Constraining or Constructive? The Effects of Examples on Idea Novelty

The tendency to conform to prior examples can be viewed as a form of mental fixation that has negative consequences and limits the scope and quality of designs. Two experiments using the Smith, S. M., Ward, T. B., & Schumacher, J. S. [(1993) Memory & Cognition, 21, 837-845] toy invention task were conducted to determine whether participants who viewed example toys would subsequently generate toys rated as less novel compared to a control group viewing no examples. Although participants who viewed examples tended to incorporate the example features into their own ideas, the novelty of their ideas was rated as higher than those of the control group. This effect occurred both with no specific instruction regarding the examples (Experiment 1), as well as when specifically instructed to be different from the examples (Experiment 2). These results indicate that examples do not always have a negative impact on creativity, and suggest they may sometimes help lead to more unusual ideas.

Keywords: creativity, divergent thinking, conformity, examples, fixation.

How does exposure to examples affect the creative process? Although prior experiences can provide the expertise needed to fully explore and develop ideas into creative products, it may be that prior experience limits original thinking when new ideas are originally being generated (Luchins, 1942; Maier, 1931). One common assumption is that when a person sets out to produce novel ideas, exploration of new ideas is hindered by examples (Jansson & Smith, 1991; Smith, Ward, & Schumacher, 1993). The reasoning behind this idea is that anchoring the focus of one’s attention by exposure to examples might block access to more unusual associations that can lead to creative ideas.

Indeed, there is a large body of research demonstrating that mental fixation can result from exposure to information immediately before creative problem solving. For example, fixation can be induced on Mednick’s (1962) Remote Associates Task by priming misleading word associations (Smith & Blankenship, 1991) prior to problem solving. Multiple studies have now demonstrated the importance of overcoming fixation in this form of problem solving (Haarmann, George, Smalio, & Dien, 2012; Koppel & Storm, 2014; Sio & Ormerod, 2009; Storm, Angello, & Bjork, 2011; Wiley, 1998). Moreover, the potential negative effects of fixation have also been explored for more open-ended creative generation, design, and invention tasks (Sio, Kotovsky, & Cagan, 2015). Rather than testing how exposure to an irrelevant stimulus word affects problem solving, these studies explore how viewing examples of ideas prior to generating one’s own ideas affects subsequent idea generation. For instance, Jansson and Smith (1991) presented mechanical engineering students with various engineering design problems (e.g., designing an inexpensive spill-proof coffee cup). Before generating their own designs, some of the participants viewed example designs that contained slight flaws. The primary dependent measure of invention quality was conformity – the degree to which the participant-generated designs incorporated features of the example designs. The presence of these features was higher in the designs of those exposed to examples than of those not exposed to examples, and this had a negative effect because participants tended to incorporate the flaws that were present in the examples. Chrysikou and Weisberg (2005) also demonstrated a similar effect with naïve-to-design participants. Thus, the tendency to conform to prior examples can be viewed as another form of mental fixation that has negative consequences and limits the scope and quality of designs.
The phenomenon is not exclusive to engineering or design contexts. In a conceptually similar set of experiments, Smith et al. (1993) tasked undergraduate students with drawing novel ideas for toys and alien creatures. In tasks like this, the emphasis is less on solving design problems and more on imagining unusual ideas. Prior to generating ideas, half the participants viewed examples of toys or creatures that contained common features (examples condition). The three example toys all contained a ball, an electronic device, and involved physical activity (see Figure 1). Compared to a control condition that viewed no examples, participants in the examples condition incorporated more of these three example features into their own ideas. Importantly, this conformity effect occurred even when participants were explicitly instructed to diverge from the examples in their own creations, suggesting the observed conformity effect was not due to participants’ implicitly assuming that they should use the features of the examples in their own creations.

