The Impact of Global and Local Processing on Creative Performance:

(Failing to) Improve Idea Selection in Brainstorming

A dissertation presented to

the faculty of

the College of Arts and Sciences of Ohio University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy

Elizabeth A. Fillion

August 2015

© 2015 Elizabeth A. Fillion. All Rights Reserved.
This dissertation titled
The Impact of Global and Local Processing on Creative Performance:
(Failing to) Improve Idea Selection in Brainstorming

by

ELIZABETH A. FILLION

has been approved for
the Department of Psychology
and the College of Arts and Sciences by

Keith D. Markman
Associate Professor of Psychology

Robert Frank
Dean, College of Arts and Sciences
Abstract

FILLION, ELIZABETH A., Ph.D., August 2015, Psychology

The Impact of Global and Local Processing on Creative Performance: (Failing to) Improve Idea Selection in Brainstorming

Director of Dissertation: Keith D. Markman

A large body of research has been directed toward enhancing the creative output of the brainstorming process. This research has specifically focused on the factors that facilitate the generation of creative ideas. However, although a variety of factors in the creativity literature have been identified that can enhance the quality of the ideas that are generated, more recent work has focused on how difficult it is for people to actually select the best of the ideas that they have generated (Faure, 2004; Rietzschel, Nijstad & Stroebe, 2006; 2010). Several unsuccessful attempts to improve the selection phase of brainstorming have been documented, and to date the only manipulation that has been shown to improve idea selection in the slightest is an instruction to select the most “creative” idea they have generated (i.e., in comparison to an instruction to select their “best” idea; Rietzschel et al., 2010). The purpose of the current research is to investigate the possibility that the generation and selection phases of brainstorming will benefit from the application of different modes of processing style (Förster & Dannenberg, 2010). An initial set of studies demonstrated the benefits of both global and local processing modes on creative performance. A second study tested the hypothesis that global, holistic processing would facilitate the generation phase of brainstorming whereas local, detail-oriented processing will facilitate the selection phase of brainstorming. However, the
manipulations in this study failed to improve the generation or selection phases of the brainstorming process. In line with previous research, individuals failed to select ideas that were better than the average of their idea set. Moreover, individuals selected ideas that were significantly less creative and effective than those top rated by trained coders. Given the widespread use of brainstorming in a variety of domains, future research is necessary to learn how to improve the selection of brainstormed ideas.
Table of Contents

Abstract ................................................................................................................................. 3
List of Figures .......................................................................................................................... 6
Overview ................................................................................................................................. 7
Introduction ............................................................................................................................. 11
  Creativity ............................................................................................................................ 11
  Brainstorming ...................................................................................................................... 12
  Global and Local Processing ............................................................................................... 26
The Current Research ............................................................................................................ 31
Study 1 .................................................................................................................................... 32
  Study 1A - RAT .................................................................................................................... 33
  Study 1B - SCT .................................................................................................................... 35
  Discussion ............................................................................................................................ 37
Study 2 .................................................................................................................................... 38
  Overview .............................................................................................................................. 38
  Predictions ........................................................................................................................... 39
  Participants and Procedure ................................................................................................. 39
  Results ................................................................................................................................. 42
  Discussion ............................................................................................................................ 46
General Discussion ................................................................................................................ 48
  Limitations ........................................................................................................................... 49
  Implications and Future Research ....................................................................................... 49
References .............................................................................................................................. 51
List of Figures

Page

Figure 1. Mean RAT performance as a function of processing style (Study 1A) ........55
Figure 2. Mean SCT performance as a function of processing style (Study 1B) ........56
Figure 3. Selected ideas versus top rated ideas (Study 2) .................................57
Overview

Creativity is commonly regarded to be a mysterious construct. It is easy to see the importance of creativity in many domains, from the fine arts to innovation, but it is difficult to objectively pin down what is and what is not creative. For this reason, creativity had been largely avoided as a subject of scientific inquiry until the second half of the twentieth century. Following Guilford’s (1950) presidential address to the American Psychological Association (APA) that called for more research in this area, however, there has since been a veritable explosion of research on creativity. The body of literature that has subsequently accumulated largely defines creative output as that which satisfies two criteria: 1) novelty and originality; and 2) plausibility and feasibility (Amabile, 1983; Mumford, 2003; Sternberg & Lubart, 1999).

Advertising executive Alex Osborn (1963) popularly formalized the creative process of brainstorming in an applied setting. He defined brainstorming as a collaborative activity of “freewheeling” and “spit-balling” any and all ideas that come to mind, without apprehension or fear of criticism. His major assertion was that “two heads are better than one.” That is, group brainstorming should produce a greater quantity and, probabilistically, a greater quality of (creative) ideas than should individual brainstorming. Subsequent empirical research, however, indicated that this is not necessarily what happens. Rather, productivity loss was often found to occur instead, such that people working within interactive groups (individuals brainstorming collectively) would tend to produce only about half as many ideas as the same number of people working in nominal groups (individuals brainstorming alone) (Taylor, Berry &
Block, 1958). Research directed toward improving interactive brainstorming has since identified several factors that diminish productivity loss (e.g. production blocking; Diehl & Stroebe, 1987), and designed interventions that can eliminate it completely (e.g., electronic brainstorming; Dennis & William, 2003).

Although an abundance of research on brainstorming has been conducted, most of this work has fallen short of investigating the full brainstorming process and its primary objective. Thus far, brainstorming effectiveness has been measured by examining the quantity of ideas generated, as well as the overall quality of the generated ideas. Importantly, however, the primary objective of brainstorming goes beyond simply producing a large idea set. Rather, from the generated set of ideas, people either by themselves or working in groups must ultimately select the best idea(s) to be implemented.

Fairly recently, researchers finally began to investigate the selection phase of brainstorming (Faure, 2004; Putman & Paulus, 2009; Rietzschel, Nijstad & Stroebe, 2006; 2010), but as a whole this recent work has painted a bleak picture of people’s ability to identify their best ideas. Indeed, these findings suggest that instructing people to select their best ideas produces no better results than does randomly selecting an idea from the generated set (Faure, 2004; Rietzschel et al., 2006; 2010), and interventions designed to improve idea selection have generally failed (Rietzschel et al., 2010).

The goal of the current research is to attempt to fill this gap in the literature. To do so, I aim to investigate the cognitive processes that underlie brainstorming generation and selection by drawing on Förster and colleagues’ Global and Local Processing Model, a
systems account (GLOMO$^{SYS}$; Förster & Dannenberg, 2010). According to GLOMO$^{SYS}$, people may perceive and construe the world through the lens of either global and holistic processing by attending to the gestalt of the stimulus, or through the lens of local and analytic processing by attending to the details that comprise the stimulus.

