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Confirmation Bias in Adoption of Seeker Exemplars in Crowdsourcing Ideation Contests

Tat Koon Koh
The Hong Kong University of Science and Technology, koh@ust.hk

Muller Y. M. Cheung
The Hong Kong University of Science and Technology, mcheung@ust.hk

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Abstract

This study examines how solution exemplars that seekers provide in crowdsourcing ideation contests affect the scanning, shortlisting, and selection of ideas by solvers; these three ideation activities are essential layers in the Knowledge Reuse for Radical Innovation model. Specifically, we consider the role of confirmation bias in solvers' behaviors and their use of seeker exemplars in the ideation activities. We posit that solvers' use of exemplars is affected by the extent to which the exemplars are consistent with solvers' prior belief and by different considerations in different ideation activities. The results from a crowdsourcing ideation contest experiment largely support our theorizing, as we find that problem-related and problem-unrelated seeker exemplars affected different ideation activities differently. This research contributes insights into seeker involvements and solver behaviors in crowdsourcing ideation contests and offers practical implications for seekers.

Keywords: Crowdsourcing, ideation contests, seeker exemplars, confirmation bias, idea generation, knowledge reuse for radical innovation

Introduction

Crowdsourcing ideation contests are competitions in which organizations solicit ideas from external individuals to address specific problems or needs. Such contests could be used to acquire solutions for technical problems or content for marketing activities. For example, on foap.com, a global marketplace for visual content with nearly three million content creators, TurboTax ran a contest for pictures of self-employed professionals working at their jobs (Figure 1). Typically, the organizations ("seekers") initiate their contests by posting specific problems on their websites or third-party ideation contest platforms, and individuals ("solvers") participate by submitting their ideas for solutions. At the end of the contests, seekers choose the ideas that they want to acquire and award the contest prizes to the corresponding solvers.

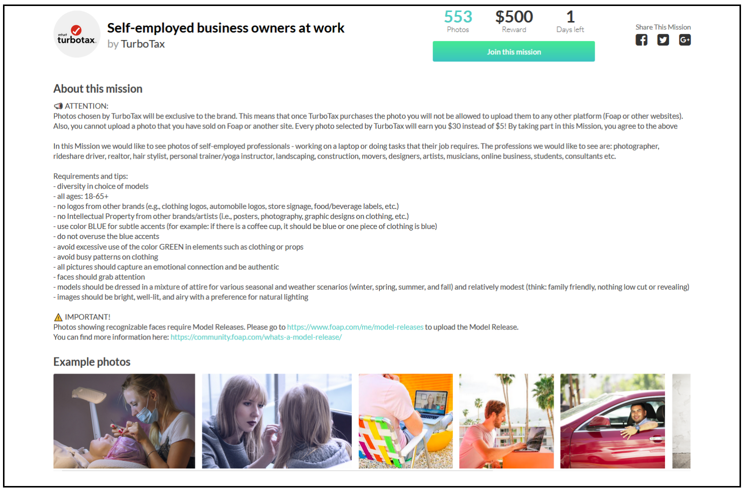

Figure 1. Contest by TurboTax on foap.com

Prior research finds that information that seekers provide in their contests has strategic impacts on how and what solvers ideate (Jian et al. Forthcoming; Koh Forthcoming; Lee et al. 2018; Wooten and Ulrich 2017). For example, in many contests, seekers often show examples of solutions that they like (see Figure 1), and these solution exemplars can affect the ideas that the solvers generate (Koh Forthcoming). The purpose of this study is to examine how seeker exemplars shape certain aspects of the solver ideation process. Numerous studies show that organizations can mobilize the crowd to come up with valuable ideas (Bayus 2010; Franke et al. 2014; Morgan and Wang 2010), and solvers in crowdsourcing contests can provide solutions for highly challenging science problems that firms could not solve internally (Jeppesen and Lakhani 2010) or generate ideas that outperform those by firms (Nishikawa et al. 2013; Poetz and Schreier 2012). One way to increase the likelihood of attaining good ideas is to encourage solvers to generate more ideas; various studies show that this strategy of *achieving idea quality through idea quantity* could be effective (Diehl and Stroebe 1987; Osborn 1993; Paulus et al. 2011; Wooten and Ulrich 2017). While existing research has extensively discussed determinants of the eventual number of ideas that solvers submit in crowdsourcing contests, little empirical attention has been paid to the intermediate quantitative outcomes during the ideation process undertaken by solvers (e.g., the number of ideas that solvers search and consider before determining the ones to submit). However, the intermediate outcomes are an important consideration because they affect the eventual outcomes; the scope of solvers' solution search and the size of their consideration set impact the number of ideas that they generate or use. Drawing from the *Knowledge Reuse for Radical Innovation (KRI)* model (Majchrzak et al. 2004), we thus examine quantity-related ideation outcomes, both intermediate and eventual ones, in crowdsourcing contests. According to the KRI model, individuals begin with a definition of an innovation project's focal problem in the *Reconceptualization* stage. Here, they could either narrowly interpret the problem or radically redefine it. Once individuals decide to reuse others' ideas to develop their solutions, they move to the *Search and Evaluate* stage, which consists of three layers: *scan*, *briefly evaluate*, and *in-depth analyses*. These are the ideation activities of interest in the present study. Thereafter, individuals commit to implementation during *Full Development*.

