Information Systems Research

Publication details, including instructions for authors and subscription information:
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To cite this article:
Tat Koon Koh (2019) Adopting Seekers' Solution Exemplars in Crowdsourcing Ideation Contests: Antecedents and Consequences. Information Systems Research 30(2):486-506. https://doi.org/10.1287/isre.2018.0810

http://pubsonline.informs.org/journal/isre/

INFORMATION SYSTEMS RESEARCH
Vol. 30, No. 2, June 2019, pp. 486–506
ISSN 1047-7047 (print), ISSN 1526-5536 (online)

Adopting Seekers' Solution Exemplars in Crowdsourcing Ideation Contests: Antecedents and Consequences

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Received: February 17, 2016
Revised: December 3, 2016; August 16, 2017; March 9, 2018; July 12, 2018
Accepted: July 19, 2018
Published Online in Articles in Advance: May 24, 2019

https://doi.org/10.1287/isre.2018.0810

Abstract. To benefit from the wisdom of the crowd in ideation contests, seekers should understand how their involvement affects solvers' ideation and the ensuing ideas. This present study addresses this need by examining the antecedents and consequences of solvers' exemplar adoption (i.e., use of solution exemplars that the seekers provide) in such contests. We theorize how the characteristics of seekers' exemplars (specifically, quantity and variability) and prizes jointly influence exemplar adoption. We also consider how exemplar adoption affects the effectiveness of the resulting ideas, conditional on solvers' experience with the problem domain of the contests. The results from a company naming contest and an ad design contest show that exemplar quantity and exemplar variability both positively affect exemplar adoption, but the effects are strengthened and attenuated, respectively, by prize attractiveness. The outcomes of a campaign using the ads from the design contest further show that greater exemplar adoption improves ad effectiveness (in terms of click-through performance) although this is negatively moderated by solvers' domain experience. We discuss the theoretical and practical contributions of this research to ideation contests.

History: Alessandro Acquisti, Senior Editor; Atreyi Kankanhalli, Associate Editor.
Funding: This work was supported by the Hong Kong Research Grants Council [Grant 26500114].
Supplemental Material: The online appendix is available at https://doi.org/10.1287/isre.2018.0810.

Keywords: ideation contests • crowdsourcing • exemplars • prizes • contest winning • effort economization • payoff attractiveness • domain experience • banner ads • click-through

1. Introduction

With the proliferation of crowd-based ideation contests, solution-seeking firms no longer have to rely solely on internal employees to address their problems; they can also call on individuals outside their organizations for solutions. These contests are competitions in which seekers engage solvers to develop ideas and solutions to solve creativity- and innovation-related problems (Terwiesch and Xu 2008, Majchrzak and Malhotra 2013).[1] Some examples include contests to solicit company logos (Bockstedt et al. 2016, Wooten and Ulrich 2017), generate new product ideas (Poetz and Schreier 2012), or solve R&D problems (Jeppesen and Lakhani 2010). It has been shown that outside solvers have the potential to produce promising ideas in contests. For example, the crowd could develop product ideas that are more effective in solving the underlying problems than the professionals in a company could generate (Poetz and Schreier 2012), and solvers who lack the domain expertise for specific R&D problems could nonetheless submit successful solutions (Jeppesen and Lakhani 2010).

To benefit from the proverbial wisdom of the crowd, seekers should understand how their involvement in contests shapes solvers' ideation and the resulting ideas. In this regard, seekers have to set the contest prizes strategically as the attractiveness of the prizes can affect solvers' effort and performance (Archak 2010, Bockstedt et al. 2016). Seekers also need to be mindful of the information they provide (Terwiesch and Ulrich 2009, Wooten and Ulrich 2017), such as examples of ideas that they like. For instance, in ad design contests, seekers can use existing ads to illustrate the types of designs they prefer. Such examples could serve as solution exemplars that solvers refer to during ideation. Contest platforms often encourage seekers to provide solution exemplars and claim that doing so contributes to the ideation process (see Figure A1 in the online appendix). For example, one platform states that showing example designs that the seekers like is "one of the best ways to inform and inspire [the] designers."[2] Yet seeker exemplars might be a constraint at the same time; as we point out later, a solver in this study remarked that seeker exemplars could provide directions during idea generation but also lead to closed-minded ideas based on the exemplars. Thus, the provision of seeker exemplars can affect solvers' ideation one way or the other.

The prominence of seeker exemplars in ideation contests necessitates the need to understand solvers'

exemplar adoption (i.e., use of seeker exemplars in their ideas). This is especially so as the extent of exemplar adoption can have important implications: greater exemplar adoption leads to ideas that are more similar to the seeker exemplars and could impact how well the ideas address the focal problems, which, in turn, affect the value to the seekers in enlisting the crowd. With this in mind, this study explores two research questions regarding exemplar adoption in ideation contests. The first looks at the antecedents of exemplar adoption in terms of seekers' exemplars and prizes. Seekers have substantial control over the exemplar characteristics (specifically, quantity and variability) and prizes in their contests, and these aspects of seeker involvement can influence the ideation process from contest initiation as they are made known to solvers at the beginning. (By comparison, other types of seeker involvement, such as giving feedback on ideas during contests or evaluating solutions at the end, occur only after solvers have begun or completed ideating.) Thus, knowing how the quantity and variability of exemplars and the attractiveness of prizes affect exemplar adoption can help seekers be strategically involved in their contests right from the start. In our theorizing of solvers' exemplar adoption, we relate exemplar characteristics and prizes to three factors that pertain to solvers' goals in contests: contest winning, effort economization, and prize attractiveness. From the interactive association among the antecedents and these goal-related factors, we hypothesize the joint effects of exemplar characteristics and prizes on exemplar adoption.

The second research question examines the consequences of exemplar adoption so as to understand how seekers' involvement affects, albeit indirectly, the ideas that they receive. Ultimately, one of seekers' key purposes in using contests is to acquire effective solutions that address their problems (Poetz and Schreier 2012). Thus, we look at how solvers' exemplar adoption impacts the effectiveness of the resulting ideas. As solvers have different expertise and experience, we argue that the effect of exemplar adoption on solution effectiveness depends on solvers' domain experience.

We conducted three studies to address the research questions. In study A, solvers were recruited from Amazon Mechanical Turk (MTurk) to generate ideas in a company naming contest. In this contest, we manipulated the contest prize and the examples of words that the hypothetical seeker liked for the company name. For study B, we hosted a contest in which solvers, including professional graphic designers, designed banner ads for an online directory. Although we manipulated the exemplars of ad designs that the hypothetical seeker provided, we fixed the prizes in this contest and instead asked solvers for their perception of the prize attractiveness. The results of these two studies showed that exemplar quantity and exemplar variability both positively impacted exemplar adoption although the impacts were strengthened and attenuated, respectively, by prize attractiveness. The use of different ideation contests (company naming versus ad designing), solvers (MTurk workers versus professional graphic designers), and prize attractiveness measures (experimenter-manipulated versus self-reported) across studies A and B contributes to the generalizability of our findings concerning the antecedents of exemplar adoption. In study C, we examined the consequences of exemplar adoption on solution effectiveness. We used a real-world ad campaign to measure the click-through performance of the ads from study B. Ads that adopted seeker exemplars to a larger extent performed better in the campaign, but the effect was negatively moderated by solvers' domain experience.

This research contributes insights into the impacts of seeker involvement in ideation contests. Although seekers' decisions about the exemplars to provide and prizes to offer may be independent from one another, we show that certain aspects of these decisions jointly affect solver behaviors. This demonstrates that individual facets of seeker involvement could intertwine and have unexpectedly intricate effects. Moreover, although prior work finds that seekers can shape solver behaviors as ideas are submitted during the contests (Bockstedt et al. 2016, Wooten and Ulrich 2017), we show that seekers can exert their influence, through their exemplars and prizes, even before any ideas have been created. In addition, by influencing solvers' exemplar adoption, seekers also affect the effectiveness of the ideas. All in all, this study highlights that seekers play an active role in how and what solvers ideate.

This research also calls attention to the moderating roles of solver heterogeneity in ideation contests. These contests often involve diverse solvers with different prize valuations and expertise, and existing research has examined the direct implications of these differences for solver behaviors and contest outcomes (Jeppesen and Lakhani 2010, Bockstedt et al. 2015). By showing that (1) solvers' perception of the attractiveness of a given prize influences the relationship between exemplar characteristics and exemplar adoption and (2) solvers' domain experience affects the effect of exemplar adoption on solution effectiveness, this work extends the findings from earlier studies and underscores the need to understand how heterogeneity in solvers' perceptions and attributes moderates the impacts of seeker involvement and the ensuing solver behaviors.

2. Related Literature

In this study, we are interested in ideation projects that take the form of crowd-based contests in which solvers submit ideas to compete for prizes that seekers offer

(Jeppesen and Lakhani 2010, Bockstedt et al. 2016, Wooten and Ulrich 2017). The core purpose of such contests is for seekers to address their problems by engaging a group of solvers to concurrently search for suitable ideas. Boudreau et al. (2011) point out that having solvers conduct a broad and parallel search for solutions can increase the likelihood of uncovering outstanding ideas. Ideation contests typically begin with seekers posting project briefs on contest platforms in which they provide details about their problems and requirements, show examples of solutions that they like, and state the prizes. Once the contests begin, solvers can ideate and submit their ideas. At the end of the contests, seekers choose their preferred solution(s) and award prizes to the corresponding winning solvers.

Seekers' involvement in contests can shape solver behaviors, which, in turn, affect the ideation process and outcomes. There are two aspects of seeker involvement that we consider in this study. The first relates to the solution exemplars that seekers show in the project briefs. Seeker exemplars, especially those of acceptable relevance and quality, can serve as references of existing solutions for similar problems. In this capacity, seeker exemplars play a critical function in ideation because new ideas are not created in a vacuum, but often involve combining or transforming prior ideas (March 1991, Audia and Goncalo 2007); as Nelson and Winter (1982, p. 130) point out, creating new ideas "consists to a substantial extent of a recombination of conceptual and physical materials that were previously in existence." These references can guide solvers in problem framing and affect specific solution attributes (Herring et al. 2009, Toh and Miller 2014). Solvers can also use the references to assess their ideas' originality and identify potential flaws or limitations (Smith et al. 1993, Herring et al. 2009). Given these roles of exemplars in idea generation, it is necessary to understand solvers' use of seeker exemplars. However, existing literature offers little specific insights into the antecedents and consequences of exemplar adoption in ideation contests.