The work of Förster and colleagues indicates that global conceptual processing leads to the activation of distant and remote concepts, whereas local conceptual processing leads to the activation of dominant and closely-related concepts (Förster, 2009; Friedman, Fishbach, Förster, & Werth, 2003). In the domain of creativity, global processing is posited to be more useful than is local processing (see Förster & Friedman, 2010). Global processing has been shown to enhance creative generation (e.g., unusual uses for a brick) to a greater extent that does local processing (Friedman et al., 2003, Friedman & Förster, 2001). Consistent with these findings, I predicted that global more so than local processing would enhance creativity during the generation phase of brainstorming. On the other hand, because local processing elicits an analytical, detail-oriented focus on stimuli, I predicted that local processing would better enhance the selection phase of brainstorming than will global processing. Taken together then, I predicted that the overall brainstorming process would benefit from both global and local processing.

Ultimately, the results did not support the hypotheses. The global and local manipulations failed to produce any significant effects. Overall, participants failed to select ideas that were more creative or effective than the average of their generated idea set. Further, participants selected ideas that were significantly less creative and less
effective than those that received the highest ratings from trained coders. Future research is necessary to determine how to improve the selection of brainstormed ideas.
Introduction

Creativity

Even though the importance of creativity has been recognized and admired for centuries, few individuals attempted a rigorous empirical investigation of creativity prior to the 1950s. In his 1950 APA presidential address, however, Guilford called upon psychologists to venture into the “murky waters” of empirically driven creativity research. The people listened, and creativity has since enjoyed a great deal of attention in the psychological literature.

Creativity researchers have come to most commonly define creativity as the generation of ideas, insights, or problem solutions that are new and useful (Amabile, 1983; Mumford, 2003; Sternberg & Lubart, 1999). Thus, the cornerstone aspects of creativity are originality and feasibility. Originality describes creative productions that are new, unique and/or infrequent, whereas feasibility requires that such productions be appropriate; that they make sense within a given context. Both aspects are necessary for creativity, but neither is sufficient. An idea that is feasible but not original is mundane, whereas an idea that is original but not feasible is simply bizarre.

Of course, creativity comes in many forms. For instance, it is highly valued in the fine arts. Be it a painting, a novel, or an interpretive dance, creativity is a often a critical feature of a highly regarded work. Moreover, creativity is also highly valued in the domains of problem solving and innovation. To illustrate, consider the Ipod. Instead of merely changing the shape of the existing CD players (which is not particularly original),
Steve Jobs and his team developed a highly original and useful means of listening to music.

The focus of the current research is on creative problem solving and idea development. Specifically, this work will examine the full brainstorming process and how it may be improved. Further, and at a broader level, this work aims to better understand creativity by investigating its underlying processes.

**Brainstorming**

**What is brainstorming?** Brainstorming was popularly formalized in the 1930s as a tool to increase productivity. The term was more concretely defined by Osborn (1953) as “…a creative conference for producing a list of ideas – ideas which can be subsequently evaluated and further processed” (p. 127). In a later publication, Osborn (1963) delineated specific rules directed toward improving the process, with the overarching goal being a simple one: to generate as many creative ideas as possible.

One major premise of Osborn’s conceptualization of brainstorming was that *quantity-breeds-quality*. Specifically, Osborn (1963) noted that “…it is almost axiomatic that quantity breeds quality in ideation. Logic and mathematics are on the side of the truth that the more ideas we produce, the more likely we are to think up some that are good (p. 131).” Thus, a major goal of brainstorming is to encourage a large quantity of ideas, as this should thereby increase the overall quality of ideas. Osborn believed that adding more people to a brainstorming session should increase the number and thereby the quality of ideas.
A second major premise of brainstorming, according to Osborn, was deferment of judgment. In his conceptualization, brainstorming individuals should vigilantly avoid any evaluation or criticism of themselves or others in order to encourage an environment of free expression. Avoiding censorship should maximize the number of ideas generated during a brainstorming session, and thereby increase the likelihood that higher quality ideas will be generated.

To achieve these goals, Osborn proposed that four rules should govern each brainstorming session. The first rule was that quantity is wanted. In line with the first major premise, brainstorming individuals should act with the goal of developing as large a quantity of ideas as possible in order to increase the overall quality of ideas. The second rule was that criticism is ruled out. In line with the second major premise, brainstorming individuals should be instructed to avoid any and all criticism of their own or others’ ideas in order to encourage free expression. The third rule was that freewheeling is welcomed. Brainstorming individuals should be encouraged to state any and all ideas that come to mind. Thus, freewheeling was meant to eliminate rigidity and functional fixedness in order to allow individuals to “think outside of the box.” Finally, the fourth rule was to combine ideas. Brainstorming individuals should be encouraged to combine existing ideas in order to improve their quality.

**Brainstorming effectiveness.**

**Defining effectiveness.** Is brainstorming effective? That is, does brainstorming enhance creative performance? An abundance of research has been directed toward examining this question since Osborn originally popularized the term. Before evaluating
the effectiveness of different brainstorming techniques, it is important to determine what is meant by “effective.” Brainstorming is considered effective when it elicits a large number of creative (i.e. original and feasible) ideas. Thus, researchers most commonly assess the effectiveness of brainstorming along four basic dimensions: *productivity, originality, feasibility* and *overall quality*.

One of the most common methods of determining the effectiveness of brainstorming techniques is to measure productivity (e.g. Diehl & Stroebe, 1987; Mullen, Johnson & Salas, 1991). Productivity refers to the number of unique (i.e. non-redundant) ideas generated during a brainstorming session. Sessions resulting in a greater number of unique ideas are considered to be more productive. This technique follows directly from Osborn’s (1957) basic premise of brainstorming that “quantity breeds quality.”

Originality and feasibility are both typically assessed as averaged subjective ratings across two or more independent coders (e.g. Gallupe et al., 1992; Feinberg & Nemeth, 2008; Rietzschel, Nijstad, & Stroebe, 2010). To determine originality, coders are trained to consider the novelty or uniqueness of each idea while ignoring the feasibility or usefulness of each idea. To determine feasibility, on the other hand, coders are trained to consider how useful and appropriate the idea is within the specified context, while ignoring the originality of each idea. Ratings are made on separate 5-point scales, with higher scores indicating higher levels of originality and feasibility.

Given the subjective nature of these measures of originality and feasibility, raters are given extensive training on their operational definitions. Further, the feasibility and originality of a single item are rated separately and in random order. Inter-rater agreement
is assessed using Cohen’s Kappa. Two raters are considered to be in agreement when ratings differ by no more than one scale point, and intra-class correlations typically exceed .75.

Finally, the overall quality (or “goodness”) of an idea is typically conceptualized as a combination of its originality and feasibility. The most straightforward way to account for both originality and feasibility is to simply average the ratings of the two. Interestingly, however, these two independent ratings are often negatively correlated (Runco & Charles, 1993). Given that originality and feasibility are cornerstones of the definition of creativity, the finding of a negative correlation may seem counterintuitive. However, consider that the goal of creative activity is often to generate the most novel, “out-of-the-box” idea that still makes sense. Thus, averaging originality and feasibility ratings together allows for a determination of the best balance between these two components of creativity.

*Are two heads better than one?* For many, brainstorming automatically elicits the image of group members working together. Indeed, Osborn (1957) initially intended the technique to be a group activity, asserting that group brainstorming should be twice as effective as brainstorming alone. Despite the intuitiveness of this claim, however, brainstorming in groups was initially only rarely found to be more effective than brainstorming alone.