In theorizing the impacts of seeker exemplars in the *Search and Evaluate* activities, we consider the role of confirmation bias in solvers' behaviors and their use of the exemplars. Prior research suggests that idea generation is subjected to cognitive or decision biases (Loch 2017) and that individuals seek confirmation of their preconceived perceptions during ideation (Liedtka 2015). We thus posit that solvers' use of seeker exemplars during idea generation is affected by the extent to which the exemplars are consistent with solvers' prior belief that their ideas should be related to the focal problems in the contests. However, due to different considerations in different *Search and Evaluate* activities, the influence of confirmation bias varies across the activities. For this reason, we argue that solvers exhibit a heuristic-switching behavior, wherein they shift their focus and orientation as they progress through the ideation activities. This tendency leads to problem-unrelated seeker exemplars being treated as secondary in the earlier *Search and Evaluate* activities but becoming important considerations in the later part. The experimental results from an online crowdsourcing ideation contest that we conducted largely support our theorizing, as we find that problem-related and problem-unrelated seeker exemplars have different effects in different ideation activities. Our results also show that the intermediate ideation outcomes (quantity of ideas scanned and shortlisted) affect the eventual outcomes (quantity of ideas submitted), thus validating the need to holistically examine the idea generation process.

The present research contributes to the extant literature in several ways. First, it advances the literature about the impacts of seeker involvements (e.g., the feedback, exemplars, and prizes that seekers provide) in crowdsourcing ideation contests (Jian et al. Forthcoming; Koh Forthcoming; Wooten and Ulrich 2017). Moreover, our focus on how seeker exemplars shape solver behaviors in different *Search and Evaluate* activities enriches the understanding of seekers' influences on solvers in specific ideation activities. Second, by considering the role of confirmation bias and the dynamic heuristic that solvers employ during idea generation, we go beyond treating the ideation process as a black box. Our theorizing of what solvers face in the respective ideation activities and their reactions and decisions gives deeper insights into their behaviors. Third, this study also offers practical implications for seekers, especially when they provide solution exemplars in their contests. Specifically, we discuss what seekers should be mindful of and what they could do to minimize potential downsides from showing exemplars.

Related Literature

Idea Quantity in Ideation Tasks

Information technology is an important facilitator of idea sourcing, from electronic brainstorming within organizations (Dennis et al. 1999; Potter and Balthazard 2004) to soliciting ideas in crowdsourcing contests (Jeppesen and Lakhani 2010; Morgan and Wang 2010). Research shows that the number of ideas generated in these activities is an important outcome of interest, as this factor could be positively associated with the quality of ideas (Wooten and Ulrich 2017) and quantity of good ideas (Diehl and Stroebe 1987). Osborn (1993:124) points out that "*quantity breeds quality*" during idea finding and that initial ideas are unlikely to be the best but could lead to other, potentially better, ideas. In addition, since the later stage of innovation usually produces a greater number of good ideas than the earlier stage, building up a large set of ideas makes it more likely that quality ideas are generated and not missed (ibid). Interestingly, individuals who focus on generating as many ideas as possible can produce a greater number of high-quality ideas than those who focus on generating high-quality ideas (Paulus et al. 2011); one explanation is that generating more ideas could increase the likelihood of thinking up some that are good, whereas an idea-quality focus might cause some good ideas to be rejected too early during ideation. In sum, when sourcing for ideas, acquiring a large number of ideas contributes to a higher likelihood of obtaining outstanding ideas (Girotra et al. 2010). Previous studies show that solvers who are highly engaged within crowdsourcing contest communities tend to generate more ideas (Füller et al. 2014). Solvers also generate more ideas when seekers offer higher rewards (Liu et al. 2014) or provide feedback that is consistent with their quality function during crowdsourcing contests (Jian et al. Forthcoming; Wooten and Ulrich 2017).

Confirmation Bias

Confirmation bias is the tendency for individuals to selectively seek or give undue weight to information that is consistent with their prior beliefs and to attend less to, discount, or ignore belief-inconsistent information or interpret it in ways that reinforce their existing beliefs (Jonas et al. 2001; Nickerson 1998). Because individuals value and strive for consistency, they are motivated to preserve their existing beliefs by treating data and evidence selectively (Festinger 1957; Nickerson 1998). Confirmation bias could also be a result of cognitive factors. Individuals are partial to using belief-consistent information to avoid or reduce the cognitive dissonance that arises from processing belief-inconsistent information (Festinger 1957; Frey 1986). Moreover, as it is easier to process belief-consistent than belief-inconsistent information (Wyer and Srull 1989), confirmation bias is also likely to arise when the information load is high (Fischer et al. 2008; Kardes et al. 2004).