The second seeker involvement that interests us pertains to the contest prizes, which are key considerations for both the seekers (cost of using contests) and solvers (potential benefits of joining contests). A value proposition for using crowdsourcing contests, as asserted by various contest platforms, is that seekers can acquire ideas at a low cost or based on how much they are willing to pay. Consider the following claims by some contest platforms (emphasis added):[3]

- DesignCrowd gives you access to a "virtual team" of 629,923 designers from around the world (via a process called crowdsourcing)—helping you to tap into the very best international design talent available, *at a low cost* (http://www.designcrowd.com/about).
- Design contests are very cost-effective. *The client chooses the contest prize they want to pay*, and know that designers will create designs for that price—there's no going over budget here (https://support.99designs.com/hc/en-us/articles/204761035)!

Nonetheless, the decisions about the prizes to offer in contests are nontrivial. Various studies show that the number of prizes affects solvers' participation and effort (Terwiesch and Xu 2008, Cason et al. 2010), and the optimal prize structure depends on factors such as solvers' risk aversion and the problems' attributes (Archak and Sundararajan 2009, Morgan and Wang 2010). Moreover, attractive prizes generally stimulate greater solver effort and lead to better performance (Archak 2010, Bockstedt et al. 2016). Yet, to our best knowledge, although extant research on contest prizes is extensive, no study has considered the impact of prize attractiveness on exemplar adoption by solvers.

3. Theory and Hypotheses Development

3.1. Antecedents of Exemplar Adoption by Solvers

To examine how exemplar characteristics and prizes influence solver behaviors, it is necessary to understand how these aspects of seeker involvement relate to solvers' goals in contests. Individuals' behaviors and activities in tasks are determined by their goals (Locke et al. 1968, Locke 2000); as Locke (2000, p. 413) succinctly states, "goals direct actions." Moreover, goals that are more important have greater influences on goal-relevant actions (Locke 2000, Ülkümen and Cheema 2011). In light of this, and drawing from existing literature, we conceptualize three prominent factors that matter to solvers: *contest winning*, *effort economization*, and *prize attractiveness*. The first two factors concern solvers' contest goals, whereas the third affects the goals' importance; the relations among these three factors are such that, although solvers strive to win and economize effort in contests, the significance of these goals depends on the attractiveness of the prizes to them. Next, we present these goal-related factors, discuss their implications for solver behaviors, and apply them to examine the impacts of exemplar characteristics and prizes on exemplar adoption. Because these factors are inherently interrelated, we expect that they work in concert in influencing solver behaviors, which leads to our hypotheses of the joint effects of seeker exemplars and prizes.

3.1.1. Factors of Solver Behaviors: Contest Goals and Goal Importance.

Contest Winning. Winning is a key goal that solvers strive for in contests (Brabham 2010, Ye and Kankanhalli 2017). Because of the typical winner-takes-all outcome, winning the contests is often the only way that solvers can be financially compensated for their participation. Solvers' pursuit of winning could lead them to adopt strategies that increase the likelihood that seekers would select their ideas. One such goal-directed strategy is to

develop ideas that reflect attributes that seekers like as seekers' preferences are influential determinants of winning solutions (Terwiesch and Xu 2008). In this regard, solvers can enhance the preference fit of their ideas by using information or signals from seekers, such as feedback provided by seekers during the contests (Bockstedt et al. 2016, Wooten and Ulrich 2017) or the exemplars that they show in the project briefs, which we discuss later.

Effort Economization. Another goal that solvers have is to economize their effort in contests as they often have commitments outside of a particular contest that compete for their limited resources (Cahalane et al. 2014). For example, many solvers are students or gainfully employed elsewhere (Brabham 2010, Füller et al. 2017) and/or participate in multiple concurrent contests (Bockstedt et al. 2016). Moreover, solvers are mindful of the cognitive effort that they invest because of the limited cognitive capacity at their disposal; Ye and Kankanhalli (2017) find that solvers are less likely to join those contests that they perceive to require high cognitive effort. Thus, given the resource constraints that they face, solvers would strive to avoid or minimize unnecessary activities in individual contests. For example, to avoid escalating their contest participation costs, solvers are likely to terminate the information search once they believe they have acquired sufficient information (even if they know they lack complete information). Also, although solvers can potentially generate a large number of alternative ideas, they would stop ideating once they think they have "good enough" ideas instead of continuing until they achieve the "best" ones (Simon 1990).

Prize Attractiveness. Another salient factor that solvers consider is the attractiveness of the contest payoffs; we focus on payoffs in the form of prizes for winning solvers because seekers have significant control over what prizes to offer.[4] Prize attractiveness can be evaluated in absolute or subjective terms. A prize with a higher absolute value (e.g., $1,000) is evidently more attractive than one with a lower absolute amount (e.g., $200). However, as the crowd is diverse, a certain prize can be perceived as attractive to some solvers (e.g., low-endowed solvers) but less so to others (e.g., high-endowed solvers) (Terwiesch and Xu 2008, Bockstedt et al. 2015). For example, a particular prize amount (e.g., $100) could be more appealing to solvers from less wealthy countries than those from wealthier ones (Bockstedt et al. 2015).

In contests, prize attractiveness—whether in absolute or subjective terms—is closely associated with both contest winning and effort economization. Specifically, prize attractiveness affects the importance of these two goals to solvers and, in the process, shapes their behaviors. First, attractive prizes increase the value and prestige of winning, thereby strengthening solvers' aim of having their ideas selected by seekers. In this context, developing ideas with high preference fit becomes an even more vital strategy for solvers. Second, attractive prizes could weaken solvers' effort economization, thus increasing their willingness to do more during ideation, such as gathering additional information and/or engaging in creative processing above and beyond the minimum required. This expectation of solver behaviors is in line with findings that show larger prize amounts positively correlate with solvers' participation length and submission quantity in contests (Bockstedt et al. 2016). To sum up, as prize attractiveness increases, having their ideas chosen by seekers matters more to solvers and avoiding additional activities in contests becomes less important.

3.1.2. Impacts of Exemplar Characteristics and Prizes on Exemplar Adoption.

References play an integral role in the ideation process. However, in addition to using seeker exemplars—assuming they are relevant and of at least adequate quality—as references (see Section 2), solvers can look outside the contest setting for *external references*. For example, solvers can search on the internet for prior work that they think is applicable (Herring et al. 2009). Although solvers can refer to seeker exemplars and external references when generating ideas, ceteris paribus, they are likely to place greater emphasis on the former as doing so aligns with their contest goals. First, seeker exemplars signal seekers' preferences, whereas external references do not. As such, focusing on seeker exemplars rather than on external references facilitates solvers in developing ideas with better preference fit, thereby improving their chances of winning (contest winning). Second, unlike external references, seeker exemplars require no search or acquisition effort on the solvers' part. Using seeker exemplars thus allows solvers to make more efficient use of their effort in the contests (effort economization). For these reasons, solvers would generally use seeker exemplars as the core and primary references during ideation and only search more aggressively for external references when they consider the exemplars to be insufficient for developing ideas. It is intuitive that, as solvers rely more on seeker exemplars relative to external references, they will adopt the exemplars in their ideas to a greater extent, resulting in these ideas being more similar to the exemplars. Next, we consider how the quantity and variability of seeker exemplars affect exemplar adoption by solvers, contingent on contest prizes.

Exemplar Quantity. When seekers provide only a few exemplars in contests, solvers have limited references during ideation and insufficient information to infer the types of ideas that seekers might like. In such

situations, solvers need to supplement the seeker exemplars with external references so as to improve the potential to develop satisfactory ideas. In contrast, when there are more seeker exemplars to better facilitate ideation, solvers might regard an extensive search for external references as an uneconomical use of resources. Having more seeker exemplars could also cause the ideation process to gravitate toward the exemplars because there are now more signals of seekers' preferences, which can contribute to solvers' chances of winning (Terwiesch and Xu 2008). Given solvers' aims of minimizing unnecessary effort (effort economization) and improving their prospects in contests (contest winning), seeker exemplars are likely to overshadow external references during ideation as exemplar quantity increases, resulting in stronger exemplar adoption.

However, although solvers should acquire additional external references to supplement seeker exemplars when exemplar quantity is low, the extent to which they would do so depends on prize attractiveness. Creative processing of extra references can involve significant effort as searching, organizing, and synthesizing numerous references requires more time and cognitive resources (Herring et al. 2009). To motivate solvers to acquire additional references, especially when there are few seeker exemplars, prizes thus need to be attractive; such prizes increase the value of winning and incentivize solvers to put in effort (Terwiesch and Xu 2008). Otherwise, if prize attractiveness is low, solvers might not readily look for external references even with few seeker exemplars.

This line of reasoning implies that the effect of exemplar quantity on exemplar adoption varies at different levels of prize attractiveness. When prize attractiveness is high, exemplar adoption should be relatively sensitive to exemplar quantity. Specifically, exemplar adoption should be lower when there are fewer seeker exemplars (as solvers supplement the exemplars with external references) but higher when there are more exemplars (as solvers rely more on the exemplars). In comparison, exemplar adoption is less sensitive to exemplar quantity when prize attractiveness is low. In this situation, solvers generally would be less inclined to acquire external references, causing seeker exemplars to dominate the ideation process regardless of the number of available exemplars. Thus, we hypothesize that the positive impact of exemplar quantity on exemplar adoption is stronger (weaker) when prize attractiveness is higher (lower).

Hypothesis 1. *The positive effect of exemplar quantity on exemplar adoption is positively moderated by prize attractiveness.*

Exemplar Variability. Solvers often refer to a variety of references during ideation because this can lead to greater inspiration (Herring et al. 2009). As a result, exemplar variability (i.e., the extent to which the seeker exemplars differ from each other in terms of characteristics or features) can affect the degree of exemplar adoption. When exemplar variability is low, solvers need to acquire external references to add to the set of relatively similar exemplars, leading to lower exemplar adoption. By contrast, when exemplar variability is high, the set of diverse exemplars better informs solvers about the various approaches that they can consider for their ideas. In the latter case, solvers could minimize an extensive search for external references and rely more on the seeker exemplars, resulting in higher exemplar adoption. Thus, because of solvers' goal of avoiding unnecessary activities in contests (effort economization), exemplar variability could positively affect exemplar adoption.

Nonetheless, low exemplar variability also indicates that seekers are particular about their preferred types of solutions, whereas high exemplar variability signals that seekers have less specific preferences and are open to considering different types of ideas. Thus, exemplar adoption could be higher when exemplar variability is low as solvers focus more on the exemplars when developing ideas so as to satisfy seekers' highly specific preferences (Terwiesch and Xu 2008). In contrast, when exemplar variability is high, solvers might want to develop some ideas that deviate from the exemplars to cater to other possible (although unstated) preferences of the seekers, which could result in lower exemplar adoption. Thus, from the perspective of solvers' desire to strategically improve their prospects in contests by developing ideas that appeal to seekers' preferences (contest winning), exemplar variability could negatively impact exemplar adoption.