In an initial test of Osborn’s claim, Taylor, Berry, and Block (1958) devised what has later come to be known as the “nominal vs. interactive group approach.” All participants in Taylor et. al.’s study were instructed to follow Osborn’s (1957)
brainstorming rules. Half of the participants were assigned to interactive groups in which four individuals brainstormed together, whereas the other half were assigned to nominal groups in which four individuals brainstormed separately with their output being combined later. Thus, the study design allowed for a direct comparison between the productivity of four individuals acting alone and the productivity of four individuals acting together. If Osborn’s claim was correct, the productivity of interactive groups should be twice that of nominal groups. Instead, however, Taylor et al.’s results revealed productivity loss in brainstorming groups, as interactive groups produced only about half the number of non-redundant ideas as did nominal groups.

This surprising finding spurred a great deal of subsequent research on the efficacy of brainstorming in groups. In a review of the then extant literature, Diehl and Stroebe (1987) reported that 82% of experiments replicated the productivity loss effect, whereas the remaining 18% showed no difference between nominal and interactive groups. In all of the reported studies, productivity (i.e. frequency of non-redundant ideas) was used as the primary dependent measure. Moreover, in the six studies within this reported group of studies in which quality was assessed, 100% demonstrated the superiority of nominal over interactive groups. Several explanations for productivity loss in groups have been posited and tested. Among the most cited are evaluation apprehension, free-riding, and production blocking.

The first explanation, *evaluation apprehension*, suggests that productivity loss results from a fear of negative evaluations from other group members. Thus, although members are specifically instructed to reserve their evaluative judgments, the fear of
judgment may nonetheless loom over participants and lead them to keep some ideas to themselves. This type of evaluation apprehension is not present in a nominal group.

The second explanation, free-riding, is based on the principle of social loafing (Latane, Williams & Harkins, 1979). Any factor that reduces the public accountability of individual contributions tends to reduce an individual’s output. Thus, because all ideas are pooled at the end of a group brainstorming session, each individual feels less pressure to contribute to the pool and may be tempted to free ride off of the contributions of others. In a nominal setting, free riding is not possible.

Finally, production blocking refers to the fact that in a group setting, only one individual is able to speak at a time. While waiting to speak, ideas expressed prior to an individual’s turn may be distracting, leading an individual to forget an idea or believe that it is less relevant in light of the previous idea. Production blocking cannot occur in a nominal setting.

Diehl and Stroebe (1987) conducted several studies to determine which of these mechanisms best accounts for productivity loss in brainstorming groups. Although some evidence was found for each mechanism, results revealed the greatest support for the impact of production blocking, which accounted for 96% of the variance. Furthermore, it was found that participants produced twice as many ideas when they were allowed to write them down while waiting their turn to speak in comparison to when they were not allowed to write them down. Research has since shown that electronic group brainstorming (interaction via computers alone) eliminates production blocking and reverses productivity loss in brainstorming groups (e.g. Dennis & Williams, 2003;
Gallupe, Bastianutti, & Cooper, 1991) because it enhances the availability of others’ ideas (Paulus, Kohn, Arditti, & Korde, 2013).

**Does quantity breed quality?** As previously discussed, one of Osborn’s (1957) main brainstorming premises was that quantity breeds quality. As such, research has focused on increasing the quantity of ideas that are generated during brainstorming sessions. Several studies have demonstrated that simply providing instructions to generate as many ideas as possible increases productivity (e.g. Meadow, Parnes, & Reese, 1959; Paulus, Nakui, Putman, & Brown; 2006; Shalley, 1991). Further, productivity has been shown to benefit from greater exposure to others’ ideas in electronic brainstorming (Paulus, 2013).

But, does quantity actually breed quality? That is, does the production of a greater number of ideas necessarily imply that a greater quality of ideas was generated? In support, a few key studies have in fact demonstrated strong positive correlations between the number of unique ideas generated and the rated quality of those ideas. For instance, Parnes and Meadow (1959) reported correlations ranging from .64-.81 between the total quantity of ideas generated and the rated quality of those ideas (i.e. the number of “good” ideas, assessed as a combination of ratings of uniqueness and usefulness) across a variety of brainstorming and non-brainstorming prompts. Similarly, Diehl and Stroebe (1987) reported a strong correlation ($r = .82$) between idea quantity and idea quality across nominal and interactive groups. Based on these findings, many researchers have chosen to forgo the time-consuming procedure of coding responses for quality and elected
instead to focus on quantity ratings alone (e.g. Diehl and Stroebe, 1987; Paulus & Dzindolet, 1993).

**The Selection Phase of Brainstorming.**

A large body of literature has examined factors that influence the quantity and quality of idea sets that are generated during a brainstorming session. However, the ultimate goal of brainstorming is to select and implement the best possible idea(s).

Indeed, Osborn (1963) clearly specified that the set of ideas that are elicited during a brainstorming session should subsequently be evaluated and receive further processing. Thus, it is just as essential to identify those factors that allow people to ultimately choose the best idea(s) from an idea set as it is to identify those factors that are most likely to elicit a high quality idea set in the first place.

Given the abundance of brainstorming research that has been conducted over the past half century, surprisingly little work has focused on identifying those factors that enhance the likelihood that people will select their best ideas. On the one hand, it may seem intuitive that generating a greater number of ideas should naturally lead to the selection of better ideas. However, following a systematic analysis of the creative productions of scientists and writers, Simonton (2003) concluded that creative individuals are not only not adept at identifying their best ideas, but also that their ability to do so does not improve over their careers.

In an initial examination of the selection phase, Faure (2004) compared the selection effectiveness of nominal and interactive groups. After generating ideas, all participants individually selected their top five favorite ideas from their group’s idea
pool. Next, group members together selected the best three ideas from their pool. Trained coders then rated all of the generated ideas for effectiveness and practicality and assigned them a dichotomous score for originality. As expected, the results revealed the classic production loss effect in the generation phase: interactive groups generated fewer ideas and fewer original ideas than did nominal groups. Critically, however, this difference was found to disappear at the selection phase, as no significant differences were found between nominal and interactive groups with regard to the quality of the ideas selected. Thus, although nominal groups had a higher quality idea pool from which to select, they did not ultimately select their best ideas. Although these initial results seemed telling, Faure (2004) did not actually compare the quality of the ideas from the generation phase to the quality of those selected, so it was not entirely clear whether individuals had in fact failed to select their best ideas.

Putman and Paulus (2009), by contrast, directly compared the quality of the ideas generated during the generation phase to the quality of those that were selected. Similar to Faure’s (2004) procedure, participants generated ideas in either nominal or interactive groups, and then together selected the top five ideas from their group’s idea pool. All ideas were rated by experts for originality and feasibility and assigned a frequency score based on the total idea pool. Results once again revealed production loss at the generation phase, as interactive groups generated fewer and less original ideas than did nominal groups. Moreover, nominal groups also selected ideas that were more original than did interactive groups, thus reaping the benefits of the higher quality pool from which they could select. However, when the authors compared the originality of the selected ideas to
the average originality of the overall idea set, no significant differences were found between interactive and nominal groups. In all, participants performed no better than chance when selecting what they believed to be their “best” ideas.

