Fostering Consumer Performance in Idea Generation: Customizing the Task Structure based on Consumer Knowledge

Lan Luo and Olivier Toubia

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Lan Luo is an Assistant Professor of Marketing (e-mail: lluo@marshall.usc.edu), at the Marshall School of Business, University of Southern California, Los Angeles, CA 90089. Olivier Toubia is Glaubinger Professor of Business (e-mail: ot2107@columbia.edu), at the Columbia Business School, Columbia University, New York, NY 10027. Please address correspondence to Olivier Toubia. The authors would like to thank Dan Bartels, Dilip Soman, seminar participants at the INFORMS Marketing Science Conference, the Product Development and Management Association Annual Research Forum, and the Columbia Marketing Brown Bag Series for their insightful comments on previous drafts of this manuscript.

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Abstract

As firms increasingly seek out consumers' ideas in various domains, they will encounter individuals with different levels of domain-specific knowledge. While both low- and high-knowledge consumers may be willing to share their ideas benevolently, the performance of the former is likely to be hindered by their lack of relevant knowledge in the problem domain. It is also well established that, despite their abundant knowledge, high-knowledge consumers may not perform in accordance with their full potential. We propose that firms can greatly enhance consumer performance in idea generation by customizing the task structure to overcome the distinctive challenges faced by these two types of consumers. In particular, we posit that the presence of stimulus ideas will greatly mitigate the lack-of-knowledge obstacle faced by low-knowledge consumers, and problem decomposition will enable high-knowledge consumers to perform more in accordance with their greater potential. We further examine the interplay between these two manipulations and outline a process for developing a customized system based on each consumer's knowledge level. Our hypotheses are supported by an extensive empirical investigation involving data from over 3,000 respondents across three studies. This research is among the first attempt to demonstrate that a customized idea generation system can be highly beneficial managerially.

1. Introduction

Idea generation is used routinely and extensively across a wide range of organizations and industries. Very few new products or services are developed, very few advertising copies are created, and very few business strategies are formulated without some reliance on idea generation. With the emerging trend of new product development (NPD) outsourcing in recent years (e.g., Carson 2007; Raassens, Wuyts, and Geyskens 2012), idea generation has also taken a new direction with an increased level of consumer involvement in innovation projects (e.g., *Forbes* 2005; Bayus 2012; Chesbrough 2003; Dahan and Hauser 2002; Fuchs and Schreier 2011; Hoyer, Chandy, et al. 2010; Magnusson 2009; Slot, Srinivasan, and Wuyts 2013; Soukhoroukova, Spann, and Skiera 2012; Terwiesch and Ulrich 2009; Toubia 2006; Toubia and Florès 2007; von Hippel 2005). For example, companies such as Dell and Starbucks have launched online open innovation platforms that allow consumers to propose ideas to the company (see www.ideastorm.com, mystarbucksidea.force.com). Other platforms, such as InnoCentive (www.innocentive.com), give companies access to online communities of "problem solvers." Open idea generation platforms have even become relevant to public policy, with various organizations and agencies, including the U.S. federal government, soliciting ideas from the general public (see for example opengov.ideascale.com).

As firms (and other organizations) increasingly seek out consumers' ideas in various domains, they will encounter individuals with different levels of domain-specific knowledge. Because firms ultimately serve consumers who may or may not possess ample knowledge about their products/services, it is crucial for firms to be attentive to ideas from all consumers who may eventually purchase their products/services. While both low- and high-knowledge consumers may be willing to share their ideas benevolently, they face distinctive challenges in an idea generation task. Specifically, the performance of low-knowledge consumers is likely to be hindered

by their lack of relevant knowledge in the problem domain (e.g., Mitchell and Dacin 1991; Finke, Ward, and Smith 1992). It is also well established that, despite their abundant knowledge, high-knowledge consumers often do not perform in accordance with their full potential, due to factors such as shallow processing and inattention (e.g., Camerer and Johnson 1991; Hoch and Schkade 1996; Wood and Lynch 2002). In this research, we propose that firms may greatly foster consumer performance in idea generation by offering a customized task structure that aims to overcome the distinctive challenges faced by low- and high-knowledge consumers.

In particular, we posit that providing stimulus ideas mitigates the lack-of-knowledge obstacle faced by low-knowledge consumers. We also suggest that decomposing the idea generation problem into sub-problems enables high-knowledge consumers to perform more in accordance with their greater potential. We further examine the interplay between these two manipulations and outline a process for developing a customized system based on each consumer's knowledge level in the focal problem. Our hypotheses are supported by an extensive empirical investigation involving data from over 3,000 respondents across three studies.

In today's marketplace, advances in technology have resulted in increased opportunities for customized interactions between firms and consumers (Ramani and Kumar 2008). Nevertheless, existing open innovation platforms (such as Dell's IdeaStorm and Starbuck's MyStarbucksIdea) typically offer identical tasks to all consumers. In our context, because idea generation tasks nowadays are often conducted online, it is easy to collect preliminary data on each consumer and customize the idea generation task on the fly based on the consumer's domain-specific knowledge. Our research is among the first to explore how firms may enhance consumer performance in idea generation by customizing the task to suit the specific consumer's knowledge level with regard to their products/services. Consequently, our research sheds light on

the potential managerial benefits of customized idea generation systems. As discussed in Hoyer, Chandy, et al. (2010), while consumers nowadays are willing and able to communicate their ideas to firms, research on how firms may effectively enhance consumer performance in such tasks has been very scarce. Hence, any progress in this domain would be highly valuable.

The remainder of the paper is organized as follows. In Section 2 we develop our hypotheses. We describe our experimental setup in Section 3. In Sections 4 to 6, we discuss our empirical investigation in a series of three studies. In Section 7 we demonstrate empirically the benefits of customizing the idea generation task based on each consumer's knowledge level. Section 8 concludes the paper by summarizing key results, discussing implications, and offering directions for future research.

2. Hypotheses Development

In this section we explore the role of prior knowledge in idea generation.[1] Following Ratchford (2001), we conceptualize prior knowledge as skill or expertise embodied in an individual and acquired through past experiences, formal or informal training, or education. We adopt a cognitive view of idea generation (Finke et al. 1992; Nijstad et al. 2002, 2003; Nijstad and Stroebe 2006; Perkins 1981), and recognize that generating ideas inevitably involves retrieving knowledge from long-term memory. Indeed, several researchers have suggested that idea generation is a two-stage process (Finke, et al. 1992; Nijstad et al. 2002). First, search cues are assembled in short-term memory to probe prior knowledge stored in long-term memory (i.e., knowledge activation stage). Second, new ideas are generated by combining knowledge re-

[1] Our research is built upon a stream of literature that emphasizes the vital role of consumer knowledge in various contexts, such as information search (Brucks 1985), new product adoption (Moreau, Lehmann, and Markman 2001), new product learning (Wood and Lynch 2002), creation of physical goods (such as cookies and scarves, see Dahl and Moreau 2007 or Sellier and Dahl 2011), product customization (Randall, Terwiesch, and Ulrich 2007), activity consumption and consumer lifestyles (Luo, Ratchford, Yang 2012), and brand preferences (Bronnenberg, Dubé, and Gentzkow 2012). We add to this literature by investigating the critical role of consumer knowledge in idea generation. Surprisingly, this has not been extensively studied in the literature.

trieved, forming new associations, or applying knowledge to a new domain (i.e., idea production stage). These ideas are then added to search cues to activate more knowledge in memory, leading to the creation of more new ideas. This process continues iteratively and new ideas are generated accordingly (Nijstad et al. 2002). One central premise of this literature is that new ideas are not constructed in a vacuum, but rather that some basic ingredients or starting points are necessary, which are then modified and combined to generate new and unique ideas. Indeed, it is well accepted that ideas cannot be generated without reference to prior knowledge (e.g., Goldenberg and Mazursky 2002; Mednick 1962; Simonton 2003).