Given the competing effects of effort economization and contest winning that stem from exemplar variability, the overall impact depends on the relative importance of these goals. We note that solvers can exercise greater control over the effort they invest (e.g., spend a certain number of hours working on the problem) than over their chances of winning (e.g., achieve a certain winning probability). As individuals favor considerations with greater certainty in decision making (Kahneman and Tversky 1979, Tversky and Kahneman 1981), we posit that, in the context of exemplar variability, the (positive) effect of effort economization tends to be stronger than the (negative) effect of contest winning. However, the extent to which the former effect dominates the latter depends on prize attractiveness. When prize attractiveness is low, improving their chances of winning is less crucial to solvers than economizing their effort. In this case, as posited, solvers would base their ideas more on the seeker exemplars when exemplar variability increases. However, when prize attractiveness is high, solvers

would value winning more and also be willing to commit greater effort. Thus, in such situations, the dominance of effort economization over contest winning should diminish, and the positive relationship between exemplar variability and exemplar adoption would become less pronounced. Based on these arguments, we hypothesize that prize attractiveness attenuates the positive relationship between exemplar variability and exemplar adoption.

Hypothesis 2. *The positive effect of exemplar variability on exemplar adoption is negatively moderated by prize attractiveness.*

3.2. Consequences of Exemplar Adoption by Solvers

Adopting seeker exemplars to develop new ideas is essentially equivalent to the concept of exploitation in solution search, when solvers use and refine existing ideas to develop new ones (March 1991, Levinthal and March 1993). As Audia and Goncalo (2007, p. 3) point out, "[like] incremental creativity, exploitation involves continuity with existing solutions, improvement through modification, and generating ideas within an established framework." The exploitation strategy is often associated with more secure, albeit short-term, performance outcomes (O'Cass et al. 2014). Prior research argues that adapting successful precedent ideas provides greater certainty of the success of new ideas (March 1991, Levinthal and March 1993), and one can obtain workable solutions by adopting already proven techniques (Youmans and Arciszewski 2014). Thus, ideas based on seeker exemplars, particularly the relevant ones with at least adequate quality, are likely to perform well. For example, by borrowing elements in good exemplars that are applicable to the specific problems, solvers could come up with relatively effective ideas.

Nonetheless, as the crowd is diverse, composed of solvers with different expertise and experience (Jeppesen and Lakhani 2010, Majchrzak and Malhotra 2013), we expect solvers' domain experience to moderate the extent to which exemplar adoption improves solution effectiveness. Solvers who have little experience with the problem domain of a given contest could face difficulties in locating relevant external references and/or discerning their quality. As a result, these solvers are likely to come up with better ideas when they rely more on seeker exemplars than on external references. In contrast, the improvements in solution effectiveness through adopting seeker exemplars could be less substantial for solvers with greater domain experience. Such solvers are knowledgeable about what makes good external references for the specific problem and where to find such references. They can also draw on their rich and relevant experience to generate effective ideas when they deviate from the exemplars. Hence, we hypothesize the following:

Hypothesis 3. *The positive effect of exemplar adoption on solution effectiveness is negatively moderated by solvers' domain experience.*

In the following sections, we present three studies to support our hypotheses. The first two studies examine the joint effects among the antecedents of exemplar adoption (Hypotheses 1 and 2) in different settings. In the first (study A), we manipulated the exemplar quantity, exemplar variability, and prize attractiveness in a company naming contest. The second (study B) involved a banner ad design contest, in which we manipulated the exemplar characteristics but offered the same contest prizes to all solvers and used the solvers' perception of the prizes as a measure of prize attractiveness. Finally, we examined the consequences of exemplar adoption on solution effectiveness (Hypothesis 3) in Study C. Using the ads from study B, we implemented an ad campaign to test the interaction of solvers' exemplar adoption and their domain experience on the click-through performance of the ads.

4. Study A: Company Naming Contest

4.1. Overview

Task and Procedure. Solvers competed in a contest to generate company name ideas for a mobile app development firm. The contest involved three stages and was conducted on an online platform that we built. In stage 1, solvers read the task overview and instructions. They were also informed about the bonus prize that they would win if the (hypothetical) seeker picked their idea. Once solvers agreed to participate in the contest, they proceeded to stage 2 to view the project brief (Appendix A) and generate ideas. The project brief, available to solvers throughout this stage, was adapted from those in similar naming contests on NamingForce.com and SquadHelp.com. It includes a description of the company's business and target customers, contest prizes, examples of words that the seeker liked in company names, and other requirements (e.g., the maximum acceptable number of letters). To prevent solvers from strategizing their ideas based on the competition, we employed a blind contest structure in which solvers could not observe each other's submissions during the contest. Solvers could submit up to 10 ideas, after which they answered a survey in stage 3 to complete the task.

Solvers and Incentives. We recruited solvers from MTurk. As MTurk required workers to be compensated, we paid solvers US$0.51. In addition to the participation fee, we offered bonus prizes to winning solvers; details of bonus prizes are discussed later.

4.2. Experimental Design

We randomly assigned solvers to groups in stage 1 using a 2 × 2 x 2 experimental design that crossed prize attractiveness (low/high), exemplar quantity (low/high), and exemplar variability (low/high). We included two groups that varied in prize attractiveness but involved no exemplars. Although these two groups could not be used in the main analyses (as exemplar adoption was clearly inapplicable with no exemplars), both helped to validate our measure of exemplar adoption as we explain below.

We manipulated prize attractiveness by varying the bonus prize. Specifically, winning solvers would receive a bonus of either US$0.40 (low attractiveness) or US$20.00 (high attractiveness), depending on the assigned groups. To manipulate the quantity and variability of seeker exemplars in the project brief, we showed different examples of words that the seeker liked. To identify exemplar words, we conducted online searches for mobile app developers and shortlisted generic words in their company names associated with app development. We eventually selected "geek" as an exemplar and identified (1) three synonyms of geek and (2) three other generic words in the short list that were neither highly similar to geek nor with one another. With these seven selected terms, we formed two sets of four exemplars (high quantity): Geek, Guru, Specialist, Techie (low variability) and Geek, Coding, Lab, Solution (high variability). We further created two sets of two exemplars (low quantity): Geek, Specialist (low variability) and Geek, Solution (high variability).

4.3. Subjects and Sample

Six hundred fifty solvers took part in the contest. In stage 3, to gauge whether solvers paid attention to the project brief, we asked them (1) what the seeker's preference for the maximum number of letters in the name was and (2) whether "geek" was an example of a word that the seeker liked. All solvers answered the first question, and those in the with-exemplar groups also answered the second question. One hundred twenty-five solvers in the no-exemplar groups correctly answered the first question, and 483 solvers in the with-exemplar groups correctly answered both questions; our sample was restricted to these 608 (93.5%) solvers. Based on solvers' self-reporting, 355 (58.4%) were women, and only 33 (5.4%) had participated in similar contests prior to the experiment. Solvers also reported their experiences with mobile apps on seven-point Likert scales; by and large, solvers were relatively experienced in using apps (mean = 4.80, standard deviation = 1.70) but less so in developing apps (mean = 1.54, standard deviation = 1.10). On average, solvers spent 707.71 seconds in the entire experiment and submitted 7.45 ideas. Table 1 shows the number of solvers in each group.

4.4. Measures

Exemplar Adoption (by Solvers). We measured exemplar adoption by determining whether the solvers used the provided seeker exemplars in their company name ideas. An idea was considered as having adopted an exemplar in any of the following scenarios. (Note that all ideas shown were actually submitted by solvers in the contest.)

1. The idea used an assigned exemplar in its root or related form. For example, we considered the ideas *Codes4U* and *App Geeks* as adopting the exemplars Coding and Geek, respectively.
2. The idea used a synonym or an associated term of an assigned exemplar. For example, the idea *Nerdosity* was regarded as adopting the exemplar Geek because "nerd" is a synonym.
3. The idea used a term that was phonetically similar to an assigned exemplar or its synonyms. For example, the ideas *GooRoo* and *Techy* were considered as adopting the exemplars Guru and Techie, respectively.

Because the solvers could submit multiple ideas, we used the proportion of ideas that adopted at least one assigned seeker exemplar as the dependent variable. The text-based nature of the ideas and exemplars minimized

Table 1. Solver Assignment (Study A)

	Group									
	1	2	3	4	5	6	7	8	9	10
Prize	$0.40	$0.40	$0.40	$0.40	$0.40	$20.00	$20.00	$20.00	$20.00	$20.00
Exemplar quantity	4	2	4	2	0	4	2	4	2	0
Exemplar variability	Low	Low	High	High	N.A.	Low	Low	High	High	N.A.
Number of solvers[a]	58	61	61	60	62	60	60	61	62	63
Percentage of ideas that adopted assigned exemplars[b]	57.9	59.8	83.7	71.4	15.9	71.6	53.5	76.6	56.4	13.7

Note. N.A., not applicable.

[a]Sixty-five solvers were randomly assigned to each group. However, the sample only included those solvers who correctly answered question(s) about the project brief.

[b]For the no-exemplar groups (i.e., groups 5 and 10), an idea was considered to have "adopted" the exemplars if it included any of the seven selected words that were used as seeker exemplars in the contest.

Table 2. Descriptive Statistics (Study A)

Variable	Mean (standard deviation)	
	Sample: All solvers	Sample: Solvers assigned exemplars
Exemplar adoption[a]	—	0.66 (0.34)
Exemplar quantity[b]	—	0.50 (0.50)
Exemplar variability[b]	—	0.51 (0.50)
Prize attractiveness[c]	0.50 (0.50)	0.50 (0.50)
Number of submissions	7.45 (3.10)	7.40 (3.11)
Time spent in ideation (stage 2 of the experiment, in seconds)	565.66 (688.61)	585.86 (750.05)
Proportion with prior experience with naming contests	0.05 (0.23)	0.05 (0.22)
Proportion with prior experience with similar contest platforms	0.01 (0.12)	0.01 (0.11)
N	608	483

[a]Not applicable for solvers in the no-exemplar groups.
[b]Binary variable (1 = high; 0 = low); not applicable for solvers in the no-exemplar groups.
[c]Binary variable (1 = high; 0 = low).

ambiguity about whether the ideas used specific exemplars. To check whether our measure for exemplar adoption was valid, we considered the base rate of solvers' use of the selected generic words in the experiment even when the words were not shown as seeker exemplars. If the base rate were high (i.e., solvers had naturally used these words in their ideas), the validity of the exemplar adoption measure would be questionable. We estimated the base rate using the percentage of ideas in the no-exemplar groups that used any of the selected generic words; we applied the criteria in the three scenarios when evaluating the ideas. On average, 14.8% of ideas in the no-exemplar groups used at least one of the selected words (see Table 1). In contrast, the average exemplar adoption in the with-exemplar groups was 66.4%, approximately 4.5 times the base rate. The significantly higher use of the selected words in the with-exemplar groups validated the exemplar adoption measure.[5]

Table 2 shows the descriptive statistics, and Table 3 presents the correlations among the key variables. As all the variance inflation factors (VIFs) of the main variables were 1.00, multicollinearity was not a concern.