Rietzschel, Nijstad and Stroebe (2006) also compared the quality of generated and selected ideas using nominal and interactive groups, but in their study they instructed participants to make selections from only their own generated ideas. Later, the generated and selected ideas were combined across three individuals in the nominal condition for the purpose of analyses. In addition, the authors also were interested in determining the effects of task separation. Thus, half of the participants experienced the traditional strict separation between generation and selection phases (“two-task condition”), whereas the other half completed the generation and selection phases at the same time (“one-task condition”). The results replicated Putman and Paulus’ (2009) finding that idea selection was no better than random selection from the idea pool. In addition, no significant differences were found for average idea quality in the generation and selection phases of any of the conditions, nor were any differences found between the proportion of good ideas (i.e., those rated a “3” or higher on five-point scales measuring originality and feasibility) that were generated and selected.

With regard to the impact of the task separation manipulation, for interactive groups Rietzschel et. al. (2006) found no differences in productivity, originality or feasibility between the one-task and two-task conditions. For nominal groups, participants in the one-task condition generated slightly more ideas than did those in the two-task condition, but no differences were found for originality and feasibility.
Moreover, productivity was found to be unrelated to the originality or feasibility of the selected ideas overall (originality and feasibility in the generation phase were found to be positively related to originality and feasibility in the selection phase). In all, then, the results of the studies described thus far could only identify improving the generated pool as a means of enhancing selection, where random selection was as effective as direct instructions to select the best ideas.

In a more recent series of studies, Rietzschel et al. (2010) sought to increase selection quality by providing a variety of instructions. Given the abundance of research demonstrating productivity loss in interactive groups, these authors employed only individual brainstorming sessions and did not compare nominal to interactive groups. Their first study investigated the effects of a pre-selection task as well as specific instructions regarding what constitutes a “good” idea. Specifically, half of the participants were told that “…a good idea is both original (innovative and unusual) and practically feasible” (p. 51), whereas the other half were simply instructed to select their “best idea.” Further, half of the participants completed a pre-selection task between the generation and selection phases. Of those in the pre-selection condition, half were instructed to mark the ideas that they believed were good enough for further consideration (“inclusion condition”), whereas the other half were asked to mark those ideas that should be excluded from further consideration (“exclusion condition”). Finally, all participants selected one idea by employing the inclusion method, the exclusion method, or without employing any specific instructions.
Overall, the experimental manipulations failed to improve selection. As expected, no differences in productivity were found between the conditions. There were also no differences found between conditions regarding the quality of the selected ideas, as assessed by an aggregate measure of originality and feasibility scored by trained raters. Further, no differences arose between conditions regarding the originality or feasibility of the generated ideas or for the selected ideas. Most importantly, the average originality and feasibility ratings did not differ between the generated and selected ideas for any of the conditions. Thus, neither the inclusion nor exclusion selection methods allowed participants to perform better than random chance.

The authors recognized a possible major limitation to the first study. Participants may have found it most important to choose feasible ideas since they were psychology students brainstorming about how to improve the psychology department. Indeed, ideas tended to center on specific common complaints that were particularly important to the students. Thus, the participants may have used a different selection criterion than originality or feasibility; whether they personally believed that the idea would reflect a positive change that would address their concerns.

In their second study, Rietzschel et al. (2010) attempted to address this limitation by rating ideas for their potential effectiveness (i.e. likelihood to have positive effects) in addition to originality and feasibility. Instead of generating ideas, all participants were provided with an identical set of pre-generated ideas selected from the first study. The authors also attempted to improve selection effectiveness by manipulating the depth of processing that occurred during the selection phase by having participants rate ideas for
originality and feasibility before or after their selection. Furthermore, half of the participants were instructed to select the “most creative” ideas, whereas the other half were given the traditional, default instruction to select “the best” ideas. Finally, all participants rated their satisfaction with the selection and rated their selection criteria; the degree to which they made their selections based on choosing the most original, creative, feasible, desirable and best idea.

Participants given “select-the-most-creative” instructions selected ideas that were more original, but no different in feasibility, than the average of the idea set. This is underscored by the fact that these participants indicated that they had primarily used originality and creativity as their selection criteria. However, they also selected ideas that were rated to be less effective than the average of the idea set. Determining an idea that is most likely to have a positive outcome is the ultimate goal of brainstorming. Thus, asking individuals to select creative ideas is not an optimal means of improving selection in the brainstorming process.

Participants given “select-the-best” instructions selected those that were less original but marginally more feasible than the average of the idea set. Importantly, unlike those with creativity instructions, these participants selected ideas that were judged by trained raters to have the potential to be more effective than the average of the idea set. This is underscored by these participants’ indication that they primarily used feasibility and desirability as selection criteria. Thus, focusing on choosing a good idea seems to be a better way to improve selection than choosing a creative idea.
Finally, participants given “select-the-most-creative” instructions (who selected more original, but less effective ideas) were less satisfied with their selections compared to those given “select-the-best” instructions (who selected less original but more effective ideas). Thus, participants preferred to choose ideas that could actually improve the psychology department rather than those that are the most unusual.

In summary, the extant literature paints a bleak picture of individuals’ ability to recognize and select their most creative and best ideas after a brainstorming session. In line with previous brainstorming research, the selection research has demonstrated productivity loss in interactive as compared to nominal groups. While Putnum and Paulus (2009) found greater originality in selection for nominal than interactive groups, Faure (2004) and Rietzschel et al. (2006) found no such differences. More strikingly, the three studies that directly compared idea quality between the generation and selection phases found that individuals were no better than chance at selecting ideas from an idea pool (Putnum & Paulus, 2004; Rietzschel et al., 2006; Rietzchel et al., 2010). The only factor that has thus far been found to significantly improve the originality of selected ideas is an attempt to select the “most creative” idea, but this did not improve feasibility and led to choices that were less satisfying and less effective than attempts to select the “best” idea. Instructions to select the “best” idea did not improve originality, but did lead to the choice of relatively satisfying ideas that were more effective and somewhat more feasible than the idea set.

Clearly, more research directed toward improving selection of ideas in brainstorming is essential, as no factor has been identified that improves the selection of
creative (i.e. original and feasible) ideas. Further, since brainstorming is aimed not merely at developing creative ideas, but those that can ultimately produce a positive product, effectiveness may be as important of a criteria as originality and feasibility at this phase. While initially developing original ideas is important for innovation, it seems that scrutinizing these ideas under the lens of what will work best will ultimately lead to the most effective selection. Thus, processes that facilitate the selection of effective (i.e. good) ideas should ultimately improve the full brainstorming process including, most importantly, the end product. One avenue by which to pursue this goal is to investigate the role of perceptual processing styles that might potentially facilitate both the generation and selection phases of the brainstorming process.

