultaneously.

Discussion

In two experiments, we find that creativity training interacts with extrinsic rewards to enhance the creativity of new product

outcomes. This synergy exists regardless of whether the training is in the form of focused ideation production or the more generalized creative imagery technique. However, the consistency of these findings raises the obvious question of whether *any* visualization might be sufficient to produce this outcome. (Why go to the trouble of elaborate training regimens if one can simply have someone "imagine anything"?) Although the training techniques that we used in our studies have been developed and refined over many years, this is a legitimate question, particularly given that our control condition did not involve visualization.

To address this concern, we undertook a follow-up study using newly recruited participants. In this study, we used the same training procedures, same design task, and same judges as in Study 2. Because this study is focused on the nature of the training manipulation, we blocked on reward condition (i.e., the reward was offered to all study participants). Otherwise, participants were randomly assigned to either the new control condition or the creativity training condition. In the new control condition, instead of "doing nothing," participants completed a guided-visualization task that involved the peeling and eating of a lemon. This task was sourced from a website that provides exercises to familiarize people with visualization techniques. The control condition and the training condition were parallel in time taken to complete. Participants who received creative visualization training exhibited significantly higher creativity in their product designs than did those who participated in a random visualization task ($M_{\text{creative visualization}} = 4.10$, $M_{\text{control visualization}} = 3.66$; $t(37) = 1.96$, $p < .05$; $n = 39$). Therefore, although there seems to be some flexibility in how the visualization training is accomplished, it must be creativity directed. Any random visualization task is not sufficient to produce creative outcomes.

General Discussion

Few issues are more important to the long-term success of a firm than the development of innovative new products. Therefore, understanding the conditions and processes that lead to such innovations has long been a focus of marketing research. Within this domain, scholarship has investigated the firm competencies and capabilities that lead to product innovation (Chandy et al. 2006; Im and Workman 2004; Sethi 2000; Troy, Hirunyawipada, and Paswan 2008), the role of interfirm relationships and strategic alliances in bringing new product innovations to market (Carson 2007; Ganesan, Malter, and Rindfleisch 2005), cross-cultural influences on the NPD process (Nakata and Sivakumar 1996; Song and Parry 1997; Tellis, Prabhu, and Chandy 2009), and the role of consumers in new product innovation and diffusion (Bendapudi and Leone 2003; Fang 2008; Hoeffler 2003; Joshi and Sharma 2004; Wood and Moreau 2006). Although creativity is relevant in all of these conversations, few of these studies actively consider its role in their investigations. Perhaps this neglect stems from the widespread perception of creativity as something mystical or divinely imparted rather than a normal cognitive process that can be enhanced (Sternberg and Lubart 1999; Weisberg 1993). As one of our informants explained,

> One of the reasons I think creativity is not consciously addressed and talked about in business is because of people's misunderstanding of creativity. I think many see creativity as a separate segment of the population, a separate skill set. Many high-performing CEOs and leaders are probably very creative, but most people label them as "intellectually brilliant" or having "good organizational skills." By not including creativity in that vocabulary, in that script, it becomes undervalued.

Our research helps refute this misconception by demonstrating that creativity can be facilitated through two tools commonly at a manager's disposal: incentives and training.

Managerial Implications

One practical implication of our findings is that firms should do more to provide creativity training to employees. Although such a recommendation may seem obvious in hindsight, a notable number of the firms in our study do not provide any type of formal creativity training for their employees (even for personnel who work in key areas such as new product design). The entirety of these firms' creative strategy entails hiring the right people and simply expecting that they will be creative. Our results show that even relatively simple creative visualization exercises can pay substantial dividends in enhancing creative outcomes.

Training may be for naught if it is not paired with the proper incentives, and this may be the most important insight to emerge from our research. As our findings make clear, rewards and training cannot be viewed independently of each other. However, all too often, managers treat them as separate issues, particularly in the case of rewards. Although we now have convincing evidence that trying to use extrinsic rewards to induce creativity is more likely to produce the opposite effect (see, e.g., Amabile 1996; Deci, Koestner, and Ryan 1999a), managers seem either unaware or unwilling to heed this evidence. A common recommendation in the management literature, therefore, is to find ways to reduce reliance on rewards (Amabile 1998). However, our results suggest that this advice may be premature. Although we acknowledge that when extrinsic rewards are offered in isolation they are likely to be counterproductive, the same cannot be said when rewards are offered in conjunction with appropriate training. Offering training along with a reward stands to benefit people in two ways. Not only does the training enhance capabilities, but it also shifts interpretation of the reward from some type of an enticement to an affirmation of valued contribution. In short, when empowered by training, the addition of the reward raises intrinsic motivation for challenging tasks.

Our findings highlight the complexities inherent in managing creativity but also the potential to leverage creativity through the careful application of common managerial tools such as incentives and training. Although we consider our results encouraging, additional contextual factors are likely to moderate the effectiveness of these tools and, therefore, represent opportunities for further research.

Limitations and Further Research

It is important to acknowledge the limitations of this research, all of which present opportunities for further

investigation. Our experimental methodology has some limits in terms of external validity. We were limited in the amount of training we were able to give our research participants. Although past research has shown that even limited creativity training can be beneficial (Clapham 1997; Dahl, Chattopadhyay, and Gorn 1999), more extensive training would be desirable, particularly in real industry settings. Thus, we consider our findings to represent a conservative test of the benefit of combining training and reward programs.