Smith et al. (1993) argued that this effect operates through a retrieval blocking mechanism as the activation of examples in memory blocks access to alternative ideas. The tendency to make use of exemplar features despite instructions to be original has been interpreted as demonstrating that prior examples and experiences can constrain creative thinking (Smith et al., 1993). Smith et al. (1993) argued that novelty is an important characteristic in creative idea generation, and previous examples tend to limit idea novelty. However, although these studies have shown that new creations are more likely to share a set of features of prior examples, it is not clear from these studies whether the increase in conformity that results from exposure to examples is necessarily harmful to the overall novelty of ideas. A few prior findings have started to address this question. Marsh, Landau, and Hicks (1996) examined conformity effects in the alien creature-generation task using several example manipulations. In one follow-up analysis in one of their experiments, they also used subjective ratings to assess the creativity of the alien creatures that were produced. When participants viewed example aliens, this led to higher ratings of creativity compared to a control condition, despite higher use of example features. However, this benefit only occurred when the example aliens had artificial combinations of features (antennae and claws) rather than typical combinations (four legs and a tail). Although participants only benefited from viewing atypical examples, these findings offer some
evidence of the possible disconnect between conformity and creativity, and suggest that exposure to some kinds of examples may actually benefit creativity.

Similarly, Agogué et al. (2014) had participants attempt to generate original ways to prevent an egg from breaking after being dropped from a building. Participants were initially either exposed to a “restrictive” example (slow the fall with a parachute), an “expansive” example (freeze the egg before dropping it), or no example. Ideas generated by the group with the restrictive example had the lowest originality scores, followed by the group with no example, and then the group with the expansive example. This again suggests that exposure to some kinds of examples may actually benefit novelty, and is consistent with work suggesting that very familiar examples tend to produce the most negative fixation effects (Perttula & Sipilä, 2007; Purcell & Gero, 1996). However, the originality score in Agogué et al. (2014) was based on statistical infrequency of responses. Responses generated by less than 5% of participants were scored as original, while the rest were marked as unoriginal. Silvia et al. (2008) have pointed out that such an approach can allow ideas that appear to be common, but that are infrequent or unique in a sample, to be considered novel. Moreover, Agogué et al.’s (2014) experiment did not examine performance under an instruction to diverge from the examples as in the third experiment by Smith et al. (1993). This raises the possibility that participants in the restrictive example condition simply assumed that they should produce ideas that were similar to the example, and their lack of originality might not have been due to being fixated per se. In sum, while it has been demonstrated that people tend to conform to the attributes of examples when generating their own ideas, it is not yet clear what impact this tendency actually has on the ability of participants to imagine novel ideas.

In contrast to the position that exposure to examples may harm novelty, which would predict less unusual ideas, it is possible that examples can sometimes provide a useful starting point for creative generation. For example, a prior example may increase novelty by serving as an analogical source for new ideas (Smith & Linsey, 2011; Smith & Ward, 2012). Examples may also help to focus a search space that is otherwise very broad (Haught-Tromp, 2016; Sio et al., 2015). Additionally, novel ideas may emerge from the combination of concepts contained in prior examples with other previously known concepts (Estes & Ward, 2002). If any of these mechanisms operate, this could predict higher novelty as a result of viewing examples.

The present studies adopted the toy invention task used by Smith et al. (1993) to test whether conformity actually results in less novel toy ideas, and whether people exposed to examples would produce ideas of lesser novelty, or whether they might produce ideas of higher novelty compared to those not exposed to examples.

EXPERIMENT 1

The first experiment involved two conditions in which participants were either asked to generate new ideas for toys without being exposed to any example toys, or following exposure to the three example toys from Smith et al. (1993). Exposure to example toys was expected to produce conformity effects. The main question for this study was whether exposure to example toys would lead to less novel toys, or alternatively, lead to more novel toys.

METHOD

Participants

Participants consisted of 68 undergraduates from the University of Illinois at Chicago subject pool. Participants were randomly assigned to the examples condition ($N = 35$) or the no examples (control) condition ($N = 33$). All participants provided agreement to participate and received course credit for their participation.

Materials

The same three example toys as in Smith et al. (1993) were shown to the participants in the examples condition (see Figure 1).

Procedure

The procedure closely followed that of Smith et al. (1993). All participants were provided with a booklet instructing them to imagine being employed by a toy company that is in need of new ideas for toys, with the task of designing some new toys for the company. They were instructed to draw as many new and different toys of their own creative design as possible, and after completing the drawing of each toy to (1) label
each part, (2) briefly describe and explain the toy, (3) continue to the next page and draw a new toy. Participants were discouraged from duplicating existing toys. Participants in the examples condition viewed the three toy examples simultaneously on an overhead screen for a 90 s period, which were then removed from view. They were given no additional instruction regarding the examples. Participants in the control condition did not view examples. Following instructions, all participants were given 15 min to draw their toys on the blank pages provided, while also labeling and explaining their toys.