Confirmation bias is prevalent in a wide range of real-world contexts, such as politics, medicine, and science; see Nickerson (1998) for a detailed review. Prior IS research has investigated the effects of confirmation bias in online word of mouth and stock trading (Park et al. 2013; Yin et al. 2016). This bias is also a common cognitive and behavioral flaw during ideation (Liedtka 2015; Potts 2010). Individuals tend to look for confirmation of their starting hypotheses instead of seeking novel ideas that disconfirm their starting point, thus limiting their ability to come up with new ideas (Loch 2017). For example, designers in a concept generation task might exhibit belief perseverance behaviors in the presence of contradicting evidence, causing them to misinterpret or ignore relevant information (Hallihan et al. 2012). Hence, in our context, it is reasonable to expect confirmation bias to influence solvers' use of information that the seekers provide.

Theory And Hypotheses

Crowdsourcing contest platforms often encourage seekers to provide examples of solutions that they like so as to guide solvers in generating ideas. For example, Figure 1 show seekers providing examples of the types of pictures that they are looking for. Such solution exemplars can help solvers frame the focal problems, evaluate the originality of their ideas, and determine potential flaws or limitations (Herring et al. 2009; Smith et al. 1993; Toh and Miller 2014). Moreover, these exemplars can serve as signals of seekers' preferences, which are a key determinant of winning solutions (Koh Forthcoming; Terwiesch and Xu 2008). Solvers can use seeker exemplars to develop ideas that better align with the seekers' preferences; doing so can improve the solvers' winning prospects, which is an important concern for them because of the typical winner-take-all outcomes in crowdsourcing contests (Koh Forthcoming). Referring to seeker exemplars when generating ideas can also help solvers economize their effort, which is a key factor that drives their contest participation (Koh Forthcoming; Ye and Kankanhalli 2017).

While it is intuitive that seekers would show exemplars that pertain to the problem domain, they might also use unrelated exemplars. Some seekers provide signals that are distant from the problem domains because they do not know what solutions are best suited for their problems, which is why they turn to crowdsourcing contests in the first place. Seekers might also want to illustrate certain concepts or approaches from unrelated problem domains that they like or think are appropriate for their own problems. Hence, there are three possible configurations of seeker exemplars: (1) problem-related exemplars only, (2) problem-unrelated exemplars only, and (3) a mix of problem-related and problem-unrelated exemplars.

Because of the strategic influences of seeker exemplars in crowdsourcing contests (Koh Forthcoming), it is necessary to understand how the exemplar configurations affect the ideation process, particularly in terms of the ideas that the solvers look for, consider, and eventually submit. We thus examine solvers' idea scanning, shortlisting, and selection in crowdsourcing contests by mapping these activities to those in the *Search and Evaluate* stage of the KRI model (Majchrzak et al. 2004). Our theorizing builds on the search and evaluation activities in the KRI model in a few ways. First, we expand the theorizing of these activities beyond the specific context of knowledge reuse (where individuals purposefully consider and use others' ideas in innovation projects), which is the focus of the original KRI model. As new ideas are not created in a vacuum but involve a combination of available ideas (Nelson and Winter 1982), we posit that the search and evaluation activities can be generalized even to situations in which knowledge reuse is not an explicit objective. Second, although search and evaluation activities in the KRI model focus mainly on radical innovation, they are also applicable for incremental (i.e., non-radical) innovation. For example, Majchrzak et al. (2004) point out that idea scanning in radical innovation projects involves broader searches in nontraditional areas and for ideas that do not directly fit the primary functional requirements; the implication is that idea scanning in incremental innovation projects could be more narrowly focused on the immediate problem area. Similarly, brief evaluations and in-depth analyses of ideas should be part of the ideation process in non-radical innovation projects just as they are in radical ones, although the characteristics of these activities could vary across the two types of projects. Thus, our theorizing is more general and emphasizes the generic ideation process rather than specific types of innovation projects. Third, our application of the search and evaluation activities extends the KRI model by adopting a dynamic view of ideation in our theoretical model and proposing that solvers' consideration sets and focus evolve across the activities. Specifically, in the context of crowdsourcing contests, we argue that solvers adapt their heuristics in different ideation activities: they focus more on the problem fit of ideas when scanning and shortlisting ideas but emphasize exemplar fit when selecting ideas to use.

Activity 1: Idea Scanning

Idea scanning refers to the process of identifying ideas with potential relevance to the focal problems (Majchrzak et al. 2004). Findings from creativity research also show individuals tend to follow the path of least resistance and consider existing solutions to the active problems (Moreau and Dahl 2005; Ward 1994). Hence, in crowdsourcing ideation contests, solvers would hold *a prior belief that their solutions should be problem related* and adopt a heuristic that emphasizes the problem fit of ideas during idea scanning. Specifically, solvers would naturally search for ideas that are (1) related to the particular domain of the focal problems and/or (2) from other domains that can be applied to the problems (Majchrzak et al. 2004).

Because of the abovementioned solvers' prior belief, seeker exemplars are not considered in isolation but rather in relation to the problem domain. Problem-related exemplars affirm solvers' prior belief and reinforce their focus on the problem fit of ideas, whereas problem-unrelated exemplars contradict the problem-oriented heuristic and increase the uncertainty about what constitutes promising ideas. Since solvers' existing belief is confirmed by problem-related exemplars, solvers' scanning of ideas in the presence of such exemplars should not differ from that in the "baseline" situation where no exemplars are provided by seekers. Similarly, solvers' idea scanning should not differ from the baseline when seekers provide a combination of problem-related and problem-unrelated exemplars, because when presented with both belief-consistent cues and belief-inconsistent cues, individuals tend to focus on the former due to confirmation bias.