4.5. Manipulation Checks

In stage 3, all solvers evaluated the attractiveness of the bonus prize on a seven-point Likert scale ("The US$0.40 (US$20.00) bonus prize for the winning participant in this contest is attractive"). The prize was rated as more attractive in the high bonus groups (mean = 6.26, standard deviation = 1.06) than in the low bonus groups (mean = 4.24, standard deviation = 1.87) (difference = 2.02, $p < 0.001$). Solvers in the with-exemplar groups also evaluated the similarity of exemplars on a Likert scale after submitting their ideas ("The examples of words that the client likes have the same meaning"). The exemplars were perceived as more similar in the low-variability groups (mean = 4.50, standard deviation = 1.67) than in the high-variability groups (mean = 3.69, standard deviation = 1.68) (difference = 0.81, $p < 0.001$). These results indicated that our manipulations of prize attractiveness and exemplar variability were effective.

4.6. Results

We restricted the sample to the with-exemplar groups when testing the hypotheses. Table 4 shows the linear regression results. Model 1 examined the main effects of exemplar quantity, exemplar variability, and prize attractiveness. Exemplar adoption was higher for solvers assigned to more exemplars ($\beta = 0.12$, $p < 0.001$) or relatively varied exemplars ($\beta = 0.11$, $p < 0.001$). In contrast, the main effect of prize attractiveness was not statistically significant ($\beta = -0.04$, $p > 0.10$).

Next, we added the two interactions of prize attractiveness with exemplar quantity and exemplar variability in Model 2. The results indicated that the effect of exemplar quantity on exemplar adoption ($\beta = 0.05$, $p > 0.10$) was positively moderated by prize attractiveness ($\beta = 0.14$, $p < 0.05$), supporting Hypothesis 1. As Figure 1A shows, the positive impact of exemplar quantity was stronger when the prize was more attractive. We also found that the positive effect of exemplar variability ($\beta = 0.19$, $p < 0.001$) was negatively moderated by prize attractiveness ($\beta = -0.14$, $p < 0.05$), supporting Hypothesis 2. As shown in Figure 1B, the positive impact of exemplar variability was weaker

Table 3. Correlation Matrix (Study A)

	Variable	[1]	[2]	[3]	[4]
(1)	*Exemplar adoption*	1.00			
(2)	*Exemplar quantity*	0.18***	1.00		
(3)	*Exemplar variability*	0.17***	0.01	1.00	
(4)	*Prize attractiveness*	–0.06	0.00	0.00	1.00

Note. $N = 483$; sample only included the with-exemplar groups.
***$p < 0.001$.

Table 4. Effects of Seeker Exemplars and Prizes on Exemplar Adoption (Study A)

Dependent variable: *Exemplar adoption*	Model 1	Model 2	Model 3
Constant	0.57*** (0.03)	0.56*** (0.04)	0.60*** (0.04)
Exemplar quantity	0.12*** (0.03)	0.05 (0.04)	–0.02 (0.07)
Exemplar variability	0.11*** (0.03)	0.19*** (0.04)	0.12 (0.06)
Prize attractiveness	–0.04 (0.03)	–0.03* (0.05)	–0.06 (0.06)
Prize attractiveness × exemplar quantity		0.14* (0.06)	0.20* (0.09)
Prize attractiveness × exemplar variability		–0.14* (0.06)	–0.09 (0.09)
Exemplar quantity × exemplar variability			0.14 (0.08)
Prize attractiveness × exemplar quantity × exemplar variability			–0.12 (0.12)
F	12.71***	9.97***	8.52***
R^2	0.06	0.09	0.09
N	483	483	483

Note. Robust standard errors in parentheses.
*$p < 0.05$; ***$p < 0.001$.

when prize attractiveness was higher. Finally, although we did not hypothesize a three-way interaction for exemplar quantity, exemplar variability, and prize attractiveness, we tested this interaction in Model 3. The results showed that the interaction term was not significant ($\beta = -0.12$, $p > 0.10$).

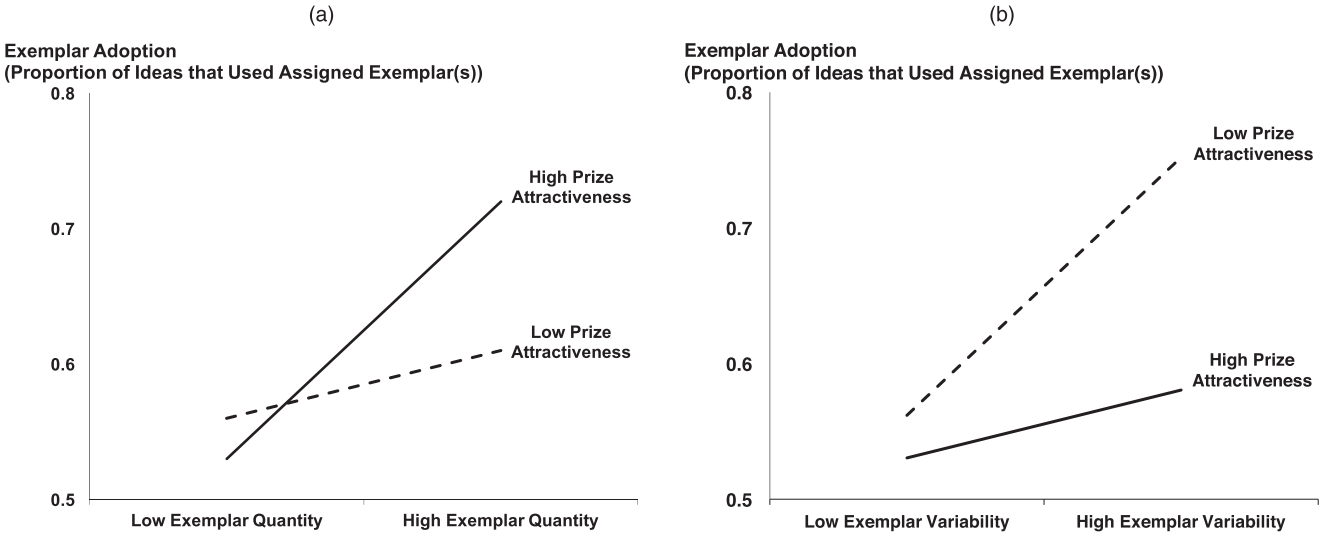
4.7. Additional Analyses

We used the entire sample to examine the relationships among contest winning, effort economization, and prize attractiveness in the contest; in the interest of space, we present the key findings of the analyses here and the details in the online appendix. Based on our theorizing, when the prizes are more attractive, solvers should regard winning to be more important but economizing effort to be less so. As expected, solvers in the high bonus prize groups reported greater importance of contest winning than those in the low bonus prize groups. Solvers also devoted more effort (which suggested weaker effort economization) when the prize was larger. Specifically, solvers in the high bonus groups spent more time in idea generation and submitted more ideas than those in the low bonus groups. Thus, the solvers' behaviors in this contest were in line with our theory concerning the three factors.

4.8. Summary

The purpose of study A is to show that the characteristics of the seeker exemplars and attractiveness of the prizes jointly affect exemplar adoption. With Hypotheses 1 and 2 supported in the company naming contest, this study corroborates our theorizing about the antecedents of exemplar adoption. Nevertheless, there are certain limitations. First, we do not know the extent to which the findings herein can be generalized to other crowd-based contests, such as those involving

Figure 1. Interactions of Exemplar Characteristics and Prize Attractiveness (Study A)



Notes. (a) Interaction between exemplar quantity and prize attractiveness. (b) Interaction between exemplar variability and prize attractiveness.

different types of ideation projects or solver pools. Second, because solvers could perceive the attractiveness of a particular prize differently (Bockstedt et al. 2015), it is necessary to see if we could obtain similar results in a contest with fixed prizes. Third, we cannot use the data from study A to examine how the effectiveness of the ideas is jointly affected by solvers' exemplar adoption and their domain experience as we posit in Hypothesis 3. This is because we are not aware of any existing studies or methods that have established objective metrics for the effectiveness of company names (i.e., what makes a company name "good"). Moreover, the solvers in study A generally had low experience with app development, and only 5.4% of them had prior experience with naming contests; such limited experiences precluded us from using the sample to test the hypothesized interaction involving solvers' domain experience. To overcome these limitations, we formulated two related studies involving a design contest, which we present in the following sections. The context and setup of the design contest allowed us to examine Hypotheses 1 and 2 in study B and test Hypothesis 3 in study C.

5. Study B: Banner Ad Design Contest

5.1. Overview

Study B tested Hypotheses 1 and 2 in a context that differed from that in study A. Specifically, we recruited graphic designers to participate in a banner ad design contest. Although a prior related study conducted an experiment by hosting different design contests on multiple contest platforms (Wooten and Ulrich 2017), we developed an online platform to facilitate the manipulation of stimuli across groups within one contest so as to minimize potential task- and platform-specific confounds. The key challenge in implementing this experiment was to achieve ecological validity by ensuring that the task (especially the project brief and exemplars involved), procedures, solvers, and incentives were representative of actual contests.

Task and Procedure. In the experiment, solvers competed in a contest to design banner ads to promote an online wedding photography directory. Solvers submitted their name and email address to register for the contest and were informed once the contest was launched. Solvers first answered a precontest survey about their design- and contest-related experiences. They then received a login password for the contest platform. Once they logged in to the platform, they viewed the project brief, which we adapted from similar contests on CrowdSpring.com and 99Designs.com, that described the wedding photography directory and its target audience (Appendix B). Solvers were asked to design attractive ads with high ad recognition and click-through potential. Depending on the assigned groups, solvers could also see the examples of banner ads that the (hypothetical) seeker liked; these banner ads served as seeker exemplars in this study (see next section).