**Scoring**

As in Smith et al. (1993), the three example toys all contained three common features: a ball, a physical activity or sport, and an electronic device. Thus, the conformity measure, as in Smith et al. (1993), was derived from the inclusion of these three specific features in participants’ ideas. To code the number of example features, two independent raters who were blind to condition decided whether each of these features was present in each toy (ranging from 0 to 3). Reliability between the two raters was ICC(1, 2) = .87. A third rater resolved disagreements by selecting the rater they agreed with. The average number of example features was then computed for each person.

Another set of raters who were blind to condition considered both the usefulness and novelty of each idea. First they decided whether the generated idea served the appropriate purpose of being a toy. If it did, then they rated each toy for novelty along a 1–5 scale (1 = not at all novel/uncommon; 5 = highly novel/uncommon). Raters were instructed to give non-toys and toys that already exist a rating of 1. The raters were not shown the example toys. Reliability between the two raters was ICC(1, 2) = .77. Once again, a third rater resolved the disagreements, and the average novelty rating was computed for each participant.

**RESULTS**

Examples of toy ideas are shown in Figure 2. As in Smith et al. (1993), participants typically produced around three toy ideas. As shown in Table 1, the number of toys was not significantly different between conditions, although there was a trend toward a lower number of toys in the examples condition than the control condition, $F(1, 66) = 3.02, p = .09, d = .41$.

Participants in the examples condition produced toys incorporating more example features than the control condition, $F(1, 66) = 39.69, p < .001, d = 1.53$. Despite this conformity effect, toys in the examples conditions were rated as more novel than those in the control condition, $F(1, 66) = 4.35, p = .04, d = .51$. Additionally, the number of example features was positively correlated with novelty ratings both at the level of subjects ($r = .34, p = .004$) and at the level of individual toys ($r = .22, p = .002$).

**DISCUSSION**

The results of Experiment 1 demonstrated a clear conformity effect as a result of viewing examples prior to idea generation, consistent with the results of Smith et al. (1993). However, this conformity effect did not hinder novelty as measured by independent ratings. In fact, the ideas of the people who viewed examples were judged to be more novel than the ideas of those who did not. Additionally, the positive correlation between the use of example features and novelty suggests that participants used the examples in a way that benefited novelty.

**EXPERIMENT 2**

The goal of the second experiment was to test whether the novelty effect observed in the first experiment might have depended on participants’ implicitly assuming that they should use the features of the examples in their own toys. Closely following the procedure used by Smith et al. (1993), in Experiment 2 participants in the examples condition were explicitly instructed to generate toys that were as different as possible from the examples. If the examples are useful in some way for producing novel ideas, then providing such an instruction could attenuate the novelty effect due to viewing examples that was observed in Experiment 1.

**METHOD**

**Participants**

Participants consisted of 80 undergraduates from the University of Illinois at Chicago subject pool. Participants were randomly assigned to the examples + instruction condition ($N = 41$) or the control condition
(N = 39). All participants provided agreement to participate and received course credit for their participation.

Materials and procedure

The materials and procedure were the same as in Experiment 1, except that in the examples + instruction condition, participants were additionally given the following instruction from Smith et al. (1993) after viewing the examples: “Note: We have found that examples like those you examined restrict people’s

FIGURE 2. Example toy designs drawn by participants.
creativity. Try NOT to restrict your ideas. When the drawing task begins, please generate ideas as different as possible from the examples given.”

RESULTS
As in Experiment 1, participants typically produced around three ideas as shown in Table 1. The number of ideas was not significantly different between the examples + instruction condition and the control condition ($F = 1.08$). Even though they were instructed to diverge from the examples, participants in the examples + instruction condition produced toys that incorporated more example features than the control condition, $F(1, 78) = 22.87, p < .001, d = 1.08$. Additionally, participants’ toys in the examples + instruction condition were rated as more novel than those in the control condition, $F(1, 78) = 4.84, p = .03, d = .49$. The number of example features was again positively correlated with novelty ratings for both subjects ($r = .32, p = .004$) and toys ($r = .25, p < .001$).