By contrast, solvers are likely to engage in less idea scanning when seekers provide only problem-unrelated exemplars. In such situations, although solvers still undertake problem-oriented scanning due to the saliency of the problem domain in their prior belief, what makes an idea applicable for the particular crowdsourcing contest is less definitive. Ideas that are appropriate for multiple but unrelated domains are also likely to be fewer and more difficult to come by; for example, ideas that address the focal problems may not fit the problem-unrelated exemplars (and vice versa). Moreover, synthesizing the properties of the problem domain with those of unrelated exemplars involves greater complexities and requires more effort, which compounds the challenges that solvers face in processing signals that are inconsistent with their prior belief (Kardes et al. 2004; Wyer and Srull 1989). As solvers strive to economize their effort in crowdsourcing contests (Koh Forthcoming), they generally would follow the path of least resistance by focusing on the problem domain instead of making a special effort to resolve the inconsistency between the problem domain and problem-unrelated exemplars. Therefore, compared to the baseline case, we hypothesize the following:

H1: Solvers scan for fewer ideas when seekers provide only problem-unrelated exemplars.

Activity 2: Idea Shortlisting

Instead of carefully analyzing or using all the ideas that they come across during idea scanning, solvers will first briefly evaluate the ideas to identify the promising ones for further consideration (Majchrzak et al. 2004). To determine which ideas should go through a more thorough analysis, solvers need to assess the ideas against a set of criteria and shortlist those that qualify. For example, Majchrzak et al. (2004) list three criteria—credibility, relevance, and adaptability—for assessing whether an idea that has been identified during idea scanning should be discarded or retained for in-depth analysis. Criteria such as feasibility, market potential, and creativity have also been used to shortlist ideas for further consideration in crowdsourcing contests (Merz et al. 2016). Shortlisting criteria, in essence, allow solvers to narrow down the list from their idea scanning to a more manageable consideration set. Generally speaking, *the more shortlisting criteria that are used to evaluate ideas, the smaller the resulting set of shortlisted ideas would be*. For instance, for a given set of ideas, fewer are likely to measure up to all the three of the criteria proposed by Majchrzak et al. (2004)—and thus be shortlisted—than if only one of the three criteria were used.

In crowdsourcing ideation contests, solvers are likely to regard promising ideas as those that that closely align to the focal problems and seeker exemplars; all else being equal, ideas that better satisfy the seekers' problems and preferences have higher chances of winning, which is a key goal for solvers (Koh Forthcoming). As a result, problem fit and exemplar fit are natural shortlisting criteria. However, despite being important considerations in shortlisting, these two criteria may not have equal significance. Due to their prior belief and problem-oriented heuristic when scanning for ideas, solvers are likely to focus first on problem fit when shortlisting ideas. For example, the abovementioned shortlisting criteria from Majchrzak et al. (2004) and Merz et al. (2016) mainly concern whether the ideas fit the focal problems.

Exemplar fit of the ideas, in contrast, becomes more pertinent as a shortlisting criterion after the fundamental problem fit requirements are met. Problem-related exemplars are likely to be a key consideration when shortlisting ideas because solvers generally pay greater attention to belief-consistent information due to confirmation bias. Solvers are less likely to strongly consider problem-unrelated exemplars because these (1) contradict the problem-oriented heuristic and (2) are relatively difficult to process because they are inconsistent with solvers' prior belief (Wyer and Srull 1989). Based on this reasoning and holding all other factors constant, since problem-related exemplars lead to more evaluation criteria, fewer ideas will be shortlisted when seekers provide such exemplars.

H2A: Solvers shortlist fewer ideas when seekers provide only problem-related exemplars.

H2B: Solvers shortlist fewer ideas when seekers provide both problem-related and problem-unrelated exemplars.

Activity 3: Idea Selection

In the final layer of the *Search and Evaluate* stage, in-depth analyses are conducted to determine if the shortlisted ideas continue to show promise and could be used to address the focal problems (Majchrzak et al. 2004). In crowdsourcing ideation contests, idea selection is likely to be a more deliberate process for solvers because their decisions (i.e., which ideas to use and submit) have a direct impact on their contest outcomes (i.e., whether they win). Although problem fit and exemplar fit are important considerations, we posit that there is a change in the comparative importance of these factors as solvers progress from scanning and shortlisting ideas (Activities 1 and 2) to selecting ideas (Activity 3). Problem fit, while still critical, may not be as dominating a decision criterion during idea selection as it was in the preceding activities because, after the first two activities, the shortlisted ideas generally should be compatible with the problem. By contrast, given the importance of seekers' preferences in determining winning solutions (Terwiesch and Xu 2008), exemplar fit remains an influential criterion because the exemplars are salient signals of what the seekers might like. This is especially true when solvers are deciding which ideas to use for crowdsourcing contests, given the typical winner-take-all outcomes in these events. Therefore, the orientation of the ideation heuristic would shift from "problem" to "exemplar" as solvers scrutinize their shortlist and select the ideas to use.