Within this context, a key bottleneck for low-knowledge consumers is that they have fewer images (i.e., knowledge structures) stored in their long-term memory associated with the focal problem (Mitchell and Dacin 1996; Moreau, Lehmann, and Markman 2001).[2] Consequently, these consumers' performance in idea generation may be hindered because it is inherently more challenging for them to search for problem-relevant knowledge in their long-term memory.

In the idea generation process, stimulus ideas serve as search cues to probe long-term memory (Brown et al. 1998; Finke et al. 1992; Nijstad, et al. 2002; Nijstad and Stroebe 2006). Extant research suggests that exposure to such cues can be either beneficial (e.g., Leggett Dugosh et al. 2000; Nijstad, et al. 2002; Paulus and Yang 2000) or detrimental (e.g., Diehl and Stroebe 1987; Lamm and Trommsdorff 1973; Nijstad, et al. 2003), depending on whether stimulus ideas interfere with the cognitive process of generating ideas.

[2] In the cognitive psychology literature, an image is defined as a knowledge structure that consists of a central concept and a number of features and associations related to that concept. For example, features of the image "hotel" include "has rooms" and "has lobby", and this image may be associated with the image "restaurant." The term "image" represents a localized set of information stored in long-term memory. It does not necessarily imply a visual or spatial representation of information.

In our context, we propose that stimulus ideas will be particularly beneficial for low-knowledge consumers. For these consumers, stimulus ideas serve as search cues that help them probe their memory for problem-relevant knowledge. Such ideas may activate associations to specific images (or sets of images) in the participant's long-term memory that may not have been retrieved otherwise. Consequently, more relevant images may be retrieved due to exposure to such external stimuli, which in turn will further facilitate the creations of new ideas.

On the contrary, stimulus ideas should be less beneficial for high-knowledge consumers, because they already possess abundant images in their associative memory related to the problem. In the case of high-knowledge consumers, stimulus ideas are more likely to point to images that would have been activated even without this intervention. Moreover, stimulus ideas may interfere with the consumers' natural retrieval process, in at least two ways. First, the presence of stimulus ideas may inhibit the spontaneous activation of relevant images. As discussed in the retroactive inhibition literature, when retrieving items from memory, the activation of cues related to a subset of items sometimes inhibits retrieval of the remaining items (e.g., Nickerson 1984; Watkins and Allender 1987). Second, the mere fact of being exposed to stimulus ideas may detract individuals from their own train of thought and induce a loss of potential ideas (Nijstad, et al. 2003). This is in line with the literature on collaborative inhibition suggesting that being exposed to external stimuli in recall tasks may have the detrimental effect of disorganizing and disrupting the retrieval strategies used spontaneously by respondents (e.g., Basden et al., 1997). We propose that such inhibitions are likely to be more detrimental to consumers who have more relevant domain knowledge. Indeed, when the set of potential images that would be retrieved in the absence of inhibition is larger, the losses from inhibition should be also greater.

Therefore, we predict a negative interaction between consumer knowledge and stimulus ideas. Specifically, we expect that stimulus ideas exert a positive impact on the performance of low-knowledge consumers in idea generation. In contrast, such ideas should not be as beneficial for high-knowledge consumers, and may in fact reduce the performance of the latter, due to inhibition. This leads us to our first hypothesis:

H1: There is a negative interaction between consumer knowledge and stimulus ideas. Namely, the performance of low-knowledge consumers will be enhanced by stimulus ideas, but such ideas may be detrimental to their high-knowledge counterparts.

Interestingly, extant research suggests that, while high-knowledge consumers possess a number of cognitive advantages over their low-knowledge counterparts, they often fail to perform at their full potential (e.g., Camerer and Johnson 1991; Hoch and Schkade 1996; Wood and Lynch 2002). In developing our next hypothesis, we first elaborate on the advantages and disadvantages of high prior knowledge in the context of idea generation. We then discuss how decomposing the idea generation problem into sub-problems may enable high-knowledge consumers to perform more in accordance with their greater potential.

Within our context, the advantages of high prior knowledge are evident. At the knowledge activation stage of idea generation, high-knowledge consumers are likely to engage in more automated thinking processes (Larkin et al. 1980; Shiffrin and Schneider 1977). Therefore, these consumers can speed up their information retrieval and delegate more cognitive resources to the cognitive task at hand (generating new ideas in our context). Additionally, high-knowledge consumers have more extensive knowledge to tap into in their long-term memory (Mitchell and Dacin 1996). They also possess a more complex knowledge structure related to the

focal problem (Chi, Glaser, and Rees 1982). Consequently, at the idea production stage, these consumers have the potential to be more capable of interpreting, modifying, and combining their existing knowledge structures into new ideas.

Nevertheless, several studies have shown that high-knowledge consumers often fail to perform in accordance with their cognitive advantages (see Wood and Lynch 2002 for an excellent review). For example, previous literature suggests that high-knowledge consumers are more likely to rely excessively on subsets of information that are more salient in their long-term memory (Camerer and Johnson 1991; Hoch and Schkade 1996). Moreover, they are more likely to exhibit a "feeling-of-knowing" phenomenon and spend less effort on the task (Hart 1965; Reder and Ritter 1992). Consequently, despite their cognitive advantages, high-knowledge consumers may not perform at their full potential in an idea generation task.

In this research, we propose that one solution to mitigate such obstacles faced by high-knowledge consumers is to decompose the idea generation problem into sub-problems. Using Dennis et al. (1996) as an example, instead of asking "What can elected officials, business leaders, and the general public do to encourage a higher level of leadership in the community?", respondents may be instructed to work first on the sub-problem of "What can elected officials do to encourage…", followed by "What can business leaders do…", and "What can the general public do …".

Within our context, decomposing the problem into sub-problems forces high-knowledge consumers to conduct a more thorough search for relevant images in their long-term memory, obliges them to devote their attention evenly to the entire set of sub-problems, and encourages them to engage in more cognitive efforts in idea generation (particularly related to sub-categories with which they are less familiar). Consequently, we predict that problem decomposition will be

particularly beneficial in helping high-knowledge consumers to overcome the obstacles they may face in idea generation.

