5-2015

Group Brainstorming in Organizations: Implementing the Functional Theory of Group Decision-Making as a Means for Increasing Performance

Kyle B. Heuett
University of Tennessee - Knoxville, kheuett@vols.utk.edu

To the Graduate Council:

I am submitting herewith a dissertation written by Kyle B. Heuett entitled "Group Brainstorming in Organizations: Implementing the Functional Theory of Group Decision-Making as a Means for Increasing Performance." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Communication and Information.

Kenneth J. Levine, Major Professor

We have read this dissertation and recommend its acceptance:

Michelle Violanti, Joan Rentsch, Franz Kellermanns

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

Group Brainstorming in Organizations: Implementing the Functional Theory of Group Decision-Making as a Means for Increasing Performance

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Kyle B. Heuett
May 2015

Acknowledgements

There are several people who have played a role in the completion of this degree and this dissertation. I would like to acknowledge my professors for their time and effort to educate me and elevate my level of thinking about communication perspectives, theories, and principles. Also the faculty of the School of Communication Studies, several of which I have engaged in research, learning, and instruction with and for their support during my education. Specifically I would like to acknowledge my dissertation committee Dr. Michelle Violanti for her support and encouragement during the entirety of my doctoral education and beyond. Dr. Joan Rentsch for making me answer the tough questions, even if she has to tell me she won't move on until I give a respectable response. Dr. Franz Kellermanns for his time and willingness to engage in discussions outside of his research area to help me develop my dissertation. And also to my dissertation chair, Dr. Ken Levine, for his initial invitation to collaborate on group research that ultimately led to this dissertation, and for his confidence in my abilities to write, discuss, and defend the work I have done not just in this dissertation, but across multiple projects.

I wish to acknowledge my family, both immediate and extended who sent encouragement and advice along the way. The last person I would like to acknowledge is my wife Erin, who I can guarantee without; this process of a doctoral education would not have even been started. I wish to acknowledge her for her support and encouragement, and for raising our two boys, often for days by herself, while I studied, wrote, and traveled to pursue this degree. Her sacrifice and effort to ensure that I had the time and sanity to complete my work is greatly appreciated and I may never find a way to repay her for her efforts, but moving on I am lucky to have her with me wherever this education may take us.

Abstract

Brainstorming was first introduced as a group focused method for generating ideas on behalf of an organization. Past studies on brainstorming have been inconclusive about the effect of certain types of brainstorming techniques on the number of ideas and the quality of ideas generated by groups. In seeking to develop different techniques for brainstorming, research has lacked a theoretical guide that has led to mixed results at best about different brainstorming techniques. Further, brainstorming research conducting using experimental methods have lacked realism compared to brainstorming groups in organizations; specifically this lack of realism is evident in the history of brainstorming groups and the topic given to brainstorming groups. This study introduced the functional theory of group decision-making as a means of addressing issues of theory and realism and improving what is known about brainstorming performance. The functional theory allows groups to brainstorm according to five task requirements, the performance of these brainstorming groups can be compared against brainstorming groups using past techniques to determine the effect of different brainstorming techniques. Also, an extensive induction of group history was used for half the brainstorming groups prior to the brainstorming session. By doing this, issues of realism can also be addressed. To further address realism in brainstorming groups a salient topic was selected for all groups to generate ideas about. Results indicate that history had a significant main effect on the number of ideas generated. Further, there were significant differences in the number of ideas generated across the different brainstorming techniques. Results were inconclusive on any differences regarding technique or history in regards to idea quality. However, a significant main effect was present for one technique across history and zero-history groups. Further results and theoretical implications follow.

Keywords: Brainstorming, Functional Theory of Group Decision-Making, Group Communication,

Table of Contents

List of Tables

Chapter 1: Introduction & Rationale

In 1957 Alex Osborn published "*Applied imagination, principles and procedures of creative problem solving."* The central focus of his text was to outline how organizations could use employees' creativity as a way of improving productivity. One suggestion for linking creativity and production was to allow individuals to work in small groups to generate a list of ideas regarding potential and current issues facing an organization. Osborn termed this process of group idea generation *brainstorming.* Osborn defined brainstorming as "a creative conference for the sole purpose of producing a checklist of ideas" (1957, pp. 151-152). Since Osborn introduced brainstorming, his technique has permeated an extensive network of organizations.

Evidence suggests brainstorming is a consistent practice in several noteworthy organizations including Starbucks, Microsoft and Toyota (Burkart, 2009). Brainstorming is such a common practice that research cites its consistent use in organizations as a rationale for the continued study of idea generation (Jablin, Sorensen, & Seibold, 1978; Lehrer, 2012; Paulus, Larey, & Ortega, 1995). In reviewing the extended reach of brainstorming in organizations, Lehrer (2012) noted that the practice of brainstorming has become "the" process for idea generation in organizations. Others have noted that individuals who excel at brainstorming are often the focus of retention and recruiting efforts (Steward, 1997). Along with permeating numerous organizations, there is a widely held belief in the effectiveness of group ideation as participating in brainstorming has been found to have a positive effect on employee morale and employee retention (Allen & Hecht, 2004; Sutton & Hargadon, 1996).