We also chose an extrinsic reward that provided a financial incentive for the designs judged as "best." Firms make use of a wide variety of extrinsic incentives including bonuses, contests, promotions, and even punitive threats to increase productivity. These incentives may operate in different ways, especially in their interaction with training. For example, the extrinsic reward that we used (a contest) probably induces competition among the designers to secure the prize. Further research could disentangle financial and competitive incentives to better understand how the effectiveness of training can be enhanced.

We also limited our experiments to a single design problem in an effort to control extraneous influences across the studies. Although we believe that an improved car jack for elderly adults represents a realistic and natural type of problem that new product designers are likely to encounter, it is nonetheless a specific type of problem. It would be interesting to find if our results hold for other types of NPD contexts, particularly in high-technology areas such as microchips, software development, and aerospace engineering.

In addition, our research focused primarily on individual-level aspects of creativity (e.g., cognitive processes, internal motivations). However, in industry, these factors will often transpire within a group context, such as part of a cross-functional team (e.g., Rathnam, Mahajan, and Whinston 1995; Sethi 2000; Troy, Hirunyawipada, and Paswan 2008), which provides an opportunity to expand into new research questions: Do individual motivations change when they are embedded in a group context? Does rewarding team performance alter the creative equation compared with rewarding individual initiative? How might team dynamics enhance (or attenuate) the benefits of training? The lack of answers to questions such as these highlights the need for further research to examine the role of creativity at multiple levels.

Another opportunity exists to extend research into the question of outside expertise. Several firms in our qualitative study outsourced a significant portion of the creative task to consultants, which raises a question: If intrinsic motivation is so fundamental to this process, why do firms so readily pay someone else to produce creative ideas? Would a consultant have the same intrinsic motivation that an employee would? The simple answer would be no. (Their effort is supplied in direct exchange for compensation.) Consultants presumably work in creative fields because they enjoy it and so may enter the process with high levels of intrinsic motivation. There has been little research that considers the influence of agent relationships such as consultants on creativity, which, again, is surprising given how prevalent this practice is in industry.

Finally, our participants were engineering students who were at the beginning of their careers; therefore, their receptiveness to training and natural intrinsic motivation probably would be high. Again, the finding that we still found differences actually suggests robustness in our results. Nonetheless, it would be interesting to examine whether our results would replicate using a group of midcareer engineers or more senior designers. The past successes and failures of these people are likely to influence both their receptiveness to training and their interpretation of incentive programs. Although our studies provide a good starting point, there are many ways subsequent studies could branch out in terms of identifying further limitations and boundary conditions of this interaction.

Appendix

Visualization Training

In solving design problems, many designers find that forming visual images (pictures in the mind) can help them produce innovative and effective designs. One visualization strategy that has been shown to aid in the design process involves visualizing the *potential customer of the product*. Seeing in your mind, a product-user being involved and interacting with a proposed product design can facilitate the development of design solutions.

For many individuals, visualizing the customer is a difficult task. The present training task is a guided imagery exercise that provides practice in visualizing the customer. Please read through the following paragraph and attempt to visualize the images expressed. After reading each sentence, close your eyes and visually process the expressed ideas and try to "see" the customer in the product usage situation.

Please picture in your mind a young adult. Perhaps someone that is in their early twenties. Imagine that the young adult is quite thin and petite. In your mind you can see them in their apartment. The apartment is quite small having only a bedroom, kitchen, living room, and a bathroom. Imagine the young adult coming into their living room. You see that they are dragging a large box. The box is obviously very heavy for the young adult and the size of it is almost overwhelming. You watch as they struggle to move the box into the centre of the room. After quite some time they finish positioning the box and begin to open it. The thick packaging tape makes opening a difficult task. You can see the young adult getting frustrated and in anger they attempt to rip at the cardboard. Finally the box is open. You see that in the box are the pieces to a set of new wooden TV dinner stands. Dumping the contents on the living room floor, the young adult searches for the page of instructions. The instruction sheet is on a small piece of cardboard and you can tell that the printing on the sheet is quite small. You can tell that the young adult is having trouble reading the fine print of the instructions. You watch as the young adult reaches to a nearby shelf and opens a glasses case, retrieves a pair of glasses, and then puts them on. The young adult studies the instruction sheet for what seems like an eternity. Finally, they put down the instructions and they begin to assemble the stand. You can tell that

they are confused by the instructions and the many differing types of screws, pieces of wood, and other assembly materials. You watch as the young adult picks up the largest piece of wood from the floor. You can tell that their small hands are obviously not large enough to hold the wood, and you watch as the heavy piece slips from their hand and crashes to the floor. Leaving this scene you wonder if the new stand will ever be assembled.

After completing the visualization exercise please raise your hand and the experimenter will give you the design task. In the design task you will be asked to image a customer using a proposed product design. We suggest that you adopt a visualization process similar to that learned in this training session. Imaging a scenario that *identifies the specific characteristics of the customer as he or she interacts with the proposed design* will facilitate your ability to produce an effective and innovative design.

Design Task

You are asked to develop an innovative and effective car jack design for elderly adults (age 60+). Please produce a thumbnail sketch of your design and include any brief written comments that are necessary to explain your design. Please disregard any economic, material, or regulatory constraints as you develop your idea. You have up to one hour to complete your design. As indicated by the experimenter, please use the scrap paper for your initial sketching, and the bonded paper for your final design.

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