Effects of Problem Scope and Creativity Instructions on Idea Generation and Selection

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Abstract

The basic assumption of brainstorming is that increased quantity of ideas results in increased generation as well as selection of creative ideas. Although previous research suggests idea quantity correlates strongly with the number of good ideas generated, quantity has been found to be unrelated to the quality of selected ideas. This paper reports the results of a brainstorming experiment aimed at increasing the average creativity of ideas and creative idea selection (rather than idea quantity). Problem scope (narrow vs. broad) and creativity instructions (emphasis on creativity vs. personal relevance) were manipulated. Results show that both narrow (vs. broad) problems and creativity (vs. relevance) instructions led to the generation of ideas that were more creative. However, only under creativity instructions did participants select more creative ideas.

Keywords: creativity; brainstorming; idea selection
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Creativity, or the generation of ideas that are novel and useful (e.g., Barron, 1955; Runco & Jaeger, 2012; Stein, 1953), is highly valued in many domains, and techniques that aim to stimulate creativity are highly popular. One of the most popular is Osborn’s (1953) brainstorming technique. Until a few years ago, brainstorming research focused almost exclusively on idea quantity, with particular emphasis on the issue of productivity loss in brainstorming groups (e.g., Diehl & Stroebe, 1987). However, recent studies have also begun to study the way in which brainstorming contributes to idea quality, both during idea generation and afterwards, i.e., in idea selection (see Stroebe, Nijstad, & Rietzschel, 2010, for an overview). One reason for adopting this new perspective is that mere quantity (a long list of ideas) cannot be the ultimate goal of a brainstorming session. Eventually, what one needs are a few high-quality ideas that get selected for further development. Research suggests that this idea selection stage leads to suboptimal results, and that the quality of selected ideas is not related to idea quantity at all, but only to the average quality of generated ideas (e.g., Rietzschel, Nijstad, & Stroebe, 2006). Thus, a closer look at idea quality in brainstorming seems warranted. In the current paper, it is proposed that idea quality can be enhanced in two ways: by enforcing a focused approach to the brainstorming problem (during idea generation), and by stressing particular quality criteria (during generation and selection).

Idea quality in idea generation

Brainstorming operates on the general principle that ‘quantity breeds quality’: The more ideas are generated, the more high-quality ideas will be found among them. On the whole, this reasoning is supported by the available research: a higher total output is associated with higher availability of high-quality creative ideas (ideas that are both original and feasible; e.g., Diehl & Stroebe, 1987). However, other studies show that even
under brainstorming instructions, people perform less creatively than they could, and that interventions aimed at increasing idea quality (rather than quantity) can lead to significant performance gains over and above the effects of the traditional brainstorming rules.

It has been theorized that an important obstacle to the generation of creative ideas is people’s tendency to follow the ‘path of least resistance’ (Finke, Ward, & Smith, 1992; Ward, 1994; Ward, Patterson, Sifonis, et al., 2002). According to this theory, people have a tendency to only generate ideas that come to mind relatively easily, and give up when it becomes harder to generate ideas. Unfortunately, the most accessible and easily generated ideas often are the least creative ones, and, according to this perspective, people therefore need to be induced to leave this path of least resistance. Although the brainstorming instructions help them to do so by emphasizing quantity and by giving the goal to generate as many ideas as possible, people nevertheless tend to fall back on ideas that are easily generated and expressed, even within the context of a brainstorming session.

One way to force people to abandon this path of least resistance and make them generate less accessible (and more creative) ideas may be to change how the brainstorming problem is defined. Specifically, it might help to impose narrow boundaries on the brainstorming problem. While creativity is commonly associated with flexibility (being able to generate ideas within several semantic categories), the recent Dual Pathway Model of Creativity (De Dreu, Baas, & Nijstad, 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010) suggests that creativity can benefit from a focused approach as well as from a flexible one. That is, rather than stimulating people to come up with ideas across many semantic categories, it may help to have them think more deeply within semantic categories. Thus, it might be useful to define the brainstorming problem narrowly, focusing on a subcategory of the overall problem, rather than on the overall problem in its entirety. Interestingly, this was also recommended by Osborn (1953), and similar points have been
raised by other researchers. For example, Finke, Ward, and Smith (1992) noted that “restricting domains of interpretation” in a creative task can stimulate creative performance, because this “reduces the likelihood that a person will fall back on conventional lines of thought” (p. 32). Pursuing this line of reasoning, Stokes and Fisher (2005) argued that effective selection of constraints may even be central to the creative process.