With regard to low-knowledge consumers, we predict that, while problem decomposition should also help them, the effect will not be as strong. Our basic argument is that, if problem decomposition helps consumers achieve more of their potential, it should be more beneficial to those consumers with a higher potential. The following metaphor may help illustrate our argument. Consider a consumer searching for tools suitable for a specific task in a set of drawers. Decomposing the problem would be akin to inducing consumers to search each drawer in sequence, instead of going through the drawers in a less structured manner (at the risk of missing certain drawers and/or visiting the same drawers multiple times). The fewer suitable tools a consumer has in these drawers, the fewer additional tools would be retrieved by adopting such a structured search. This leads us to our second hypothesis:

H2: There is a positive interaction between consumer knowledge and problem decomposition. Namely, while enhancing the performance of both low- and high-knowledge consumers, problem decomposition is more beneficial for high-knowledge consumers.

Interestingly, our two hypotheses suggest that, while both stimulus ideas and problem decomposition lead to the activation of additional knowledge, these two manipulations will have differential impacts on low- and high-knowledge consumers, with the former benefiting more from stimulus ideas and the latter benefiting more from problem decomposition.

In our last hypothesis, we examine the interaction between these two manipulations. Such an investigation is necessary because, managerially, strong positive or negative interactions may affect the optimal task structure for low- and high-knowledge consumers. We propose that the

effects of both manipulations partly overlap, because they both lead to the activation of knowledge that may not have been accessed otherwise. Therefore, we suggest that, for both low- and high-knowledge consumers, the benefits offered by the two manipulations should be partial substitutes. Consequently, we expect that the incremental benefits of problem decomposition will be smaller when stimulus ideas are presented, and vice versa that providing stimulus ideas will be less beneficial (or more detrimental, depending on the initial effect) when the problem is decomposed. This prediction is captured by our third hypothesis:

H3: There is a negative interaction between the effects of stimulus ideas and problem decomposition. Namely, problem decomposition is less beneficial when stimulus ideas are presented, and vice versa providing stimulus ideas is less beneficial (or more detrimental, depending on the initial effect) when the problem is decomposed.

3. Experimental Setup

In this section we discuss our experimental setup. Testing our hypotheses requires the following elements: 1) soliciting ideas from consumers in an idea generation task; 2) varying the task structure by providing stimulus ideas and/or decomposing the problem into sub-problems; 3) obtaining an indicator of the quality of each generated idea; 4) measuring the performance of each consumer; 5) assessing the knowledge level of each consumer within our sample; and 6) addressing identical or nearly identical ideas. We discuss each of these elements below.

3.1. Idea Generation Task

We asked respondents to suggest ideas for possible applications of a technology that allows camera cell phones to scan two-dimensional bar codes, which were referred to as "EasyCodes" in our studies. The user simply takes a picture of the code with a camera cell phone. The picture is then analyzed and coded by special software installed on the phone, and the phone communicates the

code to a server, which triggers a specific action. A detailed description of the technology presented to the respondents can be found in Web Appendix A1. This technology is well known today as "QR codes," but at the time of our studies (Fall 2009 to Fall 2010) it was still emerging in the US (some have argued that the tipping point for this technology happened in the fourth quarter of 2010. See for example Cohen 2011 or Mobio 2011).

3.2. Varying Task Structure

Across our three studies, we varied the idea generation task by providing stimulus ideas (Study 1), decomposing the problem into sub-problems (Study 2), and employing a combination of both (Study 3). All studies were conducted on the web and respondents completed the task independently, i.e., respondents were not exposed to other respondents' ideas during the idea generation task and they were not exposed to other respondents' evaluations during the idea evaluation task. The web interface was such that respondents could enter as many or as few ideas as desired, and no time limit was imposed on the task. More detail on the design of the studies can be found in sections 4-6. Web appendices A1-A3 also provide screenshots of the interface for all studies. In studies 1 and 2, the idea generation task was completed by freshman and sophomore undergraduate students who participated in the studies for course credit. In study 3, consumers recruited from Amazon's Mechanical Turk panel completed the task. Some summary statistics from studies 1-3 are provided in Table 1.

<Insert Table 1 about here>

3.3. Idea Evaluation

Because an accurate assessment of idea quality is essential to our empirical investigation, we adopted measures from the previous literature (Girotra, Terwiesch, and Ulrich 2010; Kornish and Ulrich 2011; Toubia and Flores 2007) to evaluate idea quality in three different ways: 1) *adop-*

tion intent; 2) *overall attractiveness*; and 3) *business value*. The first measure was collected in all three studies; the second and third were collected in studies 1 and 2 only.

In all three studies, we evaluated consumers' *adoption intent* associated with each idea using respondents recruited from Amazon's Mechanical Turk panel. We adopted a similar online paradigm as in Toubia and Florès (2007), who provided some evidence that the approach of having a large number of consumers each evaluate a few ideas (rather than having a small number of judges each evaluate all the ideas) is internally consistent and externally valid. After being introduced to the technology, each respondent was asked to rate 20 ideas in terms of how likely they "would be to use it if it were available" on a 10-point scale, with 1 being "there is no chance/ almost no chance that I would use it" and 10 being "I would certainly use it." This adoption intent scale was adopted from Morrison (1979). The 20 ideas presented to each consumer were selected randomly from the set of ideas generated in that study, among the ideas that had received the fewest evaluations up to that point. This selection mechanism ensured that, by the end of the study, all ideas had received approximately the same number of evaluations. Because Amazon's Mechanical Turk assigns a unique ID to each panelist, we enforced a pre-qualifier to ensure that respondents who engaged in this idea evaluation task had not participated in any other task related to our studies. A total of 1,984 respondents engaged in this idea evaluation task across the three studies, resulting in an average of at least 30 independent ratings per idea.

In addition, in studies 1 and 2, we measured the *overall attractiveness* and the *business value* of the generated ideas. *Overall attractiveness* was assessed by respondents recruited from the same subject pool as the respondents who participated in the idea generation task, using a paradigm similar to the one used to measure *adoption intent*. Specifically, after a brief description of the EasyCode technology, each respondent was shown a set of 15 ideas (selected random-

ly from those with the fewest evaluations on that dimension up to that point) and asked to "select as many or as few ideas" among the list based on the likelihood of "finding the idea useful and adopting it if available." *Business value* was assessed using a panel of business major senior students who participated in the idea evaluation task as part of a class assignment. These respondents were unaware of any other task related to our studies. As business major seniors, these students had received formal training in evaluating the business value of new product ideas through a series of business classes. We further refreshed their memory with a lecture on this particular topic shortly before distributing this assignment. Following Girotra et al. (2010), we instructed the students that an idea's technical feasibility, novelty, specificity, and potential market demand should be accounted for when the idea is being evaluated for its business value. Thirty-eight students rated the business value of all ideas generated in Study 1 on a 10-point scale, and thirty-three evaluated the business value of all ideas from Study 2 on the same 10-point scale. We adopted the method proposed by Gwet (2010) to evaluate the inter-rater reliability of these ratings. All statistics suggested that inter-rater reliability was adequate (details available from the authors upon request).