Because prior work has already shown that exposure to particularly unusual or expansive examples can spur novel ideas (Agogué et al., 2014; Marsh et al., 1996), it was important to determine if the examples created by Smith et al. (1993) might be perceived as particularly novel. A separate set of judges ($N = 16$) rated the novelty of the three example toys from Smith et al. (1993) along with a sample of six participant-drawn toys that was comprised of half toy ideas that had been previously rated as low-novel, and half as high-novel. The average rating of this sample of participant-drawn toys ($M = 2.96, SE = .16$) was not significantly different from the overall average rating or the average rating for the subsample of participant-drawn toys, $t < 1$. However, the ratings for the example toys were significantly lower than the high-novel toys ($M = 3.60, SE = .19; t(15) = 2.43, p < .05$), and significantly higher than the low-novel toys ($M = 2.33, SE = .19; t(15) = -2.77, p < .05$). Thus, the provided examples were not perceived as being especially novel.

DISCUSSION
As in Smith et al. (1993), providing participants who were exposed to examples with an instruction to diverge from the examples diminished, but did not eliminate, the conformity effect. However, as in Experiment 1, the ideas of the people who viewed examples were rated as more novel than ideas of those who did not. Further, the inclusion of example features and judgments of novelty were positively correlated. These results suggest advantages of exposure to examples for the idea generation process.

GENERAL DISCUSSION
The results of these experiments demonstrate that prior exposure to examples does not necessarily impair idea novelty. In fact, both of these experiments demonstrated a positive effect of examples on the judged novelty of toy ideas compared to a control condition that viewed no examples. This effect occurred with no further instruction regarding the examples (Experiment 1), and with an instruction to diverge from the examples (Experiment 2). While both experiments replicated the conformity effects observed by Smith et al. (1993), these results contrast with their suggestion that examples “constrain creative generation of imaginative ideas” and are more consistent with recent arguments that examples can facilitate novel idea generation (Mecca & Mumford, 2014; Sio et al., 2015). Additionally, the example toys used in these experiments were
not particularly unusual or expansive, as in the examples that benefited creativity in the studies by Marsh et al. (1996), and Agogué et al. (2014). Thus, the present experiments demonstrate a benefit for idea novelty from viewing examples that were not especially novel to begin with.

Although prior work has demonstrated the negative consequences of prior exposure to information in some problem-solving situations due to the activation of inappropriate solutions in memory (Jansson & Smith, 1991; Smith & Blankenship, 1991), it appears that in the context of more open-ended imagination tasks, exposure to examples may not always have the same negative effects, and may have positive effects. One possibility is that the examples may have “jump-started” the creative process which may otherwise be difficult to initiate. For example, among ideas that were rated as highly novel and high in example features, the physical activity feature appeared in a large majority of ideas, but was combined with original features (e.g., a game of catch where the players risk getting sprayed with a disgusting substance; see Figure 2). Additionally, a check of whether participants simply closely copied the examples revealed only three such instances. Thus, it appears that participants incorporated example features into their own original ideas, consistent with suggestions that new ideas may emerge from the novel combination of concepts contained in prior examples (Estes & Ward, 2002). This is also evidenced by the increased use of example features in more novel ideas. Rather than example features acting as retrieval blocks, they may act as retrieval cues that activate novel ideas or facilitate novel combinations of ideas. It is also possible that the examples acted to constrain an otherwise very broad search space (Haugt-Tromp, 2016; Sio et al., 2015), enabling more effective exploration of ideas. This added constraint may be especially helpful in contexts such as toy generation, which are highly open-ended and not especially limited by the use of any particular materials, rules, etc. It is also possible that examples may serve as an analogical source for new ideas (Smith & Linsey, 2011; Smith & Ward, 2012).

CONCLUSION

These experiments replicate previous work demonstrating that exposure to examples prior to idea generation affects the kinds of ideas of that are produced. Specifically, exposure to examples results in a tendency to use example features in one’s own ideas. However, the present findings suggest that examples do not necessarily limit the novelty of ideas. Instead, examples may benefit idea generation and lead to more novel products. However, these results do not suggest that having example ideas available will always benefit idea novelty. Future work is needed to examine the task contexts, the kinds of examples, and the stages of the idea generation process, for which examples may prove most and least useful.

REFERENCES

Examples and Novelty


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