**Global and Local Processing**

The Global versus Local processing Model, a systems account (GLOMO; Förster & Dannenberg, 2010) is a comprehensive model that proposes two opposing perceptual processing styles. One is characterized by attention to the gestalt of a stimulus (global processing) and another characterized by attention to the details of a stimulus (local processing). One can either see the entire forest (global processing) or the individual trees (local processing). In essence, global processing broadens perceptual attention, whereas local processing narrows perceptual attention.

Differences in perceptual processing styles have been shown to underlie a vast array of phenomena. For example, global processing tends to elicit assimilation, while local processing tends to elicit contrast (Förster, Liberman, & Kuschel, 2008). Further, global processing has been shown to evoke novelty while local processing evokes
familiarity (Förster, Liberman, & Shapiro, 2009). Finally, global processing facilitates similarity testing, while local processing facilitates dissimilarity testing (Förster, 2009).

GLOMO has also been used to explain the processes underlying creativity (see Förster & Dannenberg, 2010). The authors suggest that global processing should facilitate creativity because it broadens perceptual attention. This broadening of perceptual attention carries over to a broadening of conceptual attention, which tends to activate broad, abstract, atypical exemplars in memory. In turn, this expansive processing style allows one to think outside of the box and generate unusual concepts. Given that originality is a cornerstone of creativity, and that unusual concepts are activated by global processing style, it follows that global processing should aid the creative process.

On the other hand, the authors suggest that local processing should hinder creativity because it narrows perceptual and conceptual attention. Narrowing of attention tends to trigger only dominant, common associations and highlights dissimilarities. Thus, they argue, novel and original ideas are unlikely to result from local processing. Since originality is a cornerstone of creativity, local processing should impede the creative process.

The extant literature does suggest that creativity is facilitated by global processing and inhibited by local processing. For example, individuals primed with global versus local processing generated more atypical exemplars for various categories (e.g. birds; Friedman, Fishbach, Förster, & Werth, 2003). Also, individuals primed with global processing produce more creative cartoon titles and more unusual uses for a brick
compared with those primed with local processing (Förster & Friedman, 2010; Friedman et al., 2003; Friedman & Förster, 2001).

However, this research has only focused on creative generation. Further, creativity has only been assessed along the dimensions of originality and uniqueness. Yet creativity is defined by originality and appropriateness. Because the dimension of appropriateness has not yet been investigated under the GLOMO$^9$s framework, it is premature to conclude that global processing enhances creativity while local processing inhibits it.

I proposed that creative output is often the result of both global and local processing. Instead of opposing each other, global and local processes may often complement one another, and thus creative ideas and solutions are often borne from the flexible use of both processes. Although global processing is critical for generating novel ideas, such ideas are only useful if they are appropriate for the problem at hand (i.e., “is this a good idea?”). To ensure that an idea is appropriate, I suggested that an additional confirmation step is employed (e.g., Wason, 1966) in which the output of global processing is examined within the problem space (Newell & Simon, 1972) for appropriateness of fit. Importantly, such a confirmation step should benefit from a narrow focus of attention, which is the essential characteristic of local processing.

This should be particularly true for creative processes such as brainstorming. As previously discussed, the generation phase has been shown to benefit from techniques that encourage expansive processing, such as free association, freewheeling and
combining ideas. Global processing facilitates the use of these techniques, as evidenced by research using alternative uses tasks (e.g. Friedman et al., 2003).

Selecting ideas from an idea set seems to require a very different processing style than generating them. One must use a narrower focus to exclude ideas that are not both original and feasible, and to ultimately identify the idea(s) that are “best” according to the constraints of the goals of the task at hand.

Focusing on the details of what makes ideas different from one another should allow one to determine which is best. Research demonstrates that local processing facilitates the recognition of dissimilarities, while global processing facilitates the recognition of similarities. For example, participants asked to identify dissimilarities between various stimuli (e.g. TV shows) performed best when processing locally, whereas those asked to identify similarities performed best when processing globally (Forster, 2009). Local processing also led to the spontaneous identification of more dissimilarities, whereas global processing led to the spontaneous identification of more similarities. This link was found to be bi-directional: identifying dissimilarities hindered participants’ ability to identify global stimuli, whereas performance was improved after identifying similarities.

Taken together, I proposed that the full brainstorming process would benefit from both global and local processing, but at different stages. In line with previous research, I predicted that global processing would produce an overall more creative idea set in the generation phase compared to local processing. However, the greater attention to detail and dissimilarity testing facilitated by local processing should facilitate the selection of
ideas that are “best” with regard to originality, appropriateness and effectiveness. Thus, brainstorming was predicted to be optimal when globally processing while generating ideas and locally processing while selecting ideas.
The Current Research

The over-arching goal of the current research is to better understand the processes that underlie creativity. Further, I aim to demonstrate that creativity can be facilitated by both global and local processing styles. Given that creativity is defined by the optimal combination of uniqueness and appropriateness, coupled with the previously discussed research regarding perceptual processing styles, the generation of unique alternatives should benefit most from global processing, while the narrowing of these alternatives to the most appropriate and effective choice should benefit most from local processing.

The purpose of Studies 1A and 1B is to initially demonstrate that creativity involves and can benefit from both global and local processing. The purpose of the Study 2 is to specifically apply these findings to the brainstorming literature and test the hypothesis that the overall brainstorming process benefits from both processes, such that the generation phase benefits from global processing, while the selection phase benefits from local processing.
Study 1

Overview

The aim of studies 1A and 1B is to initially deconstruct the creative process and isolate the relative contributions of global and local processing. To do so, we employed two complementary tasks to test our hypothesis that creativity benefits from the use of both processes.

The first of these is the Remote Associates Task (RAT; Mednick, 1962), which has been commonly and traditionally conceptualized as a creative insight task (e.g., Griskevicius, Cialdini, & Kenrick, 2006; Isen, Daubman, & Nowicki, 1987; Schooler & Melcher, 1995). The RAT requires participants to generate a word (e.g., copy) that captures the association between three presented words (e.g., right-cat-carbon). Often, several words will fit one or two but not all three of the cue words.

Förster and Dannenberg (2010) argue that global processing should enhance RAT performance relative to local processing because, “…perceptually broadening attention also broadens conceptual attention and activates abstract construal and remote exemplars in memory” (p. 178). Findings reported by Markman, Lindberg, Kray, and Galinsky (2007), however, called into question the notion that RAT performance should only be enhanced by global processing. These authors found that priming a subtractive counterfactual mindset by asking participants to generate counterfactuals about a past life event (e.g., “If only I had NOT…”) evoked an analytical processing style that facilitated better performance on the RAT than did an expansive processing style that was evoked by priming an additive counterfactual mindset (e.g. “If only I HAD…”). In light of this
indirect evidence suggesting that RAT performance may benefit from a more analytical and, thus, narrower form of processing, we predicted that priming local processing would facilitate better RAT performance compared to global processing.