In the analysis of studies 1 and 2, we discovered that the three quality measures collected in these studies (*adoption intent*, *overall attractiveness*, and *business value*) gave rise to virtually identical results in hypotheses testing. Given the high inner consistency among these quality measures, we decided to employ only *adoption intent* in Study 3. In our context, we believe that collecting *adoption intent* evaluations from consumers is particularly well suited. Indeed, one primary challenge at the front end of new product development is to identify new product ideas that are likely to be well received by consumers in the marketplace. Consequently, the analyses

reported in the paper rely on the *adoption intent* measure. Comparisons based on the other two quality measures are available from the authors upon request.

3.4. Measuring Consumer Performance

Our empirical investigation requires examining how the interplay of consumer knowledge and task structure affects consumer performance in idea generation. Following the extant idea generation literature (e.g., Dennis and Valacich 1994; Dennis et al. 1996; Diehl and Stroebe 1987; Gallupe et al. 1992; Lamm and Trommsdorff 1973; Valacich, Dennis and Nunamaker 1992), we define the performance of a participant as the sum of the average quality ratings of his or her ideas. Specifically, let s_i^j be the average quality score (i.e., adoption intent) received by idea i submitted by respondent j, and N^j be the number of ideas submitted by respondent j. The performance of consumer j is measured as $\sum_{j=1}^{N^j} s_i^j$.[3]

3.5. Measuring Consumer Knowledge

We adapted the measurement scales developed by Mitchell and Dacin (1996) (see more detail on our measurement scales in the Appendix) and based our scale items on knowledge about technological products. We decided to measure knowledge about technological products because many ideas related to the EasyCode technology (e.g., scan an EasyCode on a TV screen and download and play a game from a TV show; scan an EasyCode on the back cover of a book that links to the book's Amazon page for purchase) relate to technological products in general.[4] We computed a

[3] If a consumer did not submit any ideas, his or her performance was considered to be zero.

[4] We acknowledge that whether this is the best way to measure consumer knowledge in our context is still an open question that might be addressed in future research. Nevertheless, our results provide a lower bound on the magnitude of the effects predicted by our hypotheses, and on the benefits from customizing the task based on the degree of consumer knowledge.

consumer knowledge score for each respondent in the idea generation task using the average of his/her responses to these items.[5]

In order to empirically verify that our results were related to consumer knowledge as suggested by our theoretical arguments, and not to alternative consumer characteristics, we also included the domain-specific lead user scale (adapted from Hoffman et al. 2010), the emergent consumer scale (adapted from Hoffman et al. 2010), and the domain-specific consumer innovativeness scale (adapted from Goldsmith and Hofacker 1991) in our studies (see more details of the scale items, reliability, and discriminant validity assessments in the Appendix). We found that our hypotheses did not hold when consumers were characterized based on any of these alternative characteristics, suggesting that consumer knowledge is indeed the relevant construct for our analysis. Reliability checks for all scales, as well as discriminant validity analysis, are presented in the Appendix.

3.6. Identical and Nearly Identical Ideas

The existence of identical or nearly identical ideas and the presence of entries unrelated to the topic may add noise to our performance measures. In all three studies, prior to collecting idea quality ratings, we removed entries that were ostensibly unrelated to the topic as well as any duplicate entries of ideas from the same respondent. In studies 1 and 2, we recruited a separate set of consumers to identify nearly identical ideas originating from each relevant group of consumers (i.e., respondents in each condition). We used the method proposed by Kornish and Ulrich (2011) to identify such ideas (more details in the Appendix). We discovered that approximately

[5] In order to further verify the reliability of the respondents' self-reported responses to the scale items, we also included some open-ended questions to assess the respondents' general knowledge and usage of technology products (e.g., the respondent was asked to describe situations in which he/she adopted new technology products and/or suggested new technologies to family and friends).We found that respondents with higher knowledge scores described significantly more situations across all three studies.

95% of all ideas were valid and different from all other ideas within the same group. We combined nearly identical ideas from the same respondent into one idea and averaged their quality scores. We decided to leave nearly identical ideas from different respondents unchanged in our analysis because they represent fewer than 2% of the total ideas submitted and they appear to be evenly distributed across conditions. Given that the results of our hypothesis testing in the first two studies did not change after controlling for nearly identical ideas from the same respondent, for simplicity we did not identify nearly identical ideas in Study 3.

4. Study 1

Study 1 was designed to test our first hypothesis that there is a negative interaction between consumer knowledge and the presence of stimulus ideas. Namely, providing stimulus ideas enhances the performance of low-knowledge consumers, but it may reduce the performance of high-knowledge consumers.

4.1. Method

One hundred and six freshman and sophomore undergraduate students enrolled in the subject pool of a major west coast university participated in the idea generation task in exchange for course credit. The respondents accessed the study via computers in a behavioral lab. The flow of the study was as follows. Each respondent first answered the measurement scale items and the open-ended questions discussed above (see "Section 3.5. Measuring Consumer Knowledge"). Next, a description of the technology was given. In the control condition, respondents were then prompted to generate some ideas for possible applications of the EasyCode technology. In the treatment condition, we provided all respondents with an identical set of five stimulus ideas illustrating some possible applications of the new technology prior to soliciting ideas from them (see Web Appendix A1 for a detailed description of the web interfaces shown to the respondents). A

total of 193 ideas were generated in this study.[6] The quality ratings of these ideas were then collected using the procedure described above (see "Section 3.3. Idea Evaluation") from 371 respondents from Amazon's Mechanical Turk panel.

4.2. Results

We tested H1 by regressing each respondent's performance on: 1) a dummy variable denoting whether or not the stimulus ideas were present; 2) the mean-centered knowledge score; and 3) their interaction. The results showed a significant negative two-way interaction (β = -3.697; t = 3.643; $p < .01$). This confirms H1 that there is a negative interaction between consumer knowledge and stimulus ideas. To explore the interaction further, we examined the effects of stimulus ideas at one standard deviation below and above the mean knowledge score via a spotlight analysis (Irwin and McClelland 2003; Fitzsimons 2008). Specifically, we centered knowledge score at one standard deviation below the mean and ran a similar regression as above to examine the effects of stimulus ideas on low-knowledge consumers. (Note that this analysis does not alter the sample of respondents or the observations in any way, it simply centers the knowledge score around a different value.) As expected, consumers with low-knowledge scores performed significantly better when stimulus ideas are present than when they are absent (β = 3.158; t = 3.169; $p < .01$). To examine the effect of stimulus ideas on high-knowledge consumers, we ran an equivalent regression with consumer knowledge centered at one standard deviation above the mean. We discovered that high-knowledge consumers performed significantly worse when they were exposed to stimulus ideas (β = -2.029; t = 2.023; $p < .05$). As shown in

[6] In studies 1 and 3, whenever stimulus ideas were presented, we conducted a screening to ensure that the participants did not submit ideas that were identical or nearly identical to one of the stimulus ideas. No such cases were found.