Osborn's (1957) brainstorming technique is grounded in four rules that groups are to follow during any brainstorming session. Osborn claimed that groups adhering to his rules were able to generate more useful ideas for addressing issues faced by organizations. Osborn's rules of

brainstorming outline a focus on idea quantity as a primary goal, and instruct groups to share all ideas while avoiding the evaluation or judgment of any ideas during the brainstorming session. Finally, Osborn instructs groups to engage in piggybacking, or the practice of further expanding ideas based on the previous suggestions of other group members (See Table 3 in Appendix A for a complete list of brainstorming techniques). Jablin, Sorensen, & Seibold (1978) noted that hitchhiking, as they term it, occurs when a group member has a flash of innovation in generating a novel idea as a result of something another member shared with the group.

Shortly after Osborn introduced his brainstorming technique (1957) researchers have been designing experiments to attempt to replicate Osborn's technique hoping to verify his claims. Researchers were initially interested in replicating Osborn's claims of superior idea quantity and quality as a means of later improving upon, or at minimum reaching a better understanding of the brainstorming process (Taylor, Berry, & Block, 1958). Findings of this line of research indicate that the brainstorming performance of groups was inferior to the performance of nominal brainstorming groups in the number of ideas generated during a single brainstorming session (Dunnette, Campbell, & Jaastad, 1963; Lamm & Trommsdorf, 1973; Rotter & Portugal, 1969; Taylor, Berry, & Block, 1958). Nominal groups are composed of individual brainstormers whose work is combined and multiple ideas are removed leaving a list of ideas generated by a pseudo group. At face value, these primary findings were inconsistent with Osborn's claims regarding the performance of brainstorming groups.

These results were unexpected given the concise process Osborn (1957) outlined for brainstorming, and the rate at which brainstorming had gained traction as a useful technique to organizations. As a result, brainstorming researchers separated into two factions, the first focusing their research activity on developing a new technique of brainstorming based on the

argument that Osborn's technique was no longer useful or correct (Isaksen & Gaulin, 2005; Madsen & Finger Jr., 1978; Mongeau & Morr, 1999; Nelson, Petelle, & Monroe, 1974; Rossiter & Lilien, 1994). Researchers investigating new techniques for idea generation experimented with group performance as impacted by group facilitators, combinations of individual and group idea generation during a single session, and the impact of written feedback during a brainstorming session. This line of inquiry was short-lived due to the lack of support from theory or empirical evidence, either of which would have contributed to a more sustained sequence of research.

Researchers were quick to suggest new or innovative idea generation techniques but evidence and theoretical underpinnings for their processes were not found. Although lacking evidence and theory, the idea of testing Osborn's claim against other perhaps "new" techniques is not an unwarranted idea. Given that past research indicates nominal groups as being more productive than interacting groups a theoretically driven test of multiple idea generation techniques is a logical next step missing from the current body of brainstorming literature.

The second assembly of researchers was not so quick to dismiss Osborn's claims, but rather made the argument that group interaction is much different than individual thought processes and therefore group ideation cannot be directly compared to the efforts of individuals. Specifically this argument was rooted in the findings of Diehl and Stroebe (1987) who suggest that groups experience barriers to communication in group settings that decrease overall performance whereas individuals do not experience these same barriers. Based on this, researchers were interested in the continued investigation of brainstorming groups and what factors contribute to their success (Bouchard, 1969; Bouchard & Hare, 1970). This research was mostly conducted by comparing brainstorming groups against other brainstorming groups in

experimental settings without the use of nominal groups (Blomstrom, Boster, Levine, Butler, & Levine, 2008).

One issue facing this line of research is that much of this investigation was conducted in laboratory settings by way of experimental methods. One issue with this method of studying brainstorming groups is that realism in laboratory brainstorming groups can be difficult to replicate to the extent that laboratory groups are equivalent to brainstorming groups in industry. This issue is evident in previous literature in multiple ways that include the restricted amount of time participants had to brainstorm. It is likely that Osborn observed organizational groups that had several weeks or even months of interaction prior to a brainstorming session. Research attempts to study brainstorming groups have been able to bring groups together for six hours prior to a brainstorming session (Jablin, Sorenson, & Seibold, 1978) and also some groups were able to meet one time per week for three weeks (Blomstrom, et al., 2008, Levine, 1996). Both of these attempts at group realism are noteworthy attempts by experimental standards; however, each likely falls short in replicating the group context of actual industrial groups.

The focus of this dissertation is to address the lack of theory in developing brainstorming techniques and the issues of realism that experimental methods have encountered in replicating organizational brainstorming groups. To address atheoretical and realism issues of brainstorming research the functional theory of group decision-making (Gouran & Hirokawa, 1983) will be used.