In line with these predictions, several studies have found that an artificially induced focus on subproblems of the brainstorming topic can stimulate the generation of creative ideas. For example, Dennis, Valacich, Connolly, and Wynne (1996) found that participants generated more ideas when sequentially (as opposed to simultaneously) addressing subproblems of a problem (also see Coskun, Paulus, Brown, & Sherwood, 2000; Dennis, Aronson, Heninger, & Walker, 1999). In addition, Rietzschel, Nijstad, and Stroebe (2007) found that participants who were induced to focus on a subcategory of the brainstorming problem generated more original ideas within that subcategory.

In terms of the Dual Pathway Model, narrowing down the brainstorming problem causes people to persist within a semantic subcategory, and hence should lead to the generation of more original ideas. When people generate ideas about a broad topic, there are many highly accessible but unoriginal ideas available; getting ‘past’ these ideas may be very difficult (Jansson & Smith, 1991; Smith & Blankenship, 1991). When people generate ideas about a narrow brainstorming problem, it requires less effort to deplete the pool of unoriginal ideas, because there are, by definition, fewer unoriginal ideas to be found in a narrow problem than in a broad problem. When people continue brainstorming after the most accessible and least creative ideas have been generated, their subsequent ideas will be more original. Thus, expending the same amount of cognitive effort, people are more likely to generate creative ideas about a narrow topic than about a broad one.
Creativity versus Relevance

Another way to force people off the path of least resistance might be to stress the importance of coming up with creative, rather than ordinary, ideas. Although the brainstorming instructions encourage participants to refrain from self-censoring, people find this difficult to do. This is shown by Rickards (1975), who found that organization members refrained from freely speculating in brainstorming sessions. One reason for this may be that brainstorming sessions in organizations usually concern a real (organizational) problem that is highly relevant to the participants, rather than an artificial and unrealistic problem that is not personally relevant to the participants. Indeed, research has shown that coming up with creative ideas is more difficult with a ‘relevant’ or realistic problem than with an irrelevant or unrealistic problem (Dillon, Graham & Aidells, 1972; Harari & Graham, 1975). Other research shows that explicit instructions to be creative can enhance idea quality. For example, Harrington (1975) found that participants generated more creative ideas when explicitly instructed to do so, and Shalley (1991) found that whereas productivity goals enhanced idea quantity, idea quality was enhanced most by explicit creativity goals. Thus, stressing the importance of creativity may help people to generate creative ideas, even when they are brainstorming about a realistic or relevant problem. In contrast, stressing the personal relevance of the problem should lead to the generation of ideas that are less original, because people will tend to stick with ‘safe’ ideas that come to mind easily.

Thus, the generation of creative ideas should be facilitated by providing participants with a narrow problem, and by stressing the importance of coming up with creative ideas. The question is what happens when these two interventions are combined. One possibility is that creativity instructions are sufficient to leave the path of least resistance, and that problem scope will only affect idea quality in the absence of creativity instructions. When
working under creativity instructions, people may be less likely to rely on highly accessible ideas, because the goal is to come up with novel ones. Another possibility is that, even though creativity instructions enhance idea quality, there is still enough room for improvement by narrowing problem scope; the two manipulations will then have an additive effect, with participants working on a narrow topic with creativity instructions generating the best ideas.

*Does idea quality breed selection quality?*

Although it is important to understand how creative ideas are generated, there is more to creativity than that. The assumption that ‘quantity breeds quality’ consists of two notions: a higher total output means higher output of creative ideas, and higher output of high-quality ideas increases the likelihood of a creative idea being selected. While, as described above, the first part of this reasoning is supported by research, the second part has not fared so well (Stroebe, Nijstad, & Rietzschel, 2010). Faure (2004) found that nominal brainstorming groups, although more productive than interactive groups, selected ideas of similar quality. Rietzschel, Nijstad, and Stroebe (2006) also failed to find significant differences in the quality of ideas selected by interactive and nominal groups, despite the large differences in idea quantity. Moreover, selection performance was not better than chance. Putman and Paulus (2009) observed that neither nominal nor interactive groups selected their best ideas, although nominal groups generated and selected more original ideas than interactive groups.