Figure 1, stimulus ideas enhanced the performance of low-knowledge consumers, and were detrimental to the performance of more knowledgeable consumers.

<Insert Figure 1 about here>

4.3. Discussion

The findings from this study are consistent with our hypothesis that consumers who are less knowledgeable about the focal problem benefit more from the search cues provided by stimulus ideas, and that stimulus ideas may in fact inhibit the natural idea generation process of high-knowledge consumers. This inhibition phenomenon can be linked to at least two streams of research in Psychology. First, the retroactive inhibition literature shows that when retrieving items from memory, the activation of cues related to a subset of items sometimes inhibits retrieval of the remaining items (e.g., Nickerson 1984; Watkins and Allender 1987). Second, the collaborative inhibition literature shows that being exposed to external stimuli in recall tasks may have the detrimental effect of disorganizing and disrupting the retrieval strategies used spontaneously by respondents (e.g., Basden et al., 1997). Because high-knowledge consumers possess more relevant knowledge in their long-term memory, the benefits offered by stimulus ideas are lower and the costs (due to inhibition) of such ideas are also greater. Consequently, exposure to stimulus ideas had an interesting overall detrimental effect on high-knowledge consumers.

An important managerial implication from Study 1 is that, when involving consumers in idea generation tasks, it is only beneficial for firms to offer stimulus ideas to low-knowledge consumers, not to their high-knowledge counterparts. On a broader scale, this study illustrates that the structure of an idea generation task may interact with the amount of knowledge an individual possesses about the problem domain, which in turn gives rise to differential effects on low- and high-knowledge consumers. Consequently, while largely neglected in the literature as well as in

practice, firms may greatly foster consumer performance in idea generation by customizing the task for low- and high- knowledge consumers respectively.

5. Study 2

In Study 2 we test H2 that there is a significant positive interaction between consumer knowledge and problem decomposition. While beneficial to consumers with either low or high domain-specific knowledge, we predicted that decomposing the idea generation problem into sub-problems would enhance the performance of high-knowledge consumers significantly more.

5.1. Method

Participants for the idea generation task were obtained from the same subject pool as in Study 1. They also accessed the study via computers in a behavioral lab. We pre-screened respondents to ensure that none of them had engaged in Study 1. A total of 96 respondents completed the idea generation task. The overall flow of the idea generation task and the control condition were identical to that of Study 1. In the control condition, respondents were asked to generate some ideas for possible applications of the EasyCode technology that could be "printed on any type of paper, carton, or electronic screen." In the treatment condition, the idea generation problem was decomposed into sub-problems by asking respondents to submit ideas for the three different types of support (i.e., paper, carton, and electronic screens) in sequence. See Web Appendix A2 for a detailed description of the web interface shown to the respondents. A total of 202 ideas were generated in this study. We then collected their quality ratings using the procedure described above (see "Section 3.3. Idea Evaluation") from 397 respondents from Amazon's Mechanical Turk panel.

5.2. Results

We tested H2 by regressing each respondent's performance on: 1) a dummy variable denoting whether or not the problem was decomposed into sub-problems; 2) the mean-centered

knowledge score; and 3) their interaction. As expected, we found a significant positive two-way interaction ($\beta = 4.947$; $t = 2.148$; $p < .05$). We further conducted spotlight analysis. A regression analysis with knowledge score centered at one standard deviation above the mean revealed that problem decomposition significantly enhanced performance of high-knowledge consumers ($\beta = 13.994$; $t = 5.375$; $p < .01$). A similar spotlight analysis at one standard deviation below the mean revealed that problem decomposition also positively contributed to the performance of low-knowledge consumers ($\beta = 6.064$; $t = 2.330$; $p < .03$). The performance comparisons are displayed in Figure 2. These findings support our H2, that problem decomposition enhances the performance of both high- and low-knowledge consumers, but it does significantly more so for high-knowledge consumers.

<Insert Figure 2 about here>

5.3. Discussion

Compared to the extant literature, our research provides the first empirical evidence that problem decomposition has a differential impact on low- and high-knowledge consumers. We show that, by forcing consumers to devote their attention evenly to the entire problem space, decomposing the idea generation problem into sub-problems can be considerably beneficial in helping high-knowledge consumers better leverage their cognitive advantages and perform more in accordance with their greater potential. On the other hand, while problem decomposition is also beneficial to low-knowledge consumers, its benefits are smaller in magnitude because of these consumers' lack of domain-specific knowledge.

6. Study 3

Study 3 had three purposes. The first purpose was to test H3. Specifically, we examine the interaction between the two types of manipulations used in Studies 1 and 2. Second, this study allowed testing the approach of assessing consumers' level of knowledge and assigning them on

the fly to an idea generation task that matches their type. We discuss this set of results in the next section (see Section 7 "Customizing Idea Generation Tasks: Empirical Assessment"). Lastly, this study enabled us to replicate our tests of H1 and H2 using a non-student population and a larger sample size.

6.1. Method

Study 3 comprised four conditions. In Condition 1 (stimulus ideas, decomposed problem), we presented two stimulus ideas associated with each type of support (paper, carton, or electronic screens) when asking the respondent to submit ideas for that support. Condition 2 (stimulus ideas, not decomposed) was similar in structure to the treatment condition in Study 1, with the same six stimulus ideas as in Condition 1 being shown to the respondents all at once. Condition 3 (no stimulus ideas, decomposed problem) was identical to the treatment condition employed in Study 2, and Condition 4 (no stimulus ideas, not decomposed,) was identical to the control condition used in the first two studies. Web Appendix A3 describes the web interface.

Participants of the idea generation task were recruited from Amazon's Mechanical Turk panel. Each respondent first answered the measurement scale items and some open-ended questions, as in the first two studies (see "Section 3.5. Measuring Consumer Knowledge"). Next, we randomly assigned consumers to the four idea generation conditions described above. A total of 750 ideas were generated. We then collected idea quality ratings from a different set of respondents from Amazon's Mechanical Turk panel (N=1216). We pre-screened these respondents to ensure that none of them was involved in any other task related to our studies.

6.2. Results

In line with H3, a two-way ANOVA test revealed a significant negative interaction between problem decomposition and the presence of stimulus ideas ($F(1, 403) = 3.951$, $p < .05$, see Figure

3). Study 3 also enabled us to replicate our tests of H1 and H2. We compared the performance of consumers in conditions 2 and 4 and replicated the negative interaction effect predicted by H1 (β = -3.951; t = 2.520; $p < .05$). We also compared the performance of consumers in conditions 3 and 4, and replicated the positive interaction effect predicted by H2 (β = 5.640; t = 2.540; $p < .05$).