We provided a logo and 10 pictures that solvers could use in their ads (Figure A2 in the online appendix). The pictures showed different wedding-related images, such as a bride and/or groom (in various poses and settings), a wedding bouquet, and a wedding gown.[6] Owing to legal and copyright concerns, solvers had to use only the provided pictures to design ads for the contest. However, solvers were free to create and use taglines and phrases in their designs. We specified that the ad dimensions had to be 300 (width) × 250 (height) pixels and less than 50 kilobytes in file size.

Solvers had 10 days to submit as many ads as they wanted, which were consistent with the three- to 14-day duration on actual contest platforms. Once again, we used a blind contest structure. As in actual contests, solvers could access the project brief, logo, and pictures at any time during the experiment. Solvers could also withdraw their submissions at any time before the contest deadline. After the contest ended, solvers completed a survey about the design task.

Solvers and Incentives. We recruited solvers from online communities for graphic designers, and the contest was open to all regardless of design experience.[7] To make the experiment more realistic, solvers were not compensated for participation. Instead, the solvers who submitted the top three ads in the contest would each receive between US$250 and US$600. These amounts were above the minimum awards on various design contest platforms at the time of the study.

5.2. Experimental Design

The banner ad exemplars provided in the project brief constituted the stimuli in the experiment. We used wedding photography ads that a research assistant (blinded to the study) found on the internet as the exemplars to add realism to the experiment. To achieve different levels of exemplar variability, we used four categories such that (1) exemplars within each category were relatively similar (low variability) and (2) exemplars across different categories were relatively dissimilar (high variability). The categories were (1) ads with greenery in the background, (2) ads with collages, (3) ads with a wedding bouquet as the focal point, and (4) ads with top and bottom frames. The stimuli pool consisted of six ads in each category (24 ads in total; Figure A3 in the online appendix).

We used a 2 × 2 experimental design, in which we crossed exemplar quantity (low/high) with exemplar variability (low/high). We also included two other groups, consisting of no or one exemplar. We did not vary prizes across groups in this study but

instead relied on variations in solvers' perception of prize attractiveness. Doing so allowed us to complement the findings in study A (in which we manipulated the prizes) and validate that prize attractiveness, whether in absolute or subjective terms, would affect the impacts of exemplar characteristics on exemplar adoption.

Using a multistep process, the system randomly assigned (1) solvers to groups and (2) stimuli (exemplars) to solvers when they logged on to the contest platform for the first time after completing the precontest survey. The system began by randomly choosing the number of exemplars to assign (zero, one, two, or four). If the solvers were assigned to see one exemplar, the system randomly selected an exemplar from the pool of 24 stimuli. If they were assigned to see two or four exemplars, the system randomly selected the variability of exemplars to assign next. For low variability, the system randomly selected an exemplar category and randomly chose stimuli from that category. For high variability, the system randomly chose stimuli from different exemplar categories but at most one stimulus from each category. This randomization procedure resulted in solvers within the respective groups being assigned different exemplars. We used this approach because the exemplars varied not only in terms of the structure and/or focus that we manipulated (e.g., collage, bouquets) but also in other attributes that we could not control (e.g., colors, size of images in ads, ad copy). Had the assigned exemplars not varied within groups (i.e., all solvers in a particular group were shown the same exemplars), we would be unable to isolate the effects of our manipulations from those of other extraneous aspects of the exemplars, thereby leading to biased estimates (Montgomery 2009).[8] Thus, our approach allowed us to estimate the effects of exemplar characteristics more precisely.

5.3. Subjects and Sample

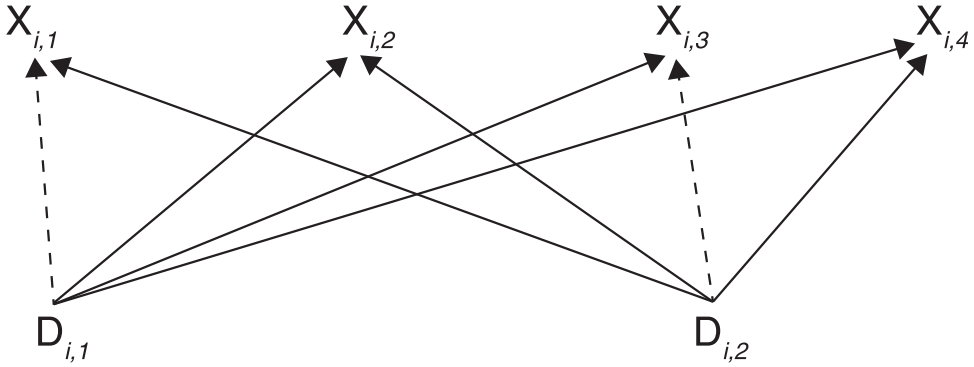
One hundred seventy-six potential solvers completed the precontest survey, 169 of whom logged on to the contest platform at least once after the survey (and so should have seen the project brief). One hundred five of the solvers who logged on submitted at least one ad.[9] In total, 385 ads were submitted in the contest, but 45 of them were not usable for the study: 18 ads included pictures that we did not provide and/or the URL of other websites instead of that of the intended online directory, and 27 were not within the specified width and/or height and could not be resized without removing key elements. Thus, the sample consisted of 340 ads from 99 solvers (Figure A4 in the online appendix). Fifty (50.5%) were women, and 71 (71.7%) had or were pursuing graphic design–related training. Eighty-six (87%) were from the United States, and the rest were from Canada (2%), India (2%), Indonesia (1%), Jamaica (1%), Malaysia (1%), Nigeria (1%), Pakistan (1%), and Singapore (4%). Solvers had an average of 8.4 years of design experience and 6.8 design project deadlines over the four weeks after the start of the experiment. In terms of their domain experience, the solvers, on average, had worked on 3.7 wedding-related graphic design projects in the prior two years. Forty-nine (49.5%) had prior experience with design contests; on average, these solvers had taken part in 14.7 design contests and won 1.7 contests in the prior two years. Using the nonparametric Wilcoxon–Mann–Whitney test, we compared these statistics with those of the 77 individuals who completed the precontest survey but did not submit any usable ads. The two groups differed only in design experience as solvers who did not submit any usable ads had fewer years of experience (mean = 6.9, standard deviation = 8.5) than those in the sample (mean = 8.4, standard deviation = 7.5) ($z = -2.08$, $p < 0.05$).

5.4. Measures

Exemplar Adoption (by Solvers). As ads that used the exemplars to a greater extent should be more similar to those exemplars, we operationalized exemplar adoption in this study by measuring the similarity of ads to assigned seeker exemplars. To do this, we recruited third-party raters from MTurk to compare the ads and the corresponding exemplars. Past studies also relied on raters on microtask platforms to evaluate the similarity between objects (Dow et al. 2011, Rahmanian and Davis 2014), and such raters could perform reliable similarity evaluations despite their (possible) lack of expertise with the objects being compared (Nguyen et al. 2014). Following Dow et al. (2011), we asked MTurk raters to compare the similarity between an ad and an assigned exemplar on a seven-point scale. Three raters independently assessed every ad–exemplar pair, and their ratings were averaged.[10] Ads by solvers who were assigned multiple exemplars had multiple exemplar-similarity ratings (each ad by a solver in the four-exemplar group had four ratings, etc.). As exemplar adoption was a solver-level behavior in our context, we averaged the maximum exemplar-similarity rating of respective ads by individual solvers to measure the attribute (see Figure 2).[11]

Prize Attractiveness. In the postcontest survey, solvers evaluated the attractiveness of the contest prizes on a seven-point Likert scale ("The US$250 to US$600 prizes for participants with the winning designs in this study are attractive"). A single item suffices when it consists of a concrete singular object (in our case, the specific prizes offered) and a concrete attribute (in our case, the attractiveness of the prizes) (Rossiter 2002). Such an item can have high predictive validity, particularly when the sample size is around 50, which is close to

Figure 2. Measuring Exemplar Adoption by Solvers



Notes. Consider a solver i in the contest, and let $X_{i,k}$ and $D_{i,j}$ be exemplars assigned to and ads by i, respectively. The arrows represent the exemplar-similarity ratings between each $D_{i,j}$ and $X_{i,k}$. Each dotted arrow points to the exemplar that a particular ad most resembles, and the exemplar-similarity rating underlying the dotted arrow is the largest among all the ratings for that ad. The exemplar adoption score for i is the average of the maximum exemplar-similarity rating of respective ads:

$$adoption_i = \frac{\sum_j (D_{i,j} \cdot \ddot{X}_{i,k})}{n_j},$$

where $\ddot{X}_{i,k}$ is the assigned exemplar that $D_{i,j}$ most resembles and $D_{i,j} \cdot \ddot{X}_{i,k}$ is the exemplar-similarity rating between the ad and exemplar.

that for our main analyses (Bergkvist and Rossiter 2007, Diamantopoulos et al. 2012). In addition, using a single-item measure could minimize participant fatigue and mindless response behavior, especially among non-students (as in this study) (Drolet and Morrison 2001); preventing fatigue and inattentive behavior was critical in our postcontest survey as the solvers (1) might have busy schedules (as indicated by their reported occupation and deadlines), (2) had committed significant effort for the 10-day contest, and (3) had to answer a number of questions.

Tables 5, 6, and 7 present the number of solvers in the respective groups, the descriptive statistics, and correlation matrix of the variables, respectively. We mean-centered prize attractiveness because it was part of the interaction terms in our analyses. As the VIFs of the main variables were 1.15 or below, multicollinearity was not likely a problem.

5.5. Manipulation Checks

In the project brief, the assigned exemplars were scaled to a maximum width or height of 100 pixels. Solvers could click on individual exemplars to view them in the original, larger dimensions. We tracked solvers' clicks on the exemplars and found that all solvers attended to the exemplars. All but two solvers clicked on every assigned exemplar at least once. Of the two who did not, one clicked on one exemplar (of two assigned) and the other clicked on two exemplars (of four assigned).

Solvers' perception of the differences among assigned exemplars indicated that exemplar variability varied as planned across groups. In the postcontest survey, solvers in the two- and four-exemplar groups compared the similarity among assigned exemplars. Solvers evaluated each pair of exemplars in terms of (1) overall similarity, (2) layout, and (3) images on a seven-point *extremely dissimilar* to *extremely similar* scale. We reverse-coded the ratings and averaged all evaluations for the respective exemplar pairs to obtain an objective measure of the dissimilarity between exemplars. The dissimilarity ratings were higher between exemplars from different categories (mean = 4.99, standard deviation = 0.58) than between those from the same category (mean = 4.05, standard deviation = 0.68) (difference = 0.94, $p < 0.001$). We then averaged the ratings for relevant pairs of exemplars to ascertain the dissimilarity of exemplars assigned to individual solvers. The aggregated dissimilarity rating among exemplars was higher for solvers assigned to high-variability groups (mean = 4.99, standard deviation = 1.05) than for those in low-variability groups (mean = 4.18, standard deviation = 1.17) (difference = 0.80, $p < 0.05$).