Rietzschel, Nijstad, and Stroebe (2010) found that the poor selection performance of their participants was due to a strong tendency to select feasible ideas, at the cost of originality. Further, Rietzschel et al. observed that participants could be induced to select more creative ideas by instructing them to select ‘creative’ (rather than ‘the best’) ideas. However, these instructions apparently did not change participants’ preferences for
practical, rather than creative ideas, since creativity instructions significantly decreased participants’ satisfaction with their selection. In line with these results, Mueller, Melwani, and Goncalo (2012) recently reported evidence for an implicit bias against creativity (and in favor of practicality) under conditions of uncertainty (also see Blair & Mumford, 2007). Further, Runco and Smith (1992) found that participants were not particularly good at recognizing their most creative and most popular ideas.

All in all, the results on idea selection can be summarized as follows: in the absence of specific selection instructions, selection effectiveness (the degree to which people actually select their most creative ideas) appears to be rather low. As a consequence, the selection outcome (the quality of the selected ideas) is not a function of idea quantity, but of (average) idea quality. This raises the question what happens to idea selection when the idea generation process is enhanced by changing the scope of the brainstorming problem and by stressing creativity.

Rietzschel et al.’s (2010) results suggest that the idea selection will benefit from creativity instructions, because these diminish participants’ reliance on feasibility as the dominant selection criterion. For problem scope, a facilitating effect on idea selection effectiveness is not likely. Participants using a narrow problem may select more creative ideas, because they have more creative ideas to choose from, but problem scope does not affect people’s preference for feasible and unoriginal ideas.

In order to address these issues, an experiment was conducted where individual participants first generated, and then selected ideas. In this experiment, both problem scope and creativity instructions were manipulated.

Method
Participants

Initially, the sample consisted of 105 participants. However, three participants did not follow instructions and were excluded from the analyses. Hence, the analyses below are based on 102 undergraduate university students (76 women and 26 men, mean age = 21.1 years), who were required to participate in psychology research as part of their undergraduate curriculum. All participants signed up for this study voluntarily. Participants received course credit or 7 Euros (about 9 US Dollars at the time).

Procedure

Upon arrival in the laboratory, all participants read a general introduction explaining that they were about to participate in a brainstorming session, and that they would be required to first generate ideas, and then make a selection from these ideas.

Participants were randomly assigned to conditions. In the creativity conditions, the instructions then explained that the goal of the study was to find out how creative students could be in generating and selecting ideas, and that it would be their task to generate ideas that were as original (i.e., innovative and unusual) as possible. Alternatively, participants in the relevance conditions were told that the goal of the study was to find out how students generate and select ideas about a topic that they were personally involved in, and that it would be their task to generate as many ideas as possible.

Participants in the conditions with a broad problem scope were then told that they would be generating ideas about “possible improvements in the education at the department of psychology”; in the conditions with a narrow problem scope, the topic was “possible improvements in the lectures at the department of psychology”. Note that the narrow topic essentially is a sub-topic of the broad one. Participants in the creativity conditions were reminded that they were supposed to generate original ideas; participants
in the relevance conditions were reminded to keep their student experiences in mind while generating ideas. Participants then generated ideas for 20 minutes.

After the brainstorming task, all participants received the instructions for the selection task. All participants were instructed to select the best idea from the ideas they had previously generated. Participants in the creativity conditions were instructed to base their selection on originality, whereas participants in the relevance conditions were instructed to base their selection on their experiences as students. A time limit of 15 minutes was set for this task.

After making their selection and completing a short post-experimental questionnaire, participants were debriefed, thanked and paid.

Measures and Dependent Variables

Idea quantity. Idea quantity was measured as the number of unique (i.e., non-redundant) ideas generated by each individual.

Idea quality. A trained rater who was blind to conditions rated all ideas for originality and feasibility. The first author coded a random subset of 250 ideas on both dimensions. Intraclass correlation coefficients (two-way random model) were .73 for originality, and .63 for feasibility, which was considered good reliability (Cicchetti & Sparrow, 1981).