<Insert Figure 3 about here>

6.3. Discussion

This study demonstrates that, although the underlying processes of stimulus ideas and problem decomposition differ, the benefits offered by the two types of manipulations are somewhat redundant. In particular, both manipulations allow activating knowledge that may otherwise not be accessed. As a consequence, the incremental benefit of each manipulation is lower when the other one is also present. Managerially, this study implies that, if employing more than one type of manipulation in idea generation, firms need to carefully investigate the potential interaction effect across different manipulation types. Moreover, this study serves as a robustness check to demonstrate that our tests of H1 and H2 can be replicated with a larger, non-student sample.

7. Customizing Idea Generation Tasks: Empirical Assessment

Upon obtaining empirical support for our hypotheses, we further examine the benefits of customizing the idea generation task conditional on each consumer's knowledge level. As per our empirical findings, we suggest a customized idea generation system as follows: 1) assess the participant's knowledge level at the focal problem; 2) categorize low- vs. high-knowledge consumers on the fly; 3) customize the task so that (a) low-knowledge consumers are presented with a decomposed idea generation problem where stimulus ideas are offered for each sub-problem, and (b) high-knowledge consumers are assigned to a decomposed idea generation task without stimulus ideas.

While our hypothesis testing employed a continuous consumer knowledge measure, task customization inevitably requires classifying consumers into low- and high-knowledge types (step 2 above). We calculated a knowledge score for each respondent and used median split to classify respondents as high- vs. low-knowledge. In order to mimic a situation where each consumer needs to be classified on the fly based on information previously collected, the threshold we used to determine the two consumer types was based on the median knowledge score calculated from a pretest with a different set of 104 consumers from the same panel. We use median splits because this approach has been widely used to classify consumers into high- and low-knowledge types (e.g., Bettman and Susan 1987; Dahl and Moreau 2007; Mandel and Johnson 2002)

Study 3 allows us to assess the value of the customized idea generation system outline above. In particular, such a system would assign low-knowledge consumers to Condition 1 and high-knowledge consumers to Condition 3. We compare the performance of low-knowledge consumers in Condition 1 combined with high-knowledge consumers in Condition 3 to that of consumers in any of the four conditions (i.e., all consumers assigned to the same task structure). We find that the average performance of low-knowledge consumers in Condition 1 combined with high-knowledge consumers in Condition 3 is significantly superior to that of consumers (both types combined) in all four conditions ($M_{adaptive} = 18.078$ vs. $M_{cond1} = 15.699$, $t = 2.112$, $p < .04$; $M_{adaptive} = 18.078$ vs. $M_{cond2} = 8.357$, $t = 4.261$, $p < .01$; $M_{adaptive} = 18.078$ vs. $M_{cond3} = 17.073$, $t = 1.980$, $p < .05$; $M_{adaptive} = 18.078$ vs. $M_{cond4} = 7.811$, $t = 4.671$, $p < .01$). These findings suggest that a customized system has the potential to considerably enhance the value firms derive from involving consumers in idea generation.

8. Conclusions

Despite the increasing popularity of consumer involvement in idea generation, research on how firms may foster consumer performance in such tasks has been scarce. Our research is among the first attempt to demonstrate that customized idea generation systems can be highly beneficial managerially.

Specifically, we demonstrate that, while potentially detrimental to high-knowledge consumers, stimulus ideas can serve as search cues to alleviate the lack-of-knowledge obstacle faced by low-knowledge consumers. Additionally, we show that, while enhancing the performance of both low- and high- knowledge consumers, problem decomposition is significantly more beneficial for high-knowledge consumers. By forcing these individuals to devote even attention to the entire problem space, this manipulation enables high-knowledge consumers to better leverage their abundant knowledge and perform more in accordance with their greater potential.

We further outline a general process for developing a customized idea generation system conditional on each consumer's knowledge level. Our empirical results suggest that firms can significantly improve consumer performance in idea generation by employing such a system. With the increased availability of online idea generation platforms as well as online panels such as Mechanical Turk and Qualtrics, this process may be readily implemented in a timely and cost-effective manner.

We conclude by highlighting some avenues for future research other than those already mentioned in the paper. First, our research focused on the interplay between consumer knowledge and two aspects of task structure (stimulus ideas and problem decomposition), due to their relevance to the distinctive challenges faced by low- and high-knowledge consumers. Future research may examine how other aspects (e.g., level of abstraction; types of stimuli) may also be considered in a customized idea generation system. Second, while adopting a well estab-

lished approach to measuring consumer performance in idea generation, we acknowledge that the ultimate performance metric should be the market performance of the new products that will be developed based on these ideas. However, collecting this metric requires developing and launching such products, which was not feasible in our context. Future research may explore how to incorporate such metric into performance evaluations. Lastly, while we focused our empirical investigation on a specific idea generation context like in most empirical studies, future research may explore the usefulness of the proposed customized system in alternative contexts.

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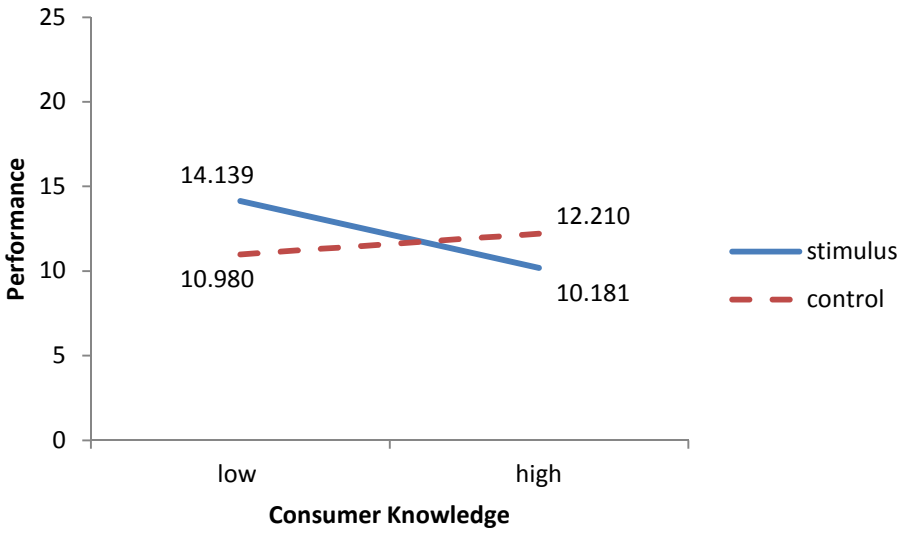
Table 1: Summary Statistics (Studies 1-3)