5.6. Results

Table 8 shows the linear regression results. We restricted the sample to multiple-exemplar groups because of issues in defining exemplar variability for the no- and single-exemplar groups. Model 1 consisted of only the main effects, which were not significant at the 0.05 level.

Table 5. Solver Assignment (Study B)

	Group					
	1	2	3	4	5	6
Exemplar quantity	0	1	2	2	4	4
Exemplar variability	N.A.	N.A.	Low	High	Low	High
Number of solvers	25	22	16	11	13	12

Note. N.A., not applicable.

Table 6. Descriptive Statistics (Study B)

Variable	Mean (standard deviation)		
	Sample: All solvers	Sample: Solvers assigned at least one exemplar	Sample: Solvers assigned multiple exemplars
Exemplar adoption[a]	—	2.11 (0.82)	2.38 (0.66)
Exemplar quantity[b]	—	—	0.48 (0.50)
Exemplar variability[b]	—	—	0.44 (0.50)
Prize attractiveness[c]	0.00 (1.46)	0.00 (1.56)	0.00 (1.68)
Number of submissions	3.43 (2.67)	3.57 (2.74)	3.90 (2.95)
Project deadlines (number of projects over next four weeks)	6.81 (22.65)	7.84 (25.86)	4.85 (10.97)
Domain experience (number of wedding-related projects in previous two years)	3.70 (20.32)	4.39 (23.41)	5.54 (27.86)
Design experience (in years)	8.39 (7.50)	8.80 (7.69)	8.84 (7.89)
N	99	74	52

[a]Not applicable for solvers in the no-exemplar group.
[b]Binary variable (1 = high; 0 = low); not applicable for solvers in the no- and single-exemplar groups.
[c]Mean-centered.

In Model 2, we added the two interactions of prize attractiveness with exemplar quantity and exemplar variability. We found that the positive effect of exemplar quantity ($\beta = 0.36$, $p < 0.05$) was positively moderated by prize attractiveness ($\beta = 0.19$, $p < 0.05$), supporting Hypothesis 1. Figure 3(a) shows that the relationship between exemplar quantity and exemplar adoption generally became more positive as prize attractiveness increased. We also found that the positive effect of exemplar variability ($\beta = 0.13$, $p > 0.10$) was negatively moderated by prize attractiveness ($\beta = -0.17$, $p < 0.05$), supporting Hypothesis 2. However, Figure 3(b) shows that some aspects of the results differed slightly from our expectations. Consistent with Hypothesis 2, the impact of exemplar variability was positive when prize attractiveness was low. However, when prize attractiveness was high, exemplar variability had a negative effect. This implied that prize attractiveness could have more strongly influenced solvers' concerns about their effort and winning chances than we initially expected in this situation. That is, although we theorized that the dominance of effort economization over contest winning would weaken with greater exemplar variability when prize attractiveness is high, the changes in relative strength of these considerations in this contest might be that contest winning ended up dominating, resulting in the observed outcome.

5.7. Robustness Checks

We conducted additional analyses to check the robustness of our results. We controlled for the solvers' deadlines and domain experience with wedding-related design projects in Model 3 of Table 8. The results were qualitatively similar to those in Model 2. Next, we measured exemplar adoption using only the ad that was most similar to the assigned exemplars for each solver (instead of considering all ads by the solver). Regardless of the exemplars' attributes and solvers' ideation strategy, solvers might have submitted some ads that were based largely on the exemplars. Restricting the analyses to ads that conformed the most to seeker exemplars for respective solvers thus provided a stricter test. We tested this in Model 4 and found the results to be consistent with those in Model 2.

5.8. Additional Analyses

We performed additional analyses using the full sample to validate our theory and examine whether certain

Table 7. Correlation Matrix (Study B)

Variable		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	*Exemplar adoption*	1.00							
(2)	*Exemplar quantity*	0.25	1.00						
(3)	*Exemplar variability*	0.16	0.07	1.00					
(4)	*Prize attractiveness*	−0.05	−0.05	0.01	1.00				
(5)	*Number of submissions*	−0.17	−0.11	−0.02	0.30	1.00			
(6)	*Project deadlines*	−0.02	−0.13	−0.09	0.01	−0.07	1.00		
(7)	*Domain experience*	−0.09	−0.11	0.13	0.08	0.04	0.25	1.00	
(8)	*Design experience*	−0.06	−0.07	−0.02	−0.17	0.08	0.24	−0.07	1.00

Notes. $N = 52$; sample only included the multiple-exemplar groups. None of the correlations were significant at the 0.05 level.

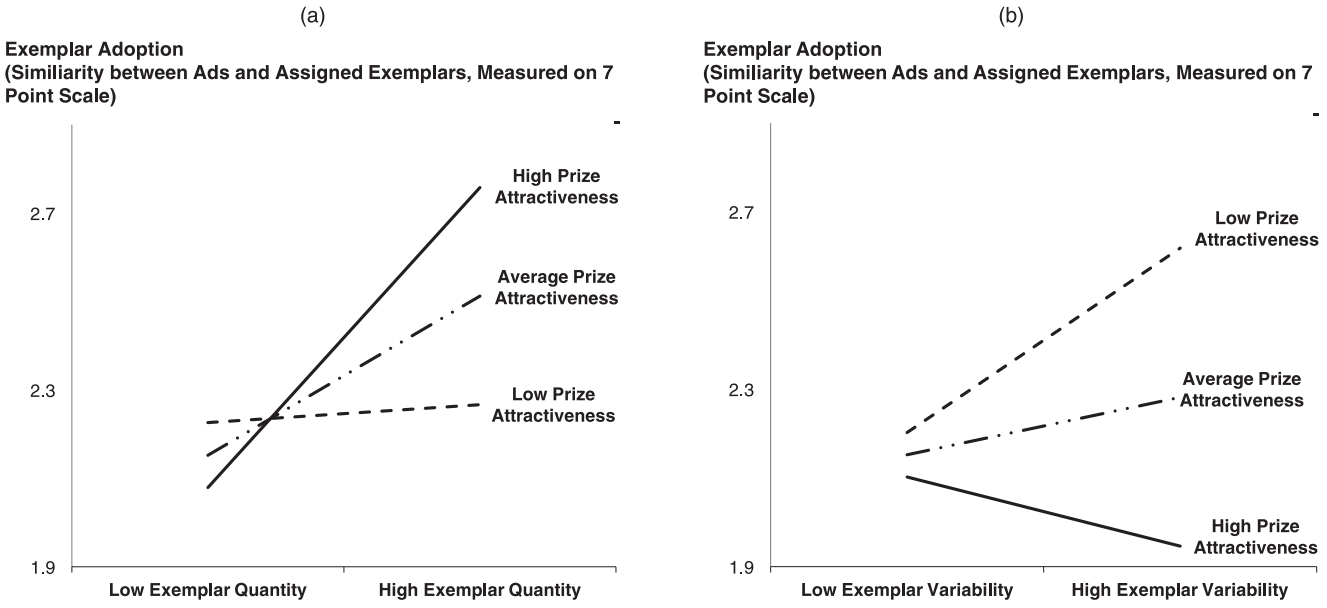
Table 8. Effects of Seeker Exemplars and Prizes on Exemplar Adoption (Study B)

Dependent variable: *Exemplar adoption*	Model 1	Model 2	Model 3	Model 4
Constant	2.15***	2.16***	2.14***	2.95***
	(0.16)	(0.15)	(0.18)	(0.18)
Exemplar quantity	0.31	0.36*	0.36	0.30
	(0.18)	(0.17)	(0.19)	(0.25)
Exemplar variability	0.18	0.13	0.14	0.19
	(0.18)	(0.17)	(0.19)	(0.26)
Prize attractiveness	–0.01	–0.04	–0.04	0.05
	(0.06)	(0.09)	(0.10)	(0.11)
Prize attractiveness × exemplar quantity		0.19*	0.18*	0.26*
		(0.08)	(0.09)	(0.12)
Prize attractiveness × exemplar variability		–0.17*	–0.17*	–0.24*
		(0.08)	(0.08)	(0.11)
Project deadlines			0.00	
			(0.00)	
Domain experience			0.00	
			(0.00)	
F-statistic	1.64	3.90**	4.81***	4.47**
R^2	0.08	0.20	0.21	0.18
N	52	52	52	52

Notes. The measure of exemplar adoption in Model 4 was based on the ad that was most similar to assigned exemplars for each solver. Robust standard errors in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

contest requirements might have biased the exemplar adoption measure; we report the main findings here and the details in the online appendix. We found that solvers who perceived prizes to be more attractive submitted significantly more ads. If we were to regard solution quantity as a function of solvers' contest winning (solvers submitted more ideas when winning was more important) and effort economization (solvers submitted more ideas when they economized effort to a lesser degree), then this finding would be consistent with our arguments concerning the relations among these three goal-related factors. We also observed that solvers with more external deadlines during the contest submitted fewer ads, thus confirming our expectation that

Figure 3. Interactions of Exemplar Characteristics and Prize Attractiveness (Study B)



Notes. (a) Interaction between exemplar quantity and prize attractiveness. (b) Interaction between exemplar variability and prize attractiveness. The value for average prize attractiveness was at the sample mean, and that for high and low prize attractiveness was at 1 standard devistion above and below the sample mean, respectively.

competition for solvers' resources would affect the effort that they commit in a contest. In addition, as solvers were required to design their ads using only the pictures that we provided, we checked whether the pictures that they used systematically biased the exemplar adoption measure. Our results showed that the maximum exemplar-similarity rating of the respective ads (which we used to calculate exemplar adoption) did not depend solely on the pictures that were included in the ads, thus minimizing the concern that the exemplar adoption measure had been affected simply by the pictures that were used in the ads.

5.9. Summary

The results from study B furnish further evidence of the interaction effects among the antecedents of exemplar adoption. We acknowledge certain limitations of the experiment. First, as the exemplar categories we used for the stimuli differed in certain dimensions (e.g., the focal images and structural elements), unobserved category-specific effects might be present; for example, solvers might be more inclined to adopt the exemplars in some categories than in others. Although the randomization procedure for assigning exemplars to solvers in the experiment prevented such unobserved effects from biasing the results (see Section 5.2), future studies can explore whether our results would hold with other types of exemplars (e.g., those involving other focal objects). Second, although we measured exemplar adoption using the overall similarity between ads and corresponding seeker exemplars, future research might consider how the exemplars could affect specific facets of the ads (e.g., theme, aesthetic, overall presentation). For example, a multi-item measurement for ad designs could be developed to examine how solvers adopt seeker exemplars for different aspects of their designs.