Functional Theory of Group Decision-Making

First introduced as the functional perspective of group communication, the functional theory of group decision-making (functional theory) (Gouran & Hirokawa, 1983) attempts to outline how “communication is the instrument by which members of groups, with varying

degrees of success, reach decisions and generate solutions to problems" (Gouran & Hirokawa, 1996, p. 55). At the core of the functional theory are five task requirements that groups are to strive to accomplish in order to increase their chances of arriving at a sound decision. Group research has supported functional theory indicating that groups who accomplish more of the five task requirements often come to more quality decisions than groups completing fewer requirements (Cragan & Wright, 1993; Hirokawa, Ice, & Cook, 1988; Nakanishi, 1990; Papa & Graham, 1990). The five task requirements of the functional theory state that groups should:

1. Show correct understanding of the issue to be resolved.
2. Members determine the minimal characteristics any alternative, to be acceptable, must possess.
3. Members identify a relevant and realistic set of alternatives.
4. Members carefully examine the alternatives in relationship to each previously agreed upon characteristic of an acceptable choice.
5. Groups select the alternative that analysis reveals to be most likely to have the desired characteristics.

Evaluating the overall goal of Osborn's (1957) brainstorming technique and the task requirements outlined in the functional theory (Gouran & Hirokawa, 1983), it appears that both sets of criteria target the same conclusion; that groups need to generate of a large set of ideas that can be used to aid in making a quality decision. Although similar in outcome, little has been done to learn more about how these two processes might work in concert, and how they might address issues relevant to the continued study of group brainstorming. On one hand, Osborn explains that a central component of the brainstorming process is for group members to refrain from evaluating ideas, that the goal is generating a high number of wide ranging ideas for *later*

evaluation. One issue with this suggestion is that nowhere in his text does Osborn outline the process to be used in the later evaluation of ideas. On the other hand, the five task requirements outlined in the functional theory offer a great detail about the evaluation of potential solutions, but does not include any instructions for accomplishing the third task requirement as listed above; identifying a realistic and relevant list of alternatives (ideas). Essentially, this third task requirement is brainstorming. Thus, the evaluation process that Osborn does not outline in detail is the focus of the task requirements in the functional theory, and the specifics of brainstorming omitted from the details of the functional theory are the focus of Osborn's technique.

By merging the five task requirement of the functional theory with Osborn's four rules of brainstorming, this study will address the atheoretical issues of past research by comparing the performance of brainstorming groups across different brainstorming techniques. In conducting such a comparison, a theoretically driven experiment may identify differences in brainstorming performance across the three different techniques.

The second benefit of using the functional theory is to address concerns of realism in past experimental brainstorming investigations. The functional theory has been noted for its ecological validity (Propp & Nelson, 1996) and application in industry ideation and decision-making groups. Having groups follow different techniques for brainstorming will also allow for groups to develop varying degrees of familiarity amongst the group members. Thus, a second condition included in this study will be the performance of groups who have been allowed to develop an extensive group history against the performance of zero-history groups, or those groups similar to the ones used in past brainstorming research.

Group History

The basic premise of the functional theory is that the more a group communicates about the issue they are addressing, the more likely they are to meet the task requirements. Essentially the functional theory suggests that the more communication a group can have the better. The result of this is a reservoir of ideas that will ultimately lead to a quality decision. It is likely that during the time a group is working toward addressing an issue, they are also developing a history of interaction with one another. Thus, one factor capable of impacting the amount of communication in a group is the history that group has while working together. Group history is commonly defined as the extent that a group is established prior to a group project or session (Mennecke & Valacich, 1998). To further clarify this definition of group history, established groups, for the purposes of this study, are those that have become established through repeated interaction over a fixed length of time. From Osborn's experience with brainstorming groups, group history may be one important factor contributing to the performance of brainstorming groups that experimental settings have been unable to accurately replicate. Given the natural constraints of experimental research, it is possible that the unexpected findings of Taylor et al., (1958) and other researchers are a product of an inadequate induction or inclusion of group history reflective of industry groups. In examining the performance of brainstorming groups, initial brainstorming experiments typically recruited groups of three to six strangers to work together on a brainstorming task (e.g., Dunnette, Campbell, & Jaastad, 1963; Rotter & Portugal, 1969). Groups were allowed anywhere from ten to thirty minutes to generate as many ideas centered around an assigned topic as they could and then the group members were dismissed without any further interaction (Dillon, Graham, & Aidells, 1972; Jablin & Sussman, 1978; Comadena, 1984; McLeod & Lobel, 1992). Seeing that time constraints and participant

availability are artifacts of experimental research, it is possible that by using such methods, researchers were unable to replicate the performance of brainstorming groups as observed by Osborn. Within his advertising agency it is possible that Osborn observed groups who had been working in the same agency and with the same individuals for long periods of time and over a range of projects and issues. The difference in group history between experimental and industry groups may contribute to the amount of communication occurring in a brainstorming group. The result, according to the functional theory would be a diminished capacity to accomplish the five task requirements, and thus poor performance. Based on the potential connection between the functional theory, Osborn's technique, and the role of group history on brainstorming performance this study will move forward in determining how these techniques and factors may be interrelated.