Due to the centrality of exemplar fit in idea selection, we expect solvers to consider both problem-related and problem-unrelated exemplars when making their selections. Prior research suggests that although individuals typically focus on belief-consistent information (Jonas et al. 2001; Nickerson 1998), they also pay attention to belief-inconsistent information when it is expected to materially affect future outcomes (Erber and Fiske 1984). Hence, in our context, solvers would attend to problem-unrelated seeker exemplars during idea selection, as they expect these belief-inconsistent cues to have strong implications for whether they could win the contests. In other words, both problem-related and problem-unrelated exemplars would serve as selection criteria as solvers decide on the ideas to use. Consequently, compared to the baseline case and with all else being equal, solvers are likely to select fewer ideas when seekers provide only problem-related or problem-unrelated signals in contests.

H3A: Solvers select (i.e., submit) fewer ideas when seekers provide only problem-related exemplars.

H3B: Solvers select (i.e., submit) fewer ideas when seekers provide only problem-unrelated exemplars.

Although there are also more selection criteria when seekers provide both problem-related and problem-unrelated exemplars, a shortlisted idea that does not meet the former might nonetheless satisfy the latter (and vice versa). Thus, ideas in the solvers' shortlist are generally more likely to be selected in this case. Moreover, as seekers' preferences appears to be less specific when the exemplars are relatively different from each other (Koh Forthcoming), solvers could find it strategic to submit more ideas so as to increase the likelihood that one would satisfy the seekers. Hence, *ceteris paribus*, we expect solvers to select more ideas when problem-related and problem-unrelated exemplars are both present in crowdsourcing ideation contests.

H3C: Solvers select (i.e., submit) more ideas when seekers provide both problem-related and problem-unrelated exemplars.

Method and Data

Experiment

Overview. Given our objective to examine the ideation process (i.e., what solvers do) and not just the ideation outcome (i.e., what solvers submit), we designed an experiment in which we could observe solver behaviors across different ideation activities in a crowdsourcing ideation contest. Specifically, we launched a contest where solvers were tasked to search for and submit images for a (hypothetical) beverage-related company (i.e., the seeker) to use in its corporate articles. A key difference between our contest and those on foap.com was in the image repository that solvers could use; instead of searching their own sources of images, all solvers in our contest relied on Getty Images, a supplier of stock images and editorial photography. We mandated Getty Images for two reasons. First, doing so removed solver heterogeneity in terms of their idea sources, which could confound our results; for example, as solvers with access to a larger (smaller) image repository might search and submit more (fewer) ideas than other solvers, using a common image source for all solvers eliminated this potential issue and improved the internal validity of our experiment. Second, Getty Images provides high-quality professional images, which (1) increased the realism of our experiment and (2) negated the need for solvers to perform additional image processing, which could bias our results due to extraneous factors (e.g., solvers' ability). Nonetheless, we assumed that the ideation process and considerations concerning seeker exemplars would largely be similar regardless of the image sources that solvers had to use.

We conducted the contest on an online platform that we developed, and we recruited solvers from Amazon Mechanical Turk (MTurk). As MTurk required all workers to be compensated, we paid solvers US$0.75 for participating in the contest and awarded a US$10 prize to the winner whose submission was chosen. Prior crowdsourcing contest research has also used MTurk as a solver pool. Koh (Forthcoming) found that MTurk workers submitted more ideas in crowdsourcing contests when they perceived the contest prizes to be more attractive or regarded winning to be more important, which is consistent with our expectation of solver behaviors in field settings.

Procedure. At the start of the contest, solvers were shown a project brief that included details such as the seeker's company name and industry, contest objective, idea requirements, and winning prize. To conduct their image searches, solvers entered words or phrases ("keywords") into a Getty Images search engine that we incorporated into our contest platform.[1] For every keyword search that the solvers performed, the search engine returned an initial result set consisting of up to 30 images that were based on the keyword. At this point, solvers could shortlist particular images from the results. They could also (1) load more images (30 images at a time) based on the same keyword or (2) conduct a new search request using another keyword. Solvers then proceeded to their shortlist and selected up to 15 images for submission to the contest; we limited the number of images so that solvers would be selective rather than submitting all search returns. (While viewing their shortlist and selecting images to submit, solvers could conduct more searches if they wished to do so. However, they could not perform additional searches once they had submitted their chosen images.) After submitting their images, solvers completed a post-contest questionnaire.

We used a blind contest setting where solvers were restricted from interacting with other solvers or seeing others' submissions. Apart from that, we did not impose any time, keyword, search, or shortlist limits or restrictions. During the contest, we tracked the time that solvers spent on different activities, such as searching for images and selecting shortlisted images for submission. We also recorded the keywords that solvers used and the images that they saw, shortlisted, and submitted.