Importantly, however, even if local processing does enhance one’s ability to isolate and ultimately identify the correct remote associate, it is still likely that global processing best facilitates one’s ability to generate multiple remote associates and to intuit that the words in the triad are related. In fact, intuizing the relatedness of the word triad is exactly what is required for the Semantic Coherence Task (SCT; Bolte, Goschke, & Kuhl, 2003). In this task, participants determine, as quickly as possible, whether a given triad is associated through a fourth word (i.e., the coherence of the triad). Although participants are explicitly instructed not to attempt to decipher the fourth word, coherence judgments do require the activation of semantic associations and the generation of associates, even if this is insufficient for conscious retrieval of the associate (see Bolte et al., 2003). Given that global processing has been posited to facilitate the activation of associations (Förster & Dannenberg, 2010), we predicted that global processing would better facilitate performance on the SCT than will local processing.

**Study 1A - RAT**

**Participants and procedure.** Eighty-two undergraduate students from an introductory psychology pool were recruited for participation and randomly assigned to experimental conditions. Two participants were excluded due to computer malfunctions, leaving a final sample of 80 participants.
The study was described to participants as an investigation of visual perception and creativity. Processing style was primed with the global/local reaction time task adapted from Förster and Higgins (2005), which is a variant of the Navon-letter task (Navon, 1977). On each trial, participants were presented with a fixation cross (+) in the center of a computer screen, followed by a large letter comprised of smaller letters (e.g. a large “H” formed by smaller “Ls”). Participants were instructed to press a blue key if the stimulus included the letter “L” or to press a red key if the stimulus included the letter “H” as quickly as possible. The stimuli were created such that participants in the global condition always indicated whether the large letter was an “H” or an “L,” those in the local condition always indicated whether the small letters were “Hs” or “Ls,” and those in the glocal control condition alternated between responding to large and small letters.

Participants then rated task difficulty and enjoyment along 1 (“not at all”) to 7 (“extremely”) rating scales and completed the PANAS (Watson, Clark, & Tellegen, 1988).

Finally, participants completed a 10-item RAT, rated perceived task difficulty and enjoyment along the same scales previously employed and were then debriefed and thanked for their participation.

**Results.** Initial analyses comparing the groups’ ratings of difficulty, enjoyment and affect revealed only a main effect of the perceived difficulty of the Navon task, indicating that participants in the glocal condition found the task to be more difficult than did those in the global and local conditions (all $p’s < .04$). However, because the
difficulty variable was not found to moderate or mediate any of the subsequent analyses, it is not discussed further.

An ANOVA revealed the predicted effect of processing style on the percentage of correct RAT solutions, $F(2, 79) = 4.32, p = .017$. As depicted in Figure 1, participants in both the local and glocal conditions outperformed those in the global condition (all $p$’s < .04). The local and glocal conditions did not differ ($p > .50$). Thus, as predicted, local processing facilitated performance on the RAT compared to global processing. Given that the RAT is a commonly used test of creativity, this is the first research (to our knowledge) to demonstrate greater creativity as a function of local, rather than global, processing.

**Study 1B - SCT**

**Participants and procedure.** Sixty-one undergraduate students from an introductory psychology pool were recruited for participation and randomly assigned to experimental conditions. Because the mean percentage of correctly identified coherent and/or incoherent triads of 6 participants fell greater than three $SD$s away from the mean percentage of correctly identified coherent and/or incoherent triads for the entire sample, these 6 participants were eliminated from subsequent analyses, yielding a final sample of 55 participants.

The procedure was identical to Study 1A, except that participants completed the SCT instead of the RAT. Following the procedure of Bolte et al. (2003), participants were told that their goal on each trial was to determine whether a word triad was coherent or incoherent. Specifically, participants were told that some sets of three words were
weakly associated with a fourth word. However, they would not be given enough time to determine the fourth word. Instead, they should not attempt to determine the fourth word, but use their “gut instinct” to quickly assess whether the word triad is coherent (associated through a fourth word) or incoherent (not associated through a fourth word). Half of the triads were coherent and half were incoherent. The triads were originally adapted from the RAT and were matched on the semantic relatedness between the triads (Bowers, Regehr, Balthazard, & Parker, 1990).

Each triad was presented for three seconds, after which participants quickly indicated their coherence decision by pressing one of two buttons on a computer keyboard. Following completion of all study tasks, participants were debriefed and thanked for their participation.

**Results.** Initial analyses comparing the groups’ difficulty, enjoyment, and affect ratings revealed no significant differences (all $ps > .26$).

A 3 (Condition: Global vs. Local vs. Glocal) X 2 (Trial: Coherent vs. Incoherent) mixed factorial ANOVA with repeated measures on the final factor revealed a significant Condition X Trial interaction, $F(2, 52) = 3.34, p = .040$. As depicted in Figure 2, for coherent triads, participants in the global [$t(55) = 2.26, p = .028$] and glocal [$t(58) = 3.37, p = .001$] conditions performed significantly better than did those in the local condition, whereas the global and glocal conditions did not differ from one another ($p = .31$). There were no significant differences between conditions on incoherent triads, all $ps > .09$. In addition, participants in both the global [$F(1, 15) = 4.87, p = .043$] and glocal [$F(1, 20) = 13.39, p = .002$] conditions performed significantly better on coherent than incoherent
triads, whereas there was no difference in performance on these two types of triads within the local condition, $p = .71$. Finally, no significant differences in reaction times were observed either as a function of Condition, or between coherent and incoherent triads, all $ps > .27$. Thus, as predicted, global processing more easily allowed participants to detect word associations than did local processing. No differences were expected for incoherent triads, as processing styles only influence the ability to detect connections between associated concepts.

**Discussion**

The goal of Studies 1A and 1B was to demonstrate that creativity can benefit from both global and local processing. Previous research suggested that creativity is facilitated by broader, global processing and hindered by narrower, local processing (e.g., Förster, 2012; Förster & Friedman, 2010). In contrast, the results of Study 1A suggest that narrowing one’s perceptual focus can also enhance creative performance, in this case on a very commonly used measure of creativity – the RAT. On the other hand, and consistent with prior research, the results of Study 1B suggest that broadening one’s perceptual focus does enhance creative performance, in this case on a similar and complementary task, the SCT. Given the close similarity between these two tasks, these studies provide initial support for the hypothesis that creativity benefits from both global and local processing.
Study 2

Overview

Studies 1A and 1B provide initial evidence that creativity involves both global and local processing. It is important to note that the mixed glocal condition always performed as well as the best individual processing style condition across both studies. At this point, it is impossible to definitively determine why this might be the case. One possibility is that participants presented with both processing styles may have been able to flexibly use the most beneficial processing style for the task. Alternatively, glocal processing could be viewed as a control condition, and this may be interpreted to indicate that the lowest performing processing style inhibited creativity, rather than that the highest performing individual processing style enhanced creativity. It is thus unclear whether mixed glocal processing facilitates creativity as well as the individual processing style due to the inclusion of its elements, or if the lowest performing individual processing style actually inhibits creativity, or if there is some other quality of a mixed processing style that enhances creativity. These are important questions that will be addressed in future research. Because the answer is as yet unclear, the proposed research will include only the pure global and local processing conditions. This will allow for an initial clean examination of the different influences of global and local processing on brainstorming. Future research will be conducted to further investigate the role of mixed glocal processing in brainstorming and creativity in general.