Chapter 2: Literature Review

Group brainstorming has long been at the disposal of organizations as a cost-effective, time proven technique that affords new and innovative ideas for making decisions and solving problems. The cost of such a process is free as brainstorming uses groups of people who belong to the same organization, and may already work together or have worked together previously. As much as brainstorming has become a highly employed technique in organizations (Lehrer, 2012), research supporting group brainstorming as the most productive process for generating ideas is not so abundant as nominal groups, according to research findings, have been more productive (Taylor, et al., 1958, Lamm & Trommsdorf, 1973).

Alex Osborn (1957) first shared his ideas on how organizations could benefit from using the creativity of their own employees to help in the decision-making and problem solving process in his book *Applied Imagination: Principles and Practices for Creative Problem Solving*. In his book, Osborn highlighted brainstorming as a technique that could be used to generate ideas for an organization. Specifically Osborn pitched brainstorming as a technique used to "generate a list of ideas, ideas that could later be used for solving problems" (p. 151). According to Osborn groups chosen to engage in brainstorming were instructed to adhere to four rules (See Appendix A).

As a result of groups using Osborn's process, groups were thought to generate the highest number of ideas and, perhaps more importantly, the most quality ideas. Having revised and updated his book, Osborn was able to effectively "sell" his technique to a large number of organizations and brainstorming the Osborn way quickly became the preferred method for generating ideas in a large number of organizations (Jablin, Sorensen, & Seibold, 1978; Lehrer, 2012).

Shortly after the initial spread of Osborn's brainstorming technique, group and organizational researchers set out with the goal of validating and extending what was known about the procedure and outcome of brainstorming groups. Taylor, Berry, and Block (1958) conducted the first in a line of several investigations focused on replicating Osborn's technique and claims of superior performance. However, before this could be done Taylor, et al., needed to determine a comparison unit for interacting brainstorming groups. In developing such a comparison unit Taylor, et al. settled on nominal groups. Nominal groups are technically not groups at all, but rather individuals who brainstorm alone, and whose ideas are combined with other individual brainstomrers to create a pseudo group. Repeated ideas are removed from the final list of ideas resulting in a set of unique ideas that can be used as a comparison against the performance of ideas generated by interacting brainstorming groups. Since their introduction, nominal groups have been the consistent comparison unit for gauging the success of interacting brainstorming groups (Henningson & Henningson, 2013).

Having established a comparison unit for brainstorming groups, Taylor, et al., (1958) conducted an experiment to determine the number of ideas interacting brainstorming groups produced and found that in each instance brainstorming groups were never able to generate more ideas than nominal groups. Although the initial findings on brainstorming groups were not what researchers expected, several follow-up studies indicated results consistent with Taylor, et al. and were unable to verify that brainstorming groups outperformed nominal groups (Bouchard, 1972a; Bouchard, 1972b; Bouchard & Hare, 1970; Dunnette, Campbell, & Jaastad, 1963; Robins, 1960; Rotter & Portugal, 1969). Closely following this early series of brainstorming experiments Lamm and Trommsdorff (1973) conducted a meta-analysis in an attempt to understand the breadth of results centered on group brainstorming. The primary purpose in conducting their

analysis was to determine if brainstorming researchers were short-sighted in their attempts to replicate brainstorming practices. However, the primary outcome of Lamm and Trommsdorff's analysis was a verification of previous research reports; essentially that, at least in published research, interacting brainstorming groups were not as productive as nominal groups in the number of ideas they were able to generate in a single brainstorming session.

About the time that researchers started to accept that brainstorming individually yielded more ideas than in a group setting, Bouchard and his colleagues started a program of research that looked more closely at uninvestigated factors of brainstorming groups. In this series of studies (Bouchard, 1969; Bouchard, 1972a; Bouchard, 1972b; Bouchard, Barsaloux, & Drauden, 1974; Bouchard & Hare,1970) Bouchard and his colleagues attempted to single out several factors that could have potentially impacted the number of ideas generated by interacting brainstorming groups. This list included: individual personality type, group size, perceived group potential, group motivation, and the sex of participants.

For the most part Bouchard's research produced little by way of explanation for the number of ideas brainstorming groups were able to produce. However, Bouchard's research was the first instance when research moved away from using nominal groups as the sole comparison of brainstorming performance and instead compared interacting brainstorming groups to other interacting brainstorming groups. The primary motive in moving toward a comparison of interacting brainstorming groups was to address the question among researchers, "If nominal groups consistently outperform brainstorming groups, then by what means and influence can the most productivity be garnered from brainstorming groups themselves" (Jablin & Sussman, 1978, p. 331). Thus the later 1970's and early 1980's saw some decline in the comparison of nominal groups to interacting brainstorming groups. Even still, as part of several experiments nominal

groups were continually found to outperform interacting brainstorming groups (Jablin, 1981; Jablin & Seibold, 1978; Jablin, Sorensen, & Seibold, 1978). In comparing across interacting brainstorming groups Bouchard was able to determine differences in performance between groups, thus learning more about the process of brainstorming outside of the number of ideas a group was able to generate. Moving away from comparing interacting groups to nominal groups was a novel idea for Bouchard's time; one that was criticized by other researchers. However, current brainstorming research is more supportive of Bouchard's methods.