Manipulations. Solvers were randomly assigned to the respective experimental conditions, which varied in terms of the exemplars that were shown in the project brief. Because the contest involved images for beverage-related articles, we used images of a soda container and a penholder as problem-related and problem-unrelated exemplars, respectively. A research assistant, blinded to the experiment, photographed the objects in several settings (Table 1). We implemented three treatment conditions: (1)

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[1] We integrated the image search engine into our contest by using Getty Images' application programming interface (http://developers.gettyimages.com). The entire experiment, including the image search, was conducted within our contest platform.

a problem-related exemplars condition showing two images of a soda can ("related exemplars"), (2) a problem-unrelated exemplars condition showing two images of a penholder ("unrelated exemplars"), and (3) a mixed exemplars condition showing an image of a soda can and an image of a penholder ("mixed exemplars"). We also included a fourth condition where we did not show any exemplars ("no exemplars") as the baseline control group. Our pretests indicated that the perceived relatedness of the exemplars to the beverage industry differed significantly across the three treatment conditions and was the largest for the related exemplars condition and the lowest for the unrelated exemplars condition.

Table 1. Solution Exemplars in the Experiment

Image				
Relatedness of image to beverage industry (1=very unrelated; 7=very related)	6.81	6.95	1.14	1.52

Sample

Two hundred and fourteen solvers participated in the contest. We found no duplicate IP addresses among the solvers, thereby minimizing the concern that some solvers took part in the contest multiple times. We also checked online communities for MTurk workers to see if there had been discussions about the contest, which would have contaminated the solver pool.[2] No mentions of our contest on these communities were found, minimizing this concern as well.

In the post-contest questionnaire, we asked solvers to recall the seeker's company name and industry and the contest objectives to check the extent to which they paid attention to the project brief. One hundred and fifty-seven (73.4%) solvers correctly answered all of these questions and were included in the sample. There were 39, 39, 40, and 39 solvers in the *no exemplars*, *related exemplars*, *unrelated exemplars*, and *mixed exemplars* conditions, respectively.

Manipulation Checks

The manipulations of the problem-relatedness of exemplars were effective. In the post-contest survey, we asked solvers in the treatment conditions to evaluate the extent that the assigned exemplars, taken together as a pair, were related to the context of the contest. ANOVA results indicated that the relatedness of the exemplars to the beverage industry was significantly different across the conditions ($F = 247.65$, $p < .001$). Specifically, *related exemplars* were perceived to be the most related to the beverage industry (mean = 6.85, s.d. = 0.43), followed by *mixed exemplars* (mean = 4.92, s.d. = 1.16) and *unrelated exemplars* (mean = 1.70, s.d. = 1.30).

Measures

Dependent variables. The outcomes of interest in this study relate to the scanning, shortlisting, and selection of ideas by solvers in the contest. We used the quantity of images that appeared in the solvers' searches to operationalize idea scanning. As a particular image might show up multiple times in all the searches conducted by a solver (e.g., when the solver used similar keywords to perform different image searches), we considered the number of distinct images that appeared across all the solver's search results (*Scan*) to avoid double counting. We used the numbers of shortlisted images (*Shortlist*) and submitted images (*Select*) by the solvers as measures for the other two dependent variables.

[2] The online communities that we checked included www.mturkforum.com, www.mturkcrowd.com, www.mturkgrind.com, www.turkernation.com, and www.turkerhub.com.

Control variables. Solvers' behaviors in contests are influenced by various intrinsic and extrinsic factors, such as the importance of winning the contests, their willingness to exert effort in the contests, and their perceptions of the attractiveness of the contest prizes (Koh Forthcoming; Leimeister et al. 2009; Mo et al. 2018; Ye and Kankanhalli 2017). Given solver heterogeneity in these aspects, we included relevant control variables in our estimation models to account for individual differences and improve the precision of our estimations. We measured solvers' desire to win and perception of the prize attractiveness in the post-contest survey; solvers indicated the importance of winning the contest (*Winning Importance*) and evaluated the attractiveness of the US$10 prize for the winning solver (*Prize Attractiveness*) on seven-point Likert scales. We used the time that solvers spent in ideation in the contest as a proxy for their incurred effort. Specifically, we measured the total time (in minutes) that they took to scan, shortlist, and select images for the contest (*Effort*); this measure excluded the time required to register for the contest and complete the post-contest questionnaire.

Table 2 shows the descriptive statistics and Table 3 shows the correlation matrix. The correlations between the independent variables and control variables are not statistically significant at the .10 level.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.
Scan	270.21	252.19
Shortlist	13.97	8.19
Select	10.63	4.62
Related Exemplars	0.25	0.43
Unrelated Exemplars	0.25	0.44
Mixed Exemplars	0.25	0.43
Winning Importance	5.96	1.33
Prize Attractiveness	6.63	0.74
Effort	7.79	6.68

Table 3. Correlation Matrix

	Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1]	Scan	1.00								
[2]	Shortlist	0.36^{***}	1.00							
[3]	Select	0.42^{***}	0.71^{***}	1.00						
[4]	Related Exemplars	-0.01	-0.13	-0.13	1.00					
[5]	Unrelated Exemplars	-0.09	-0.05	-0.20	-0.34^{***}	1.00				
[6]	Mixed Exemplars	0.02	-0.01	0.08	-0.33^{***}	-0.34^{***}	1.00			
[7]	Winning Importance	0.12	0.27^{***}	0.36^{***}	-0.04	-0.09	0.11	1.00		
[8]	Prize Attractiveness	0.13	0.20^{*}	0.21^{**}	0.13	-0.06	0.03	0.47^{***}	1.00	
[9]	Effort	0.53^{***}	0.31^{***}	0.35^{***}	0.07	-0.07	0.03	0.14^{+}	0.10	1.00