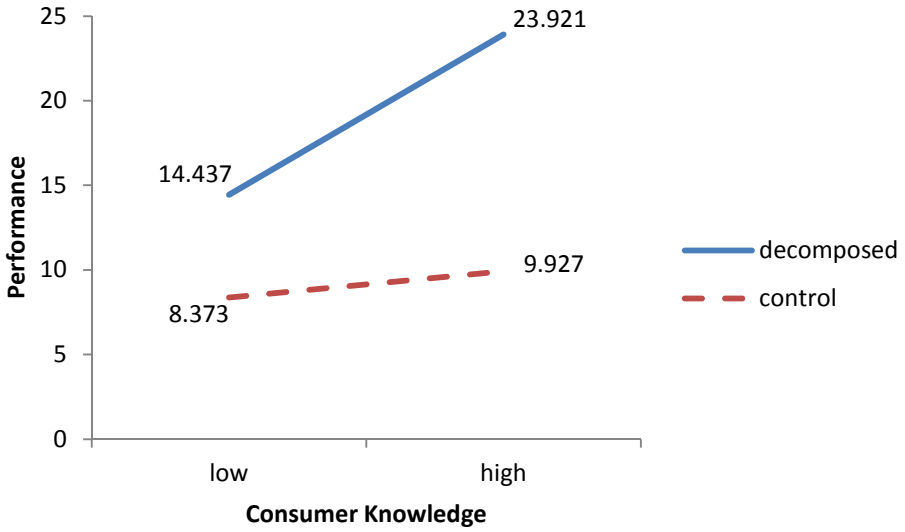
	Study 1		Study 2		Study 3	
	Idea Generation					
Participants Type	undergraduates		undergraduates		consumer panel	
# of Participants	106		96		407	
	mean	std. dev.	mean	std. dev.	mean	std. dev.
Consumer Knowledge Score (0-5)	2.410	.702	2.438	.801	2.812	.781
# of Ideas	1.802	1.828	1.990	1.997	1.799	1.990
Idea Quality Score (1-10)	6.843	1.712	6.844	1.618	6.635	1.766
Consumer Performance	12.330	11.658	13.616	10.412	11.933	12.975
	Idea Evaluation					
Participants Type	consumer panel		consumer panel		consumer panel	
# of Participants	371		397		1216	
Ave. # of Evaluations Per Idea	38.4		39.3		32.4	

Figure 1: Performance Comparisons – Study 1



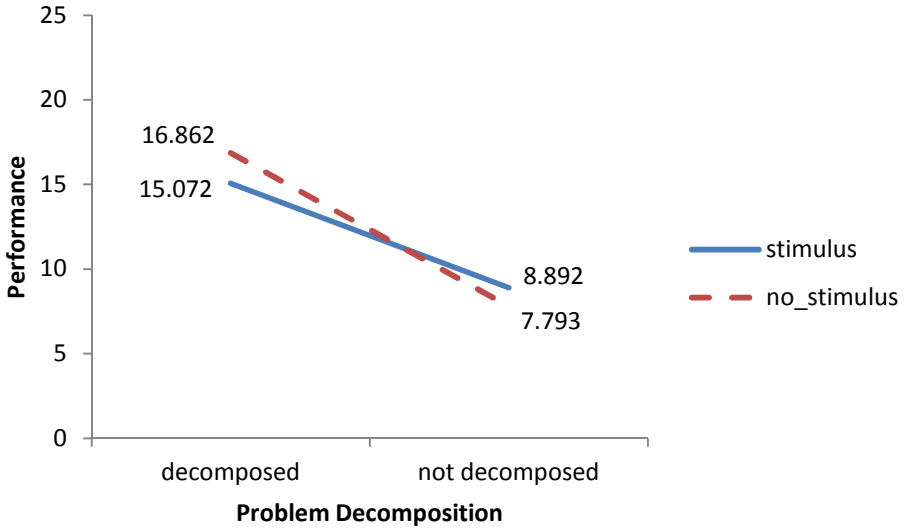
low is 1 std. dev. below and high is 1 std. dev. above the mean

Figure 2: Performance Comparisons – Study 2



low is 1 std. dev. below and high is 1 std. dev. above the mean

Figure 3: Performance Comparisons – Study 3



Appendix: Supplementary Information on Empirical Studies

Measurement Scales Used to Categorize Consumer Types:

Domain-Specific Consumer Knowledge Scale (adapted from Mitchell and Dacin 1996)

Compared to the average person, I do not know much about technology products. (reverse)
I am very familiar with technology products.
I am not skilled at utilizing technology products. (reverse)
I am very interested in technology products.
I own a lot of technology products.
My friends own a lot of technology products.
I read articles related to technology products all the time.

Domain-Specific Lead Users Scale (adapted from Hoffman et al. 2010)

Other people consider me as "leading edge" with respect to technology products.
I tend not to look for new and different usages of technology products. (reverse)
I have suggested to my friends and family members some new and different ways of utilizing new technology.
I normally do not participated in store offers/promotions to try out new technology products. (reverse)
I have come up with some new and different solutions to satisfy my unmet needs by using technology products.

Emergent Consumers Scale (adapted from Hoffman et al. 2010)

When I hear about a new technology product, it is easy for me to come up with ideas of how to apply this technology.
If I don't see an immediate use for a new technology, I normally do not think about how I might use it in the future. (reverse)
When I see a new technology product, it is easy for me to visualize how it might fit into the life of an average person in the future.
If someone gave me a new technology product with no clear application, I could "fill in the blanks" so someone else would know what to do with it.
Even if I don't see an immediate use for a new technology, I like to imagine how people might use it in the future.
I try to avoid experimenting with new ways of using new technology products. (reverse)
I do not like to find patterns in complexity. (reverse)
I can picture how new technology products could be applied to improve an average person's life.

Domain-Specific Consumer Innovativeness Scale (adapted from Goldsmith and Hofacker 1991)

In general, I am among the last in my circle of friends to adopt new technology products. (rev
If I heard that a new technology product was available, I would be interested to try it out.
Compared to my friends, I do not adopt a lot of technology products. (reverse)
In general, I am the first in my circle of friends to know about a new technology product.
I will adopt a new technology product, even if I haven't heard of it before.
I get to know many technology products before other people do.

Reliability and Discriminant Validity Checks

We conducted assessment of these scales in a pretest with 123 respondents following the guidelines proposed by Churchill (1979). For the 7-item consumer knowledge scale, we submitted the corresponding items to an exploratory factor analysis with oblique rotation. The analysis suggested one dominant factor with loadings above .570 for all the items. The Cronbach's alpha for this scale is .835. Similar analysis was conducted for the 5-item domain-specific lead user scale. The exploratory factor analysis suggested one dominant factor with loadings above .5 for all the items. The Cronbach's alpha for this scale is .658. With regard to the 8-item emergent consumer scale, the exploratory factor analysis revealed a single factor with factor loading above .62 for all items, with the Cronbach's alpha being .817. Finally, for the 6-item domain-specific consumer innovativeness scale, the exploratory factor analysis suggested a single factor with factor loading above .563 for all items. And the Cronbach's alpha for this scale is .790.