Study 2 was designed to test the hypothesis that the generation phase of brainstorming will benefit from global processing, while the selection phase will benefit
from local processing. To do so, participants were primed with either global or local processing prior to completing a brainstorming generation task. Participants were then again primed with either global or local processing before completing a brainstorming selection task.

**Predictions**

There are several predictions. First, it was predicted that global processing would lead participants to generate more creative ideas than local processing. Second, it was predicted that only participants in the global-local condition would select ideas that were more creative and more effective than the average of the idea set. The central predictions were that global processing during generation but local processing during selection would ultimately lead to the selection of the most creative and effective ideas, while local processing during generation but local processing during selection would ultimately lead to the selection of the least creative and effective ideas, with the other conditions falling in between.

**Participants and Procedure**

Ninety university students participated in exchange for course credit. Data for 8 participants was removed due to failure of one or both of the manipulation checks (2 participants from each condition), data for one participant was removed for spending less than one minute on the brainstorming task, and data for 7 participants was removed due to computer errors during the experiment. Altogether, data for 74 participants were included in the analyses.
Participants arrived at the lab, completed an informed consent form, and were informed that the purpose of the study was to investigate brainstorming and visual perception. The entire study was administered on computers using MediaLab software.

There were two phases in the study session – the generation phase and the selection phase. Participants were randomly assigned to one of four experimental groups: 1) global generation-global selection (global-global); 2) local generation-local selection (local-local); 3) global generation-local selection (global-local); or 4) local generation-global selection (local-global).

**Generation phase.** In the generation phase, all participants first completed the same global/local reaction time task used in Studies 1A and 1B. Participants in the global-global and global-local conditions completed the version designed to elicit global processing (i.e. identifying the large composite letter). Participants assigned to the local-local and local-global conditions completed the version designed to elicit local processing (i.e. identifying the small letters that make up the large composite letter). Participants then rated task difficulty and enjoyment along 1 (“not at all”) to 7 (“extremely”) rating scales and then completed a brief 10-item version of the PANAS (Thompson, 2007).

Next, all participants engaged in the generation phase of brainstorming. Participants first received detailed instructions regarding the nature of brainstorming and creativity, in layman’s terms. Specifically, participants were told that brainstorming is the process of coming up with as many creative ideas as possible for a specific topic. Creativity was defined as ideas that are both original and appropriate. Originality was
defined as unique and uncommon ideas of which others may not think. Appropriateness was defined as ideas that are practical and something that could actually be used in the real world. To make sure that this distinction is clear, participants were informed that ideas that are highly original but not appropriate are not creative; ideas that are highly appropriate but not original are not creative; and ideas that are highly original and appropriate are creative.

Participants were then given ten minutes to develop as many creative ideas as possible for a particular topic. The most common brainstorming paradigm asks undergraduate participants to brainstorm ways in which the Psychology department can be improved (e.g. Rietzschel et al., 2010). However, the subject pool from which participants were drawn included many diverse majors, creating variability in the background knowledge that one has of the psychology department. Thus, a topic was chosen that could potentially appeal to all participants. Specifically, they were given the following instructions: “A local TV news station is interested in attracting younger viewers (18 – 34 years old). In what creative ways could you get younger people interested in watching local TV news broadcasts?” This topic was selected from the University’s annual “Innovation Challenge” for which any student may submit a proposal for funding. After generating ideas, participants rated the difficulty of the brainstorming task along 1 (“not at all”) to 7 (“extremely”) rating scales.

**Selection phase.** In the beginning of the selection phase, all participants again completed the global/local reaction time task. Participants in the global-*global* and local-*global* conditions completed the version designed to elicit global processing (i.e.
identifying the large composite letter). Participants assigned to the local-local and global-local conditions completed the version designed to elicit local processing (i.e. identifying the small letters that make up the large composite letter). All participants then again rated task difficulty and enjoyment and completed the brief 10-item version of the PANAS.

Next, participants were presented with the list of ideas that they had generated during the generation phase. They were asked to select, in order, the three most creative ideas. They were again reminded that creative ideas are those that are both original and appropriate, and to consider both of these factors when making their selection. Finally, all participants were fully debriefed and thanked for their participation.

**Results**

**Data coding.** Prior to analyzing the data, each idea was coded separately for originality, feasibility and effectiveness by two trained coders on five-point scales. Ratings no more than 1 scale point apart were considered to be in agreement. In the case of disagreement, a third rater made a judgment. Inter-rater reliability was greater than .72 for each rating score using Cohen’s Weighted Kappa (Cohen, 1960), indicating a substantial level of agreement between the raters. Originality and feasibility ratings were then averaged for each idea to create a composite creativity score.

**Preliminary analyses.** Separate independent samples t-tests of difficulty and enjoyment ratings of the generation phase global-local reaction time task revealed no significant differences between the conditions (all p’s > .3). Separate 2 (generation condition: global vs. local) x 2 (selection condition: global vs. local) ANOVAs were conducted for ratings of difficulty and enjoyment of the selection phase global-local
reaction time task. Only the main effect of selection condition on difficulty ratings was marginally significant, indicating that during the selection phase manipulation, those in the global condition rated the task marginally more difficult than those in the local condition, $F(1, 70) = 3.39, p = .070$, all other $p$’s > .5. However, because the difficulty variable was not found to moderate or mediate any of the subsequent analyses, it is not discussed further.

Separate independent samples t-tests for positive and negative affect following the generation phase global-local reaction time task revealed no significant differences between the groups ($p$’s > .6). Separate 2 (generation condition: global vs. local) x 2 (selection condition: global vs. local) ANOVAs were conducted for positive and negative affect following the selection phase global-local reaction time task. Only the main effect of selection condition on negative affect was significant [$F(1, 70) = 4.35, p = .041$] indicating that following the selection phase manipulation, those in the global condition reported more negative affect than those in the local condition ($M$s = 1.40 and 1.19, respectively; all other $p$’s > .5). However, because the negative affect variable was not found to moderate or mediate any of the analyses, it is not discussed further.

**Creativity.** It was predicted that the creativity of the overall idea set developed in the generation phase would be best facilitated by global (vs. local) processing. However, an independent samples t-tests for the average creativity of the generated ideas at the
generation phase revealed no significant differences between the groups, $t(72) = 1.10, p = .277^1$.

Secondly, it was predicted that participants in the global-local condition would select the most creative ideas. Those in the local-global condition were predicted to select the least creative ideas, as local processing should hinder creative generation and global processing should hinder selection. There was no theoretical basis upon which to expect differences between those in the global-global and the local-local conditions, thus it was only predicted that these would fall between the other two conditions. To test these predictions, creativity scores were submitted to a one-way ANOVA with condition as the between-subjects variable. There were no significant differences between the conditions, indicating that the hypothesis was not supported, $F(1, 69) = 1.55, p = .21$.

Finally, it was predicted that only participants in the global-local condition would select ideas that were more creative than the average creativity of the generated idea set. To test this hypothesis, the average creativity of each participant’s generated idea set and the creativity of each participant’s selection were submitted a 2 (generation condition: global vs. local) X 2 (selection condition: global vs. local) X 2 (creativity: selection vs. average) MANOVA, with creativity as a within-subjects variable and conditions as a between-subjects variables. Results revealed no significant main or interaction effects (all $p$’s > .20).

**Effectiveness.** It was predicted that those in the global-local condition would select more effective ideas than all other conditions, those in the local-global condition

---

1 All creativity analyses were also conducted using separate analyses for originality and feasibility ratings. These analyses revealed no significant effects, unless otherwise noted.
would select less effective ideas than all other conditions, and that the other two conditions would fall in between. To test these hypotheses, effectiveness ratings of the selected idea were submitted to a 2 (generation phase: global vs. local) X 2 (selection phase: global vs. local) factorial ANOVA. Results revealed no significant main or interaction effects, indicating that the hypotheses were not supported (all \( p \)'s > .33).

Finally, it was predicted that only participants in the global-local condition would select more effective ideas than the average effectiveness of the generated idea set. To test this hypothesis, the average effectiveness ratings of each participant’s generated idea set and the effectiveness rating of each participant’s selection were submitted to a 2 (generation condition: global vs. local) X 2 (selection condition: global vs. local) X 2 (effectiveness: selection vs. average) MANOVA, with effectiveness as a within-subjects variable and conditions as between-subjects variables. Results revealed no significant main or interaction effects, indicating that the hypothesis was not supported (all \( p \)'s < .15).

**Ideas rated highest by trained coders.** Although there were no significant differences between conditions regarding the average creativity and average effectiveness of ideas generated, it was possible that these conditions differed based on their most creative and effective ideas, as rated by trained coders. However, separate independent samples t-tests for creativity and effectiveness of the highest coded brainstormed idea at the generation phase revealed no significant differences between the conditions (\( p \)'s > .87). Thus, there were no differences between the global and local conditions’ highest coded brainstormed ideas.
Based on all previously discussed analyses, it appears that participants failed to select their best ideas (i.e. most creative and effective), regardless of condition. Another means to test this is to compare the ideas that participants selected with those that were rated highest by trained coders. To do so, four separate 2 (generation condition: global vs. local) X 2 (selection condition: global vs. local) X 2 (rating type: selection vs. highest coded) MANOVAs were conducted for each of the four ratings (effectiveness, creativity, and the individual coding of originality and feasibility) with conditions as between-subjects variables and the rating type as a within-subjects variable. All analyses revealed only significant main effects of rating type (all p’s <.001). As seen in Figure 3, the ideas that participants selected were rated significantly lower than the idea that received the highest rating by trained coders for each rating category (i.e. effectiveness, feasibility, originality and creativity). In other words, regardless of condition, participants selected ideas that were significantly less effective, feasible, original and creative than their best ideas.

**Discussion**

Overall, the experimental hypotheses were not supported. The global-local processing manipulation had no effect on the average creativity, average effectiveness, most creative or most effective idea generated in the generation phase. Given previous research demonstrating that creative generation is facilitated by global processing and inhibited by local processing (e.g. Friedman, Fishbach, Förster, & Werth, 2003; Förster & Friedman, 2010; Friedman et al., 2003; Friedman & Förster, 2001), it is surprising that there were no significant differences for creativity of generated ideas in the current
research. One possible explanation may be that unlike in the previous research, participants were directly instructed to take feasibility into account when being creative. That is, participants in previous research may have focused only on the originality component, whereas the additional focus on feasibility in the current study may have eliminated the effect.

Further, the manipulations had no effects on the ultimate selection of ideas. In line with previous research, the conditions did not differ significantly in the creativity or effectiveness of the ideas they ultimately selected. This was also true when comparing the groups based on the trained coders’ ratings of their most effective and creative ideas. Selected ideas also did not differ from the average creativity or feasibility of the idea set for any of the conditions, indicating that participants’ selections were no better than chance. Underscoring this finding, participants selected ideas that were significantly less effective, creative, original and feasible than those that received the highest rating from trained coders.

In summary, global and local processing had no effect on the generation and selection of brainstormed ideas. Regardless of processing style, participants failed to select their best ideas across a variety of criteria.
General Discussion

Brainstorming is a popular and widely used method of generating new ideas and problem solutions. The vast majority of brainstorming research has focused on improving the average creativity of the entire brainstormed idea set. Researchers have more recently begun to focus on the second phase of brainstorming: the selection of ideas for implementation. This area of research has consistently demonstrated that individuals fail to select their best ideas (Putnum & Paulus, 2004; Rietzschel et al., 2006; Rietzchel et al., 2010).

The purpose of the current research was to identify a means by which to improve idea selection in brainstorming. Specifically, the current research aimed to investigate the role of global and local conceptual processing styles on creativity and effectiveness of the idea generation and selection phases of brainstorming.

Studies 1A and 1B utilized complimentary creativity tasks to deconstruct the creative process and provided initial evidence that both global and local processing play a role in creativity. Forming connections between concepts that are typically not associated often provides the spark that ignites the flame of new and creative ideas. Thus, recognizing and generating remotely associated concepts is an important part of the creative process. Study 1B demonstrated that global processing facilitates the recognition of remote associations between concepts, while Study 1A demonstrated that local processing facilitates the generation of remote associations between concepts.

Given this initial evidence that global and local processing both play a role in the creative process, the goal of Study 2 was to apply these findings in an attempt to improve
the brainstorming process. The primary central prediction that global processing during idea generation and local processing during idea selection would lead to the selection of the most creative and effective ideas was not supported. The manipulations had no effects on the creativity or effectiveness of the average of the idea set, the selections or the highest rated ideas. Overall, selected ideas were no better than the average of the idea set, regardless of condition.

Not only did individuals fail to select ideas that differed from the average of the idea set, but they also selected ideas that were significantly less creative, original, feasible and effective than those that were rated highest by trained coders in each of these categories. Thus, this research conceptually replicates the findings of previous research demonstrating that individuals are poor at idea selection in brainstorming.

**Limitations**

A potentially major limitation of the current research may the fact that participants were given such strict definitions of creativity, emphasizing originality and feasibility. Perhaps if participants were simply told to generate and select their “best” or “most creative” ideas, the manipulations would have naturally carried them toward originality, feasibility and/or effectiveness. That is, the strict creativity instructions may have interfered with the natural effects of the global and local manipulations.

**Implications and Future Research**

The results of this work, coupled with that of the relatively small amount of research on brainstorming selection, demonstrates that individuals fail to select their best idea. No method to improve selection effectiveness in brainstorming has been identified
in the extant literature. Given the popularity of brainstorming, future research is imperative to identify methods by which individuals can select and ultimately implement their best ideas.
References


Figure 1. Mean RAT performance as a function of processing style (Study 1A)
Figure 2. Mean SCT performance as a function of processing style (Study 1B)
Figure 3. Selected ideas versus top rated ideas (Study 2)