Nominal Groups

Since Bouchard's program of research, the interest in nominal groups as a comparison unit to interacting groups has been carefully critiqued. In an early attempt to find a new comparison unit outside of nominal groups, researchers sought to compare brainstorming groups to other brainstorming groups; a method that would, at minimum, hold some ecological validity (Bouchard, 1972a; Bouchard, 1972b; Bouchard, & Hare, 1970). However, considering the heavy reliance early research placed on nominal groups as a comparison unit for brainstorming groups, these studies had a limited impact on the brainstorming community. Nominal groups were considered to be such a solidified standard for comparing the performance of brainstorming groups that the limitations of most of Bouchard's and other studies include a discussion of how future research should consider looking at their findings in relation to the performance of nominal groups.

As research has continued, the argument has been made that nominal groups are more a product of tradition in brainstorming research than a rational comparison unit (Henningsen & Henningsen, 2013). These claims are based on findings that indicate when brainstorming groups work together in more than one session they do outperform nominal groups in the number of

novel ideas they are able to produce (Henningson & Henningson, 2013). Henningson and Henningson also identified that the majority of past brainstorming experiments treated the brainstorming process as a one-time event conducted with a group whose members were not familiar with one another; a far stretch from how the process is conducted in industry. A second argument opposing the comparison of brainstorming to nominal groups is the lack of ecological validity regarding nominal groups. Researchers have argued that nominal groups are rarely, if ever, used in actual organizations (Dugosh, Paulus, Roland, & Yang, 2000). Dugosh, et al. also argued that Osborn specifically outlined his brainstorming process to be conducted in a group setting allowing group members to work together to generate ideas as creativity flows. As numerous organizations tend to follow Osborn's technique when using brainstorming, these organizations would have no need to consider the role of individuals in a process so centered on the group (Burkart, 2009).

As a final argument in support of the exodus from using nominal groups in experimental settings, the original rational offered by researchers who developed nominal groups suggested that nominal groups were created as a comparison unit only, and not because of their actual utility, or their existence in organizations (Taylor, et al., 1958). This line of thinking is reflected in more recent research that has omitted any comparison between interacting groups and nominal groups completely in favor of a comparison between two or more interacting brainstorming groups (Blomstrom, et al., 2008; Bolin & Neuman, 2006; Levine, 1996; Levine, Heuett, & Reno, 2014; Litchfield, Fan, & Brown, 2011). Given the lack of ecological validity and that researchers have largely turned away from nominal groups and toward a comparison of interacting brainstorming groups, this investigation will compare the performance of interacting brainstorming groups against one another.

Communication and Brainstorming

Following Bouchard's research program, the next major contribution to brainstorming research came in the late 1970's and early 1980's. The primary advancement of brainstorming research done during this time was credited to Fredric Jablin, who conducted a series of studies that effectively accomplished two things. First, Jablin and his colleagues established the role of communication as central to the brainstorming process (Jablin & Sussman, 1978). Communication had largely been incorporated into brainstorming research as an assumption, typically a sidebar acknowledgement that groups obviously must communicate as part of the idea generation process, but other factors were of more importance (Dillon, Graham, & Aidells, 1972). The lack of attention given to communication to this point in the brainstorming research is largely due to brainstorming research stemming from psychology and business fields. Common outlets for brainstorming investigations prior to Jablin's research program commonly included journals such as *Journal of Applied Psychology*, *Administrative Science Quarterly*, and *Journal of Personality & Social Psychology.*

Jablin established brainstorming as a communication driven practice by investigating communication related factors such as communication apprehension, extroversion, and interpersonal perception of others communication (Jablin, 1981; Jablin, Sorensen, & Seibold, 1978). The primary finding that links communicative practices to brainstorming performance is the common result that as communication becomes more effective, general feelings of negativity and apprehension are reduced in the brainstorming group (Jablin & Sussman, 1978). These findings suggests that as negative communicative characteristics are reduced, the extrovert nature of the group is increased thus raising the potential of the group to generate a high number of ideas. Based on this finding, Jablin concluded that with more time to develop positive

communication habits, groups may be able to overcome negative factors of group work that might stifle idea generation. Given that negative factors tend to decrease as corresponding communication enabling factors increase, Jablin deduced that more communication may equal more ideas; and according to Osborn (1957), more ideas equate to the potential for those ideas to contain ones of high quality. However, even in light of improved communication across Jablin's experiments, and subtle improvements in the performance of interacting brainstorming groups compared to other interacting groups, little headway was made in improving the performance of brainstorming groups in general. Jablin and his colleagues work left several opportunities open for future research to consider the role of communicative factors and brainstorming performance. Some of which include group history.