A correlation analysis revealed moderate correlations among the four consumer type categorizations (ranging from .382 between lead users and emergent consumers, to .429 between emergent consumers and high-knowledge consumers). We further used confirmatory factor analysis to formally test the discriminant validity of these four constructs. We found that a four-factor structural model fits the data significantly better (GFI=0.917, RMSEA=0.053) than a single-factor model (GFI=0.6749, RMSEA=0.095). This suggests that domain-specific knowledge, domain-specific leader user, emergent nature, and domain-specific innovativeness are four distinct constructs.

Robustness Check: Controlling for Identical or Nearly Identical Ideas

Following the guidelines provided by Kornish and Ulrich (2011), 120 respondents recruited from Amazon's Mechanical Turk panel were each presented with ideas from the same group and asked to identify sets of two or more ideas that were identical or nearly identical. As usual, we employed a pre-qualifier to ensure that these respondents were different from those who participated in our idea generation or evaluation tasks. As recommended by Kornish and Ulrich (2011), ten or more respondents evaluated each subset of ideas and the more conservative "majority threshold" was used to identify identical or nearly identical ideas (namely, at least 50% of the raters identified the ideas as being identical or nearly identical). We found that, among all ideas received, less than 5% were considered to be identical or nearly identical using the "majority threshold" rule. This finding is also consistent with Kornish and Ulrich (2011) that redundancy is quite small in idea generation tasks.

Web Appendix A1: Study 1 Interface (Idea Generation Task)

[The page was refreshed each time the respondent selected "submit idea." The task ended when the respondent selected "I have no more ideas."]

ScanWork is a new software that enables camera cell phones to read a type of special barcodes called EasyCodes. These EasyCodes direct the cell phone to perform specific actions. Below is an example of an EasyCode:

Easycodes can be printed on any type of paper, carton, or electronic screens. Using EasyCodes involves three steps illustrated below. These three steps only take a few seconds to complete.
STEP 1: Scan an EasyCode using your cell phone.
STEP 2: Your cell phone connects to a remote server via Internet.
STEP 3: Server returns information back to the cell phone.

[Control Condition:]
WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY?
We are interested in new applications for the EasyCode technology. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea
I have no more ideas

[“Stimulus ideas” condition:]

Here are a few examples of possible applications of EasyCodes:

- A user could scan an EasyCode in a billboard or magazine and see a movie's trailer & show times.
- Scanning an EasyCode could automatically send, edit or save an appointment or date in the user's calendar.
- Scanning an EasyCode could automatically save someone's contact information.
- A user could scan an EasyCode at a bus stop and get the bus schedule on the fly.
- A user could scan an EasyCode on a TV screen and download and play a game from a TV Show.

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY?
We are interested in new applications for the EasyCode technology. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea
I have no more ideas

Web Appendix A2: Study 2 Interface (Idea Generation Task)

[The "paper" instructions below were shown first. These instructions were replaced with the "carton" instructions after the respondent selected "I have no more ideas using paper," and the "carton" instructions were in turn replaced with the "screen" instructions after the respondent selected "I have no more ideas using carton." The page was refreshed and the same instructions appeared each time the respondent selected "submit idea."]

ScanWork is a new software that enables camera cell phones to read a type of special barcodes called EasyCodes. These EasyCodes direct the cell phone to perform specific actions. Below is an example of an EasyCode:

Easycodes can be printed on any type of paper, carton, or electronic screens. Using EasyCodes involves three steps illustrated below. These three steps only take a few seconds to complete.
STEP 1: Scan an EasyCode using your cell phone.
STEP 2: Your cell phone connects to a remote server via Internet.
STEP 3: Server returns information back to the cell phone.

["Decomposed" condition:]

[Paper:]

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING PAPER?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of paper**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using paper

[Carton:]

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING CARTON?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of carton**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using carton

[Screen:]

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING ELECTRONIC SCREENS?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of electronic screens**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using screens

Web Appendix A3: Study 3 Interface (Idea Generation Task)

[The page was refreshed each time the respondent selected "submit idea." The task ended when the respondent selected "I have no more ideas."]

ScanWork is a new software that enables camera cell phones to read a type of special barcodes called EasyCodes. These EasyCodes direct the cell phone to perform specific actions. Below is an example of an EasyCode:

Easycodes can be printed on any type of paper, carton, or electronic screens. Using EasyCodes involves three steps illustrated below. These three steps only take a few seconds to complete.
STEP 1: Scan an EasyCode using your cell phone.
STEP 2: Your cell phone connects to a remote server via Internet.
STEP 3: Server returns information back to the cell phone.

[Condition 1: stimulus ideas, decomposed problem]:

[Paper:]

Here are a few examples of possible applications of EasyCodes using **paper**:

- A user could scan an EasyCode in a magazine and see a movie's trailer & showtimes.
- A user could scan an EasyCode on the back cover of a book that links to the book's Amazon page for purchase.

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING PAPER?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of paper**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using paper

[Carton:]

Here are a few examples of possible applications of EasyCodes using **carton**:

- Scanning an EasyCode on a business card could automatically save someone's contact information.
- Scanning an Easycode on a billboard could give the user additional information about the product or brand being promoted.

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING CARTON?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of carton**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using carton

[Screen:]

Here are a few examples of possible applications of EasyCodes using **electronic screens:**

- Scanning an Easycode at the bottom of an email could automatically send, edit or save an appointment or date in the user's calendar.
- A user could scan an Easycode on a TV screen and download and play a game from a TV Show.

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY USING ELECTRONIC SCREENS?

We are interested in new applications for the EasyCode technology. For now, we would like to focus on applications of the EasyCode technology in which the codes are printed **on any type of electronic screens**. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea

I have no more ideas using screens

[Condition 2: stimulus ideas, not decomposed:]

Here are a few examples of possible applications of EasyCodes:

- A user could scan an EasyCode in a magazine and see a movie's trailer & showtimes.
- A user could scan an EasyCode on the back cover of a book that links to the book's Amazon page for purchase.

- Scanning an EasyCode on a business card could automatically save someone's contact information.
- Scanning an Easycode on a billboard could give the user additional information about the product or brand being promoted.
- Scanning an Easycode at the bottom of an email could automatically send, edit or save an appointment or date in the user's calendar.
- A user could scan an Easycode on a TV screen and download and play a game from a TV Show.

WHAT COULD BE SOME APPLICATIONS OF THE EASYCODE TECHNOLOGY?
We are interested in new applications for the EasyCode technology. In the space provided below, please enter any new idea that you make think of. Each idea should propose a possible application of the EasyCode technology. You may propose as many ideas as you wish, but **please do not enter more than one idea in the box below**. If you want to submit additional ideas, press 'submit idea' first. (Note: your ideas will remain anonymous to other participants.)

submit idea
I have no more ideas

[Conditions 3 and 4 instructions were identical to Study 2]