$^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$, $^{+}p < .10$

Analyses and Results

Main Results

As all the dependent variables in this study were count data, we considered using either Poisson regression or negative binomial regression in the analyses (Cohen et al. 2003). Poisson regression is appropriate when the conditional mean and variance of the Poisson distribution are equal in the sample. In contrast, negative binomial regression is more appropriate when over-dispersion occurs (i.e., when the conditional variance is larger than the conditional mean). Based on the likelihood ratio test of over-dispersion, we decided to use negative binomial regression to estimate the *Scan* and *Shortlist* models and Poisson regression for the *Select* model. Two models were estimated for each of the dependent variables: we included only the control variables in the first model and added the independent variables in the second model. In all the second model estimations, we used the *no exemplar* condition as the baseline group.

Models 1A and 1B in Table 4 show the factors affecting idea scanning. Compared to not showing any exemplars and holding the other factors constant, showing *unrelated exemplars* reduced the number of distinct images during solvers' idea scanning by 26.7% (β = -.31*, p* < .05).[3] Hence, H1 is supported. However, idea scanning when *related exemplars* (β = -.06*, p* > .10) or *mixed exemplars* (β = -.15*, p* > .10) were provided did not differ significantly from that when *no exemplars* were shown.

Table 4. Main Results

	Model 1A	Model 1B	Model 2A	Model 2B	Model 3A	Model 3B
	DV: Scan		DV: Shortlist		DV: Select	
Constant	3.61^{***} (0.43)	3.85^{***} (0.44)	1.18^{**} (0.45)	1.25^{**} (0.44)	1.36^{***} (0.37)	1.50^{***} (0.29)
Winning Importance	0.00 (0.05)	0.00 (0.05)	0.10^{*} (0.04)	0.08^{*} (0.04)	0.11^{**} (0.03)	0.07^{*} (0.03)
Prize Attractiveness	0.16^{*} (0.07)	0.15^{*} (0.07)	0.10 (0.07)	0.12^{+} (0.06)	0.03 (0.05)	0.01 (0.04)
Effort	0.10^{***} (0.02)	0.10^{***} (0.02)	0.03^{**} (0.01)	0.02^{+} (0.01)	0.02^{**} (0.01)	0.01^{**} (0)
Related Exemplars		**-0.06 (0.14)**		**-0.35^{**} (0.11)**		**-0.16^{*} (0.08)**
Unrelated Exemplars		**-0.31^{*} (0.14)**		**-0.19 (0.12)**		**-0.23^{**} (0.08)**
Mixed Exemplars		**-0.15 (0.15)**		**-0.22^{+} (0.11)**		**-0.05 (0.06)**
Scan				0.001^{*} (0.00)		
Shortlist						0.03^{***} (0.00)
Wald $\chi 2$	38.38^{***}	41.67^{***}	19.85^{***}	40.53^{***}	23.35^{***}	97.48^{***}
Observations	157	157	157	157	157	157
Regression	Negative binominal	Negative binominal	Negative binominal	Negative binominal	Poisson	Poisson

*** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .10$

Next, we examined the drivers of idea shortlisting in Models 2A and 2B. We included the number of distinct images that the solvers scanned (*Scan*) as a control variable in Model 1B. After accounting for idea scanning, we found that the solvers shortlisted 29.5% fewer images when they were provided with *related exemplars* (β = -.35*, p* < .01), supporting H2A. We further found that H2B is marginally supported, as the number of shortlisted images was 19.7% lower when *mixed exemplars* were shown (β = -.22*, p* = .052). These results indicated that solvers generally shortlisted fewer images when problem-related exemplars were provided. However, consistent with our theorizing, the impact of showing *unrelated exemplars* (β = -.19*, p* >. 10) on the number of shortlisted images did not differ significantly from that of providing *no exemplars*.

Finally, we examined idea selection in Models 3A and 3B. In Model 3B, we used the number of shortlisted images (*Shortlist*) as a control variable. Compared to solvers in the no exemplars condition, after controlling for idea shortlisting, those in the *related exemplars* condition selected 14.8% fewer images (β = -0.16*, p* < .05) for the contest and those in the *unrelated exemplars* condition selected 20.5% fewer images (β = -0.23*, p* < 0.01), supporting H3A and H3B. However, contrary to our

[3] The coefficient of *unrelated exemplars* in Model 1B, β = -.31, implies that the expected number of distinct images in idea scanning in this condition is exp(-.31) = .733 times that in the baseline (*no exemplars*) condition. Hence, the difference in *Scan* between showing *unrelated exemplars* and showing *no exemplars is* 1-.733 = 26.7%.

expectation, solvers did not submit significantly more images when they were shown *mixed exemplars* (β = -0.05*,* p > 0.1). Thus, H3C was not supported.

Our analyses also show that the number of ideas scanned positively affected the number of ideas shortlisted (β = 0.001*,* p < 0.05; Table 4, Model 2B), which in turn positively affected the number of ideas selected (β = 0.03*,* p < 0.001; Table 4, Model 3B). These results thus justify our interest in both the intermediate and eventual ideation outcomes in this study.