Two originality and feasibility measures were for each participant: the average originality (feasibility) of the ideas generated by that participant, and the originality (feasibility) of the idea selected by that participant.

Satisfaction. Two items asked participants to indicate their satisfaction with the number of ideas they had generated and with the quality of their ideas; one item asked participants how satisfied they were with the quality of the idea they had selected. All items were rated on 5-point scales (1 = “not at all”, 5 = “very much”).
Results

For clarity, results with regard to idea generation and idea selection are discussed separately.

Idea Generation

Idea quantity. On average, participants generated 20.92 ideas ($SD = 8.88$), but a 2 (Instructions) x 2 (Problem Scope) ANOVA yielded no significant main or interaction effects, indicating that neither originality instructions nor problem scope had an effect on the number of ideas that participants generated.

Idea Quality. Means and standard deviations for idea quality are presented in Table 1. The average originality and feasibility of the generated ideas were negatively correlated ($r = -0.57, p < .001$). A 2 x 2 ANOVA on the originality of the generated ideas ($M = 2.25$, $SD = 0.34$) showed that, as expected, a narrow problem led to the generation of more original ideas ($M = 2.33$, $SD = 0.41$) than a broad problem ($M = 2.18$, $SD = 0.23$) ($F (1, 98) = 5.56, p = .02$, partial $\eta^2 = .054$). A marginally significant main effect of instructions ($F(1, 98) = 3.81, p = .054$, partial $\eta^2 = .037$) indicated that participants with originality instructions tended to generate more original ideas ($M = 2.31$, $SD = 0.35$) than participants with relevance instructions ($M = 2.19$, $SD = 0.32$). The interaction, however, was not significant ($F(1, 98) = 1.14, p = .288$).

An ANOVA on the feasibility of the generated ideas ($M = 3.31$, $SD = 0.35$) yielded no significant main or interaction effects ($ps > .1$). Thus, neither problem scope nor instructions affected the feasibility of the generated ideas.

Idea Selection

Selection outcome. The average originality and feasibility of the selected ideas were significantly negatively correlated ($r = -0.25, p = .012$), although this correlation was significantly smaller than that for the generated ideas ($Z = 2.76, p = .003$).
A 2 x 2 ANOVA on the originality of the selected ideas showed that participants with originality instructions selected more original ideas ($M = 2.64, SD = 0.83$) than participants with relevance instructions ($M = 2.12, SD = 0.83$) ($F (1, 98) = 9.88, p = .002$, partial $\eta^2 = .09$); there was no effect of problem scope, nor was the interaction of problem scope and instructions significant.

An ANOVA on the feasibility of the selected ideas yielded no significant effects ($F$s $< 1$).

**Selection effectiveness.** To analyze selection effectiveness, a 2 x 2 mixed model ANOVA was conducted with the average originality of the generated ideas and the selected idea as the within-subjects factor originality. This analysis revealed a significant Originality x Instructions interaction ($F (1, 98) = 6.25, p = .014$, partial $\eta^2 = .06$). Simple effects analysis showed that participants with originality instructions selected ideas that were more original ($M = 2.64, SD = 0.83$) than their generated ideas ($M = 2.31, SD = 0.35$; $F (1, 98) = 8.91, p = .004$); this difference was not significant for participants with relevance instructions ($F < 1$). In other words, participants with originality instructions selected above chance level; participants with relevance instructions did not. There was no effect of problem scope.

A repeated measures ANOVA with the feasibility of the generated and selected ideas as the within-subjects factor feasibility yielded no significant effects (all $ps > .1$): the feasibility of the selected ideas was not different from that of the generated ideas, and this was the case in all conditions.

**Satisfaction**

The three items measuring participant satisfaction were analyzed with univariate 2 x 2 ANOVAs (see Table 2). For all three items, only a main effect of instructions was found: participants with relevance instructions were significantly more satisfied with the number
of ideas they generated \( (F(1, 98) = 7.87, p = .006, \text{partial } \eta^2 = .07) \), the quality of the ideas they generated \( (F(1, 98) = 10.09, p = .002, \text{partial } \eta^2 = .09) \) and the quality of the idea they selected \( (F(1, 98) = 7.19, p = .009, \text{partial } \eta^2 = .07) \) than participants with creativity instructions.