The aforementioned limitations notwithstanding, the findings from study B, in combination with those from study A, suggest the generalizability of our theory and findings. Although the contests in both studies required ideation, they differed in the types of solvers involved and the ideation effort needed. The exemplar adoption measures also varied as we evaluated whether the ideas included the text-based exemplars in the naming contest but recruited MTurk workers to judge the similarity between the ads and exemplars in the design contest. Similarly, prize attractiveness was operationalized differently as we manipulated the prize amount in one contest but measured solvers' perception of a particular set of prizes in the other. Nonetheless, despite these differences, the results were largely consistent across the two studies, albeit the magnitudes of the effects did vary between the contests. Thus, our theory is relatively robust across different ideation contests, solver pools, and measure operationalizations.

6. Study C: Banner Ad Campaign

6.1. Overview

Hypothesis 3 involves the joint effect of solvers' exemplar adoption and their domain experience on solution effectiveness. In our research context, an appropriate and objective measure for solution effectiveness was the click-through performance of the banner ads submitted by solvers in study B.[12] Click-through performance is an essential indicator of ad campaign effectiveness (Shen 2002). Besides generating more website traffic, superior click-through performance can provide other benefits to advertisers. For example, Google Display Network (GDN), a popular contextual ad network, charges a lower cost per click for ads with higher quality, which is partly determined by the ads' click-through performance.[13]

To collect click-through data for the 340 ads from study B, we launched an ad campaign on GDN. At the time of this study, Google provided options for displaying ads, including (1) optimizing for clicks or conversion and (2) rotating ads more evenly. We opted to rotate ads evenly to remove a possible confound that ad effectiveness was driven by Google's optimization algorithm. We set the maximum cost per click at US$0.70 for all ads and placed the ads only on wedding-related websites. The campaign duration was 56 days, longer than the 12 to 15 days used in earlier studies (Dow et al. 2010, 2011). The campaign received 1,291,938 impressions and 2,054 clicks, and the click-through rate (CTR) was 0.16%. Each ad received between 3,520 and 7,790 impressions (mean = 3799.82, standard deviation = 414.40) and between zero and 25 clicks (mean = 6.05, standard deviation = 3.24).[14]

6.2. Measures

Click-Through Performance. We operationalized solution effectiveness using the CTR of the ads. Because the CTR of ads in the campaign was relatively low (ranging from 0% to 0.50%), we multiplied CTR by 100 to facilitate the readability of estimated coefficients. Thus, the dependent variable represented the number of click-throughs per 10,000 impressions.

Exemplar Adoption (of Ad). We operationalized exemplar adoption of ads using the exemplar-similarity ratings from study B. As the ads by solvers in the multiple-exemplar groups had multiple exemplar-similarity ratings, we used the maximum rating of respective ads as the construct measure to minimize potential measurement errors (see endnote 11).

Domain Experience. We used the number of wedding-related graphic design projects that the solvers reported to have participated in during the previous two years as a measure of their domain experience. This measure

was taken from solvers' responses in the precontest survey in study B.

6.3. Results

Because the ads were nested in solvers, we used hierarchical linear modeling (HLM) for the analyses. HLM accounts for dependence among observations within clusters and provides efficient estimates in unbalanced nested designs (Raudenbush and Bryk 2002). As exemplar adoption was undefined for solvers who were not assigned any exemplars, we excluded ads in the no-exemplar group. Thus, the sample consisted of 265 ads (level 1) by 74 solvers (level 2), which should be sufficient to obtain unbiased estimates in multilevel modeling (Maas and Hox 2005). We controlled for solvers' perception of prize attractiveness in our model. The level 1 independent variable (exemplar adoption) was grand mean-centered, and the level 2 independent variables (prize attractiveness and domain experience) were mean-centered at the solver level (Raudenbush and Bryk 2002). Table 9 shows the descriptive and correlation statistics. All VIFs did not exceed 1.01, indicating no multicollinearity concerns.

Table 10 shows the results. Model 1 only included the main effects. We found that prize attractiveness had a positive effect on click-through performance ($\beta = 1.04$, $p < 0.01$). Solvers who perceived the prizes to be more attractive might have devoted greater effort in the contest, thereby leading to better ad performance. We added the interaction of exemplar adoption and domain experience in Model 2. The effect of exemplar adoption ($\beta = 0.68$, $p > 0.10$) was negatively moderated by domain experience ($\beta = -0.01$, $p < 0.05$), supporting Hypothesis 3. Thus, basing ad designs on seeker exemplars had a stronger (weaker) positive impact on ad performance for solvers with less (more) experience with the problem domain. As shown in Table 11, a given increase in exemplar adoption of ads resulted in a greater increase in expected click-throughs for solvers with lower domain experience.

Although the estimated coefficients appeared small, there could still be practical implications as click-through performance for ads was typically low; between September 2012 and April 2017, the average CTR for display ads was only 0.17%.[15] For example, as Table 11 shows, the predicted click-throughs per 10,000 impressions for ads by solvers with low domain experience was between 14.85 (low exemplar adoption) and 16.21 (high exemplar adoption). These estimates ranged from 6.2% lower to 2.4% higher than the sample average of 15.83 click-throughs per 10,000 impressions. Such variations in ad effectiveness should be of import to seekers using contests to solicit ad designs, especially when they intend to launch sizeable ad campaigns (in terms of the number of impressions) and/or maximize click-through performance.

6.4. Summary

Study C validates the interaction of exemplar adoption and domain experience in a field setting. Using an ad campaign implemented through a widely used Google ad network, we collected objective performance data for banner ads from the design contest in study B. We found that exemplar adoption did affect the click-through performance although the effect was stronger for certain solvers. Interestingly, we also found that (perceived) prize attractiveness impacted ad effectiveness. These findings support our thesis that seeker involvement could affect solvers' ideas. Nevertheless, one limitation is our focus on click-through performance, which is but one indicator of solution effectiveness. Future work can consider the consequences of exemplar adoption using other metrics, such as conversion rates (for ad design contests) or idea feasibility (for other types of contests).

7. Discussion and Conclusion

This research examines the antecedents and consequences of solvers' adoption of seeker exemplars in ideation contests. We theorize that the respective positive effect of exemplar quantity and exemplar variability on exemplar adoption is strengthened and attenuated, respectively, by prize attractiveness. We also argue that greater exemplar adoption can improve solution effectiveness although this is negatively moderated by solvers' domain experience. The results of two ideation contests and an ad campaign affirm our theory; the use of real contests (studies A and B), professional graphic designers (study B), and performance data of a real ad campaign (study C) support the validity of our findings.

Table 9. Descriptive Statistics and Correlation Matrix (Study C)

Variable		Level	Mean (standard deviation)	(1)	(2)	(3)	(4)
(1)	*Click-through performance*	1	15.83 (7.97)	1.00			
(2)	*Prize attractiveness*	2	0.00 (1.45)	0.12*	1.00		
(3)	*Domain experience*	2	0.00 (23.41)	0.02	0.07	1.00	
(4)	*Exemplar adoption of ad*	1	0.00 (0.74)	0.06	0.00	0.00	1.00

Notes. N (level 1) = 265; N (level 2) = 74. Level 1 independent variable was grand mean-centered, and level 2 independent variables were mean-centered at the solver level.
*$p < 0.05$.

Table 10. Effects of Exemplar Adoption and Domain Experience on Click-Through Performance

Dependent variable: *Click-through performance*	Model 1	Model 2
Constant	15.53*** (0.56)	15.53*** (0.56)
Prize attractiveness	1.04** (0.39)	1.04** (0.39)
Domain experience	0.00 (0.01)	0.00 (0.01)
Exemplar adoption of ad	0.67 (0.56)	0.68 (0.56)
Exemplar adoption of ad × domain experience		−0.01* (0.01)
Random Effect	Variable component	Variable component
Constant	4.59 (2.80)	4.62 (2.80)
Residual	57.60 (6.21)	57.49 (6.18)
Wald χ^2	9.21*	12.53*
Number of ads (level 1)	265	265
Number of solvers (level 2)	74	74

Note. Robust standard errors in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Caution is advised when generalizing the principles and findings from this present work to other settings. To serve as useful references for ideation, exemplars need to be relevant to the problems at hand. To help increase the certainty of success of new ideas, exemplars that the ideas are based on should be of adequate quality at the very least. Our theorizing assumes seekers provide exemplars that exhibit such characteristics. In our experiments, the seeker exemplars also met these criteria. In study A, the exemplars were generic words in actual company names and pertinent to the problem domain. These exemplars were unlikely to be of low quality because firms would not deliberately use poor-quality words in their company names. Similarly, in study B, the exemplars were real ads used by firms in the relevant industry. Solvers also judged these ads to be at least of reasonable quality. Solvers who were assigned at least one ad rated the appropriateness and attractiveness of each ad on seven-point scales in the postcontest survey. We averaged all solvers' ratings for the respective ads to derive an objective measure of ad quality and found that the aggregated quality for individual ads was average and above (minimum = 3.40, maximum = 6.00, mean = 4.60, standard deviation = 0.80). Thus, we cannot be sure of the extent to which our theory and results hold when seeker exemplars are of low quality and/or not relevant to the focal problems.

7.1. Theoretical and Practical Contributions

This study contributes on multiple fronts. First, to our knowledge, this is the first examination of the joint effects of exemplar characteristics and prizes on solver behaviors in ideation contests. We show that seekers acquire ideas not just *through* the crowd but also *with* the crowd. Thus, instead of simply delegating idea generation to solvers, seekers should share the onus of ideation and be aware of the impacts of their involvement. Specifically, seekers ought to treat every interaction with solvers as a strategic touch point as information from them could aid or hinder the ideation process. Prior research suggests that seekers' feedback can affect solution outcomes (Wooten and Ulrich 2017), and the ways in which input constraints are imposed in creative tasks shape creative processing by solvers (Moreau and Dahl 2005). In terms of seeker exemplars, as a solver commented after the design contest in study B,

> Seeing an example or a reference would have given me some more direction as to how I was going to design [the ads], but I also believe sometimes following an example [would lead to] a lot of close minded designs based off the example. —Solver X (three years' graphic design experience, had participated in one contest and won none)

Seekers must also carefully decide on the prizes for their contests. Consistent with findings from prior studies (Archak 2010, Morgan and Wang 2010, Bockstedt et al. 2016), our results show that attractive prizes could cause solvers to spend more time ideating, submit more ideas, and develop more effective ideas. Therefore, setting prizes low, as some platforms suggest (see Section 2), can lead solvers to commit inadequate effort and negate the potential benefits of using ideation contests. However, rather than merely focusing on the prize amounts or structure per se, seekers should also pay attention to the attractiveness of their planned prizes to potential solvers. Seekers can consider the composition of various solver types on contest platforms

Table 11. Estimated Click-Throughs per 10,000 Impressions

	Low exemplar adoption of ads	High exemplar adoption of ads	Difference
Low domain experience	14.85	16.21	1.35
High domain experience	15.20	15.86	0.66

Note. The values for high and low domain experience and exemplar adoption of ads were one standard deviation above and below the mean, respectively.

and the corresponding payoff expectations for each solver type. Seekers should also take into account the number and prizes of ongoing contests as solvers may refer to other contests when evaluating a particular contest.