Discussion and conclusion

Providing solution exemplars is a common practice by seekers in crowdsourcing ideation contests. The theorizing and results from this study offer insights into how such exemplars affect certain aspects of the ideation process that solvers undertake. Specifically, depending on the relatedness of the seeker exemplars to the focal problem domains, the presence of seeker exemplars could lower the number of ideas that solvers scan, shortlist, and/or select in the contests. Hence, although contest platforms claim that seeker exemplars can guide solvers in coming up with ideas and prior research shows that adhering to seeker exemplars could lead to effective solutions (Koh Forthcoming), these benefits might be at the expense of a smaller search space explored and fewer ideas submitted. This study thus contributes to a more balanced perspective on the influences of seeker exemplars in crowdsourcing contests.

Theoretical and Practical Implications

In this study, we not only examine eventual ideation outcomes (i.e., ideas that solvers submit) in crowdsourcing ideation contests but also consider the intermediate outcomes that are usually unobserved (i.e., ideas that solvers search for and shortlist). We thus gain a deeper and more nuanced understanding of the inner workings of solvers' ideation processes, particularly in relation to their focus in the various activities. We find that solvers generally focus on the problem fit of ideas during idea scanning and shortlisting but pay greater attention to the exemplar fit of ideas during idea selection. Our results have important theoretical implications concerning solver behaviors. Generating ideas often involves a series of interrelated activities and our analyses show that the number of resulting ideas in idea scanning affects that in idea shortlisting, which in turn affects that in idea selection. While it is reasonable to assume solvers hold a consistent focus across the activities, solvers might adopt a dynamic heuristic in reality—switching focus and emphasis as they progress from idea scanning to idea selection—due to changes in (1) the set of ideas that they are considering and (2) the salient decision-making criteria. Therefore, when studying idea generation in crowdsourcing contests, it is critical to account for solvers' consideration set, concerns, and decision-making heuristics in different activities. Doing so would help us attain a more accurate explanation of solver behaviors to inform theory development on this topic.

To the best of our knowledge, this is the first research that examines the role of confirmation bias in solvers' use of seeker exemplars in crowdsourcing ideation contests. Because of this cognitive bias, solvers' prior belief that their ideas should be related to the problem domain affects how they incorporate seeker exemplars into their search, shortlist, and selection of ideas. Specifically, while problem-related exemplars are major factors in solvers' heuristics in idea scanning and shortlisting, both problem-related and problem-unrelated exemplars are salient in idea selection. The dominating effect of solvers' prior belief that arises from confirmation bias could cause them to sacrifice potentially good ideas in distant domains, since they are less likely to actively explore and consider such ideas during the early stages of idea generation. This implies that it is necessary to consider the cognitive biases that shape solvers' behaviors when theorizing how they generate ideas in crowdsourcing contests, to avoid surprises from unexpected ideation outcomes from well-intended actions, such as providing seeker exemplars.

Consistent with prior research (Koh Forthcoming; Wooten and Ulrich 2017), the present study demonstrates that seeker involvement in terms of the information provided strategically influences solver behavior in crowdsourcing ideation contests. However, presenting more exemplars or giving more feedback, as some contest platforms suggest that seekers do, is not necessarily beneficial. As our results indicate, showing seeker exemplars could restrict the search space and/or idea quantity in the contests, which limits the effectiveness of relying on crowdsourcing ideation contests to achieve a broad and wide search of the solution space. Hence, a managerial implication is that seekers should be aware of the various quantitative effects of the exemplars that they provide, particularly when their objective is for solvers to search widely for and/or generate a large number of ideas. Seekers should carefully select their exemplars even when they are mainly concerned with idea quality, because acquiring more ideas increases the likelihood of finding good ones (Girotra et al. 2010; Osborn 1993). In addition, if seekers decide to provide exemplars, they should also consider how they can encourage solvers to explore and generate more ideas to minimize and/or counter the negative impacts of the exemplars. For example, seekers can provide attractive contest prizes or appropriate feedback to motivate solvers to submit more ideas (Bockstedt et al. 2016; Koh Forthcoming; Wooten and Ulrich 2017).

Suggestions for Future Research

We conclude by discussing the limitations of this study and suggesting opportunities for future research. First, in this study, we mainly consider the effects of confirmation bias on solver behavior in crowdsourcing ideation contests. New research can advance this work by examining other types of cognitive biases that potentially influence solvers' use of cues during idea generation. Second, our findings are based on an experiment involving a specific contest type (photo contest) and solver pool (MTurk). As is typical of experimental studies, there are concerns about the external validity and replicability of our findings. Future research can thus test the generalizability of our theory and findings in related contexts. Finally, although there are other outcomes of interest in ideation contests (e.g., idea quality), we focus only on idea quantity. In addition, certain limitations in our experiment (such as the use of a common image repository for all solvers and the relatively high quality of that Getty Images repository) precluded us from examining the impact of showing seeker exemplars on qualitative attributes of the ideas (e.g., novelty). Subsequent studies can thus allow solvers to tap into their own sources of ideas and solutions and examine the impacts of seeker exemplars on other ideation outcomes.

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