Discussion

The results showed that problem scope and creativity instructions influenced idea quality. Participants generated more creative ideas when the problem focus was narrow rather than broad, and when they were instructed to come up with ideas that were original and unusual rather to think of ideas that were relevant. Interestingly, there was no interaction between these two manipulations; although the most creative ideas were generated by participants working under creativity instructions on a narrow problem, this effect was additive, rather than interactive. Thus, although both manipulations might be taken to have been successful in forcing participants to abandon ‘the path of least resistance’ (Finke et al., 1992), both also seem to have left sufficient room for the other manipulation to improve idea quality as well.

With regard to idea selection, the results of this experiment replicate and extend earlier findings (e.g., Rietzschel et al., 2010). Originality instructions enhanced idea quality, and improved the effectiveness and outcome of the selection process. Specifically, participants with originality instructions made a more effective selection from the ideas that they had generated (selecting ideas of higher originality and equal feasibility), whereas participants with relevance instructions performed at chance level. As found in other research, originality instructions led to a lower satisfaction with the selection. Furthermore, although participants who generated ideas about a narrow topic generated more original ideas, this affected neither the selection outcome nor selection effectiveness.
Previous research suggests that the selection of creative ideas is not related to idea quantity; instead, it is idea quality that seems to matter. The current study shows that improving idea quality (e.g., by using a narrow topic) does not necessarily improve idea selection either. Similarly to earlier research, in the current study participants only selected more creative ideas when they were explicitly instructed to take originality into account. The reason for this pattern is probably the pervasive bias against original ideas (Mueller et al., 2012; Rietzschel et al., 2010), again indicated by the satisfaction ratings: Participants with relevance instructions were more satisfied than those with originality instructions.

These results indicate an important discontinuity between idea generation and idea selection: interventions aimed at improving idea generation (e.g., the use of nominal groups, limiting problem scope) do not seem to carry over into the selection stage. The findings thus underscore the role of idea selection as a bottleneck in the innovation process. This point is exacerbated by findings that, when it comes to idea implementation, creative ideas may actually be less likely to be implemented than mundane ones (e.g., Baer, 2012), and that the outcomes of idea evaluation may be interactively (rather than additively) influenced by idea quality and evaluation criteria (Lonergan, Scott, & Mumford, 2004). Future work should delve deeper into this issue; in particular, learning more about the complex relation between ideational fluency, idea creativity, idea evaluation, and willingness to invest in creative ideas (e.g., Rubenson & Runco, 1992) is necessary to come to a more complete understanding of the entire creative process, rather than single stages of it. What is clear at this moment, is that it is not useful to get people to come up with more creative ideas in a brainstorming session, if the most creative options are simply going to be rejected. Future research on group and individual brainstorming should therefore focus on strategies that improve the process of idea selection, rather than only idea generation.
References


Burlington: Academic Press.

Table 1

<table>
<thead>
<tr>
<th>Measure</th>
<th>Originality</th>
<th>Relevance</th>
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<th>Relevance</th>
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<td></td>
<td></td>
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<tr>
<td>Broad problem</td>
<td></td>
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</table>

Means and Standard Deviations for Idea Quality

<table>
<thead>
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<th>Broad problem</th>
<th>Originality</th>
<th>Relevance</th>
<th>Originality</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.15 (0.78)</td>
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<td>3.19 (0.72)</td>
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<td>2.21 (0.21)</td>
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</table>

Note. Maximum value = 5; N = 85; Standard deviations are in parentheses.

Means within a row with different superscripts are different from each other with p < .05.

Means within a row with different superscripts are different from each other with p < .01.

Means within a row with different superscripts are different from each other with p > .05.
### Table 2: Means and Standard Deviations for Items Concerning Satisfaction

<table>
<thead>
<tr>
<th>Measure</th>
<th>Broad Problem</th>
<th>Narrow Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>3.21 (0.66)</td>
<td>3.19 (0.78)</td>
</tr>
<tr>
<td>Originality</td>
<td>3.00 (0.96)</td>
<td>3.96 (0.99)</td>
</tr>
</tbody>
</table>

Satisfaction with quality of selected idea
Satisfaction with quality of ideas generated
Satisfaction with number of ideas generated

Note. Maximum value = 5; N = 85; standard deviations are in parentheses.