More importantly, the interaction effects of exemplar characteristics and prize attractiveness on exemplar adoption indicate that the outcomes of seekers' decisions about the exemplars to show and the prizes to offer are more closely related than they appear. Thus, seekers should understand the interdependence among the elements in their project briefs and set up their contests accordingly to shape solver behaviors strategically. Contest platforms can also help in the contest setup process by giving appropriate guidance to seekers, especially those who are relatively less experienced.

Second, this research makes a theoretical contribution by using three factors that relate to solvers' contest goals (contest winning, effort economization, and prize attractiveness) to explain their behaviors in response to seeker involvement. Although these factors concern different aspects of solvers' goals, their respective effects should not be considered in isolation. Instead, as our theory indicates, these factors work in tandem to shape solver behaviors. For example, although effort economization matters to solvers because of their limited resources, their effort is also influenced by the attractiveness of the prizes, which concurrently affects the importance of winning the contests. Moreover, depending on the situation, the factors can be complementary or competing. In this research, effort economization and contest winning have similar effects with regards to exemplar quantity but opposing effects for exemplar variability. Thus, we need to be mindful of how the impacts of seeker involvement are affected by the interdependencies and interrelationships among these factors.

Third, this research highlights the need to consider the moderating role of solver heterogeneity in ideation contests. Solver diversity is a key trait of an effective crowd and characterizes many contests (Jeppesen and Lakhani 2010, Bockstedt et al. 2015). However, this feature of the crowd also means that the effect of a particular seeker involvement can vary considerably among solvers. As shown in study B, because of heterogeneity in the solvers' valuations of the contest prizes, the relationships between the characteristics of exemplars and exemplar adoption could be moderated by perceived prize attractiveness. Similarly, the outcomes from an ideation strategy can also vary across solvers; Study C demonstrated that the differences in solvers' domain experience could influence the effect of exemplar adoption on solution effectiveness. Thus, although it is important to examine the main effects of solvers' attributes, such as their motivations, experience, and knowledge (Brabham 2010, Jeppesen and Lakhani 2010, Zheng et al. 2011), it is also necessary to consider the moderating effects of these attributes in seeker–solver dynamics.

7.2. Limitations and Suggestions for Future Research

Apart from the limitations that we mentioned in the respective studies, there are two others that relate more broadly to the theorization. First, certain elements in contests are abstracted away in our theorizing. Although some solvers participate in contests for enjoyment or to improve their skills (Ye and Kankanhalli 2017), we do not explicitly consider such factors given our focus on aspects that seekers control in contests. New studies can build on this research by investigating how solvers' intrinsic motivations affect their behaviors in response to seeker involvement. Second, exemplar adoption might affect contest outcomes at different levels in different ways. On one level, converging toward exemplars helps the crowd to exploit and refine existing ideas (March 1991). Such an approach can contribute to the effectiveness of individual ideas as we show in this study. On another level, when solvers collectively incorporate seeker exemplars, it might reduce the variance in idea quality and the likelihood of identifying exceptional ideas (Girotra et al. 2010). Future studies can examine how such contrasting idea- and contest-level impacts of exemplar adoption play out in ideation contests.

Appendix A. Project Brief in Company Naming Contest (Study A)

Contest type: Naming/Company Name
Title of the project: Looking for a name for an app development company.
What is the business about? We are a mobile app development company specializing in Android and iOS applications. We work with companies to develop apps that meet their business needs.
Target customers: Small and medium enterprises who are looking for developers to build mobile apps for their business.
Maximum number of words in the company name: No limit.
Prize: The worker who submits the company name that is chosen by the client will receive a bonus prize of US$20.00.
Examples of words that the client like for the company name:
1. Geek
2. Coding
3. Lab
4. Solution

Maximum number of letters in the company name: We do not have a preference.

Notes. This is the project brief that we provided to the solvers in the naming contest. We manipulated the prize and examples of words that the client liked during the experiment.

Appendix B. Project Brief in Banner Ad Design Contest (Study B)

Project overview: Please design banner ads to promote a noncommercial Wedding Photography Directory (http://photography.aweddinglist.com/).

Business description: The website is an online directory that lists wedding photographers in different cities. The target audience is couples who are looking for wedding photographers. These couples have different budgets and preferences for photography styles.

Professional photographers usually provide various photography packages for engagements, bridal sessions, and weddings. Most photography services start from $600, and come with certain hours of wedding day coverage. Many photographers provide copyright-free edited images, wedding photo albums, coffee table books, DVDs, and/or online wedding albums for their clients.

Project objective: You can submit multiple ad designs during this project. We are open to any ad designs. However, please only use the logo and images that we provide in your submissions.

The technical specifications are:

1. The required banner dimension is 300 x 250 pixel.
2. Please submit your designs in jpg format, and less than 50 kilobytes in size.

Your designs should be attractive, achieve high ad recognition and click-through rates. A panel of judges will evaluate all submissions and select the three best designs. Winning participants will receive between US$250 and US$600.

Notes. This is the project brief that we provided to the solvers in the banner ad design contest. We manipulated the examples of designs that the client liked during the experiment (Figure A3 in the online appendix).

Acknowledgments

The author appreciates the valuable feedback from the senior editor, associate editor, and anonymous reviewers. This research also benefited from the helpful comments of Wai Fong Boh, Steven P. Dow, Mark Fichman, Yongsuk Kim, Robert E. Kraut, Tridas Mukhopadhyay, Arun Rai, Viswanath Venkatesh, and Xiaojun Zhang, as well as seminar participants at Nanyang Technological University, the Academy of Management Annual Meeting, and the International Conference on Information Systems.

Endnotes

[1] We use "ideas" and "solutions" interchangeably in this paper.

[2] https://support.99designs.com/hc/en-us/articles/204108469 (accessed June 2018).

[3] The URLs were accessed in June 2018.

[4] In terms of solvers' incentives, some studies primarily focus on contest prizes (Yang et al. 2008, Cason et al. 2010), and others also consider factors such as solvers' intrinsic motivations or desire for recognition (Brabham 2010, Zheng et al. 2011, Ye and Kankanhalli 2017). Unlike the prizes to offer, seekers have relatively low influence on nonmonetary incentives and intrinsic motivations that matter to solvers. For example, seekers have little say about the recognition that can be given to solvers because it is the contest platforms that decide how to promote winners and showcase solvers' track records on their respective websites.

[5] The use of selected words in the with-exemplar groups over the base rate was a conservative underestimate. We considered all seven selected words in the experiment when evaluating the use of these words in the no-exemplar groups but only considered the two or four assigned words in the respective with-exemplar groups. Thus, the extent of use of the selected words in the no-exemplar groups was biased upward; the base rate would be lower if we only considered the relevant words when comparing with the respective with-exemplar groups.

[6] A wedding photographer, who was blinded to the purpose of the experiment, granted us permission to use these pictures for this study. The photographer took all the pictures during different weddings that she covered.

[7] Specifically, solvers were recruited from various design-related LinkedIn groups (e.g., www.linkedin.com/groups/123977) and online communities (e.g., www.graphicdesignforum.com).

[8] For example, suppose all solvers in a group were assigned the same set of exemplars (A, B, C, D). Even if exemplar adoption in this group differed from that in the other groups, we could not rule out the possibility that the difference was because of certain attributes in the respective exemplars that we did not manipulate (such as the aesthetic of exemplar B).

[9] It is not uncommon in crowdsourcing projects for users to view project details but not participate in the projects. Other studies found significantly higher nonparticipation rates in crowd-based contests than that in this study (37.9%). For example, 89% of registered users never participated in any contests on Taskcn.com, a platform for various types of contests, including those pertaining to graphic design (Yang et al. 2008). The nonparticipation rate was 95.9% on InnoCentive, on which an average of 240.7 individuals examined the project details but only 9.9 submitted solutions for each project (Jeppesen and Lakhani 2010).

[10] The evaluations by the MTurk raters were reliable. We asked a professional wedding photographer to compare the similarity of 36 ad–exemplar pairs in the sample. We randomly chose 12 ad–exemplar pairs with high similarity ratings (as evaluated by the MTurk raters), 12 pairs with low ratings, and 12 pairs with average ratings. The evaluations by the MTurk raters and the photographer correlated strongly ($r = 0.74$, $p < 0.001$).

[11] We could have used the mean (instead of the maximum) exemplar-similarity rating of respective ads to measure exemplar adoption by individual solvers. However, using mean rating would introduce potential measurement errors because of the nature of the groups. Consider two solvers, one assigned to a high-variability group and the other to a low-variability group. Suppose the solvers had each submitted one ad that was based mainly on the same assigned exemplar in the experiment. The two ads should have similar maximum exemplar-similarity ratings despite the solvers being in different groups. However, because the exemplars were relatively similar in the low-variability group, the mean rating for the ad in that group would be higher than that for the ad in the high-variability group. In this case, the mean ratings of the ads would incorrectly suggest that the solver in the high-variability group adopted seeker exemplars less than the solver in the low-variability group did. Similarly, for the two high-variability groups with different exemplar quantities, the mean exemplar-similarity rating for an ad could be lower in the four-exemplar group than that in the two-exemplar group even if the ads were largely based on the same exemplar in the respective groups.

[12] Other objective measures included conversions and sales that the ads generated; however, although these metrics were important, we did not have such data in this study.

[13] The cost per click that advertisers incur on GDN depends in part on the ads' quality score, which takes into account the click-through rate of the ads. See https://support.google.com/adwords/answer/2996564 and https://support.google.com/adwords/answer/7050591 (accessed June 2018).

[14] Even though we chose to rotate ads more evenly, Google did not distribute exposure equally among the ads. According to Google, although the ads were eligible to be shown an equal number of times under this option, the actual impressions could nonetheless differ across ads based on a number of factors. Google did not provide specific details about these factors.

[15] See http://www.richmediagallery.com/tools/benchmarks (accessed June 2018).

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