Barriers to Interacting Brainstorming Group Performance

Unable to account for the success that interacting brainstorming groups were said to have in organizations, brainstorming researchers took a look back at the performance of interacting and nominal brainstorming groups in an attempt to address why brainstorming groups might be having difficulties nominal groups were able to avoid? In general past research has suggested that group communication is subject to more miscommunication, so much so that Steiner (1978) suggested an equation that attempts to outline group performance:

Group Potential – Faulty Process = Actual Performance.

Researchers (Diehl & Stroebe, 1987) took a more narrow focus on the factors that might be contributing to the "faulty processes" outlined in Steiner's equation. As a result three barriers were identified in the group experience to which nominal groups would be immune (Diehl & Stoebe, 1987, 1991). The three barriers identified by Diehl and Stroebe are:

1. Production Blocking

2. Evaluation Apprehension

3. Social Loafing

Production blocking is a product of working in groups, whether the group is brainstorming or not is irrelevant. The function of having more than one mind and mouth working together is going to result in the loss of information. Simply put, when one person is talking, others cannot (Diehl & Stroebe, 1987; Nijstad, Stoebe, & Lodewijkx, 1991). As a result of this blocking, especially in brainstorming groups, members may forget ideas, re-think the value of ideas as others move the discussion forward, or simply not get a chance to share their ideas (Diehl & Stroebe, 1991). In any circumstance, production blocking suggests that the nature of working in groups limits communication, a phenomenon that is highly unlikely to happen in nominal groups.

Evaluation apprehension is the second barrier of communication in groups. Diehl and Stroebe (1987) suggest one reason interacting brainstorming groups underperform may have to do with group members fear of having their ideas judged by other members of the group. Thus, evaluation apprehension would prevent group members from speaking up just like other types of apprehension might inhibit communication. The result of group members withholding ideas due to evaluation apprehension violates two of Osborn's (1957) rules; rule two: all ideas, no matter how outlandish or off-the-wall are to be shared with the group, and rule three: no ideas are to be evaluated during a brainstorming session. Due to these rule violations it is possible that groups experiencing high levels of evaluation apprehension have a high probability of sub-par performance during the brainstorming session. As an overall result, Diehl and Stoebe would suggest that the increase in evaluation apprehension would be enough for interacting groups to

underperform in relation to nominal groups, as individuals are likely to have much lower levels of evaluation apprehension, if they even experience evaluation apprehension at all.

The final barrier identified by Diehl and Stroebe (1987) is social loafing. Diehl and Stroebe suggested that the intentional laziness of one or more group members could result in a less-than-productive brainstorming session. It is the tendency of some individuals, when working in a group, to let others take control and ultimately do a majority of the work, thus social loafing. Not only does this limit the amount of communication that occurs during the brainstorming session; but has the potential to cause negative feelings between group members, further decreasing the productivity of the group (Harkins, 1987).

In a review of brainstorming research, Mullen, Johnson, and Salas (1991) found that much of the difficulty experienced by groups could be attributed to one of the three barriers identified by Deihl and Stroebe. Nominal groups were found to be largely unaffected by these barriers because nominal groups lacked the communication and collaboration of interacting groups.

Shortly after Diehl and Stroebe (1987) identified barriers capable of explaining why brainstorming groups may encounter challenges, Mullen, Johnson, and Salas (1991) provided further evidence for these barriers by conducting a meta-analysis looking for effects in previous studies that could be attributed to production blocking, evaluation apprehension, and social loafing. In providing evidence for Diehl and Stroebe's claims, research on brainstorming was given a new direction, a new set of variables to focus on, and although not a theory, the identification of these three barriers did offer some guidelines for future research, or at least some new areas of focus.

Electronic Brainstorming

The basis of electronic brainstorming groups was to offer the benefit of idea generation and group collaboration without the restrictions of group members being geographically close. Electronic brainstorming offered the benefit of working remotely and was introduced with the upswing in the effort for globalization that occurred in many organizations in the late 1990's (Dennis, Valacich, Connolly, & Wynne, 1996). Electronic brainstorming groups were also afforded access to group decision support software (GDSS) that included technological advances that were thought to be too difficult for interacting brainstorming groups to offer (Barki & Pinsonneault, 2001). Some of the GDSS components included computer generated images to help with cognitive stimulation, network interfacing that allowed employees to brainstorming without leaving their offices and to interact with others in the organization that may not share a close proximity (Dennis & Williams, 2003). Electronic brainstorming was based on the idea that through technology, organizations could create a superior brainstorming experience with the aid of GDSS programs.

Given the struggles of interacting brainstorming groups, at least from a research standpoint, electronic brainstorming was a new and enticing area that appeared capable of replacing interacting brainstorming groups (Dugosh, Paulus, Roland, & Yang, 2000). However research has suggested that the performance of electronic brainstorming groups, specifically in the number of ideas that are generated, experienced a similar path as interacting brainstorming groups. The first issue is, that just like interacting groups, electronic groups have failed to outperform nominal groups in every instance (DeRosa, Smith, & Hantula, 2007). Further, results are mixed that electronic groups actually outperform interacting groups. This claim is based on some research that indicates interacting groups are able to match the output of electronic groups

(Barki & Pinsonneault, 2001). Barki and Pinsonneault also suggest that in addition to being very similar in the number of ideas they produced, interacting groups and electronic groups also appeared to be extremely similar in the quality of ideas they were able to generate.

Other difficulties encountered by electronic brainstorming groups include the difficulties that commonly come with the use of advanced technology. Specifically that in some instances research has documented electronic brainstorming groups as experiencing more technological problems such as programs not loading correctly for all group members, or the inability to connect with one or more group members (Isaksen & Gaulin, 2005). As a result, some organizations find it much easier to assemble a team of employees for ideation projects that are familiar with each other and geographically close rather than deal with issues related to technological problems (Dennis & Williams, 2003). Dennis and Williams continue to argue in favor of interacting brainstorming suggesting that organizations are realizing that the push for globalization creates issues such as time-zone differences and relevance of issues facing organizations in specific regions being too diverse for long-range electronic brainstorming groups to be considered as a realistic option. With the inconvenience of electronic brainstorming, and findings that suggest electronic groups do not offer superior performance over interacting groups on a consistent basis, organizations tend to go with the path of least resistance and continue to use interacting brainstorming groups (Barki & Pinsonneault, 2001). This has and continues to make the study of interacting brainstorming groups an important part of organizational and group communication research.

Interacting Brainstorming Groups

Although some hoped the shift to electronic brainstorming would invigorate the study of brainstorming in communication, others remained steadfast in their inquiry into interacting

brainstorming groups. Primarily, brainstorming research began to focus on the amount of information and experience group members were given prior to engaging in any brainstorming session. Two factors that were found to influence the performance of brainstorming groups were the training groups received on how to brainstorm (training), and the familiarity groups had with the topic they were to brainstorm about (priming). Research on training suggests that groups who are walked through the brainstorming procedure prior to brainstorming perform slightly better than groups who are not familiar with the brainstorming process (Levine, 1996; Blomstrom, et al., 2008). Blomstrom et al., found that groups who were trained regarding Osborn's four rules were able to generate more ideas than groups who received no training. Thus, when comparing interacting brainstorming groups, research indicates that training groups on how to brainstorm will result in groups generating a higher number of ideas (Levine, 1996).

Researchers have also investigated the impact of priming individuals with the topic they are to discuss prior to the brainstorming session (Levine, 1996; Levine, Heuett, & Reno, 2013). In comparing groups that received the brainstorming issue at least one week prior to the brainstorming session versus groups who did not receive the topic early, there was no difference in the number of ideas or the quality of the ideas generated (Levine, et al., 2013). One possible reason why trained groups were able to outperform untrained groups is that during the training process groups become more established and are able to build rapport prior to the actual brainstorming session. Revisiting the concept of group history it is possible that due to the training sessions, groups were able to develop more history as a group than groups who were not trained prior to brainstorming. Any history developed during the training might not be extensive but may be enough to give trained groups an advantage over untrained groups with zero interaction prior to a brainstorming session.

Group History Prior to Brainstorming

At two different points in the brainstorming research there appears to be a set of studies that indicate group history has the potential to impact the performance of brainstorming groups. The first of these instances was during the research conducted by Bouchard and Jablin in the 1970's and early 1980's. Bouchard noted that in his two closely related studies (1972a & 1972b) group members who had more in common by way of personality type and motivation were able to overcome initial unease and work effectively with other members of the group more quickly than the diverse groups. He attributed the ease in working together in these groups to the fact that these groups were most likely able to bypass any initial uneasiness or tension due to the commonalities between the group members. In the earlier of the two studies Bouchard (1972a) also attempted to create history in groups by having subjects brainstorm over several instances at different times. Bouchard's purpose in doing so was to determine the impact of group size, sex of participants, and psychological personality on idea production. However, the results did not include any comparison of history versus zero-history groups over the different time intervals in regards to number of ideas produced.

In a similar way, Jablin noted a relationship between the apprehension of group members and the length of time the group took to complete the brainstorming session. Specifically, Jablin reported that the longer groups worked together the more their apprehension was reduced. Thus, indirectly Jablin was able to surmise that the longer groups worked together the more effective they became. Jablin, Sorenson, and Seibold (1978) created brainstorming groups with a history of interaction by having participants work together in class on an assignment for six hours before starting the brainstorming session. Zero-history groups and nominal groups were used for comparison. Results indicated that no difference in idea quantity was found between the history

and zero-history groups. These findings may indicate that perhaps history is difficult to create in a single session, even considering what by experimental standards may be a large amount of time (six hours).

Neither Bouchard nor Jablin began their investigations with group history in mind, but both provide some evidence that the length of time, or the amount of interaction groups have, could lead to a group being more established by way of developing a certain amount of group history. More recent research (Levine, 1996) more directly measured groups over time, with each brainstorming group meeting one time per week for three weeks. In these studies, the quantity of ideas generated increased between week one and week two, but decreased between week two and week three. These results might suggest that three weeks is a more adequate induction of history than only one session; however, it is likely that three weeks is still a minimal amount of time given the length of time that some industry groups have worked together. In a study directly testing an extensive induction of the history variable, Levine, Heuett, and Reno (2014) found that history groups who interacted at least one time per week for approximately ten weeks generated more ideas than groups with zero-history.

Working from these findings, it is likely that group history does have an impact on idea generation as long as an adequate amount of time is allowed for history to be developed and groups to become established. From the existing research, six hours (Jablin, et al., 1978) and three weeks (Levine, 1996) might not be enough time to develop such a history, while ten or more weeks may be more sufficient. Based on these findings this study will replicate the Levine, et al., (2014) method for inducing history into brainstorming groups by allowing for interaction over several weeks prior to the brainstorming session.

Functional Perspective

The functional perspective of group communication is used when researchers consider the role of communication as a catalyst in the group process. The functional perspective was first introduced as part of an attempt to consolidate the efforts of group researchers. The first to approach groups from a functional perspective were Gouran and Hirokawa (1983), who argued that three issues with existing group research were restricting the field of group communication from moving forward. Issues in the field included (1) a limited understanding of how communication specifically impacted group performance, (2) the lack of systematic testing of communicative factors that would impact group performance, and (3) the largely atheoretical nature of group research prior to their time.

The functional perspective is composed of a set of theories and assumptions directed at issues regarding the "quality of teamwork and those factors that contribute to it, or detract from it" (Wittenbaum, Hollingshead, Paulus, Hirokawa, Ancona, Peterson, Jehn, & Yoon, 2004, p. 18). Researchers approaching group process from a functional approach typically start with the end in mind. In other words, functional researchers consider the output of the group and then design questions to further understand how groups arrived at these outcomes be they positive or negative (Gouran & Hirokawa, 1983).

As a rationale for developing the functional approach Gouran and Hirokawa argued that, "research to date ironically has contributed little information with which to describe the precise nature of that [communication] role" (1983, p. 168). As a result of this limitation, the details of how communication impacted the decision-making process remained largely unclear. At best, researchers were able to establish that a systematic relationship was present between group communication and group performance (Gouran,1991; see also Jablin, 1981).

Perhaps the greater concern of those that beset group communication research prior to the functional approach was the lack of theory available to guide investigation. Gouran and Hirokawa (1983) suggest that the result of such an atheoretical foundation was that past research had failed to provide findings that were impactful enough to move the study of group communication forward. Gouran and Hirokawa suggest that had investigations been initiated from a viable framework or theory, the results would have been much more influential in advancing what was known about communication and more specifically group decision-making (See Harper & Askling, 1980; Landsberger, 1955; Lanzetta & Roby, 1960; Leathers, 1972 for group decision-making studies prior to the functional approach). To address these concerns, the functional perspective of group decision-making was developed with the purpose of acting as a stimulus and catalyst for group communication research.

The functional approach was initially designed with three major assumptions that included "1. Groups being goal oriented; 2. Group performance varies in quality and quantity, and can be evaluated; and 3. Internal and external factors influence group performance via the interaction process" (Wittenbaum, et al., 2004, p. 19). From these initial assumptions, there have been revisions and adaptations to the functional approach that have expanded the perspective of research that is considered as functional (Gouran & Hirokawa, 1996; Gouran, 2003).

From the functional approach emerged the functional theory of group decision-making that consists of a core of five task requirements that should be fulfilled in order for decision-making groups to arrive at the highest quality decision (See Table 3 in Appendix A for the complete list of task requirements). These task requirements are aimed at improving decision quality, and require that communication be central in their fulfillment.

Having established the task requirements necessary to result in quality decisions, the functional approach has become a widely used perspective from which to study decision-making groups. Although several task requirements had been identified according to the functional theory, there was some concern over the limited scope of the theory. In an attempt to expand the functional theory (and along with it the functional approach) at the urging of other researchers, Gouran and Hirokawa (1983) added seven propositions to the five task requirements that allowed for social aspects of groups to be taken into account (Gouran, Hirokawa, Julian, & Leatham, 1993). These included propositions that took environmental and individual factors into consideration for the impact they might have on the decision-making ability of the group. The seven social propositions included:

1. The members of a decision-making or problem-solving group are motivated to make an appropriate choice.
2. The choice confronted is nonobvious.
3. The collective resources of the group in respect to the particular task exceed those of individual members.
4. The requisites of the task are specifiable.
5. Relevant information is available to the members of can be acquired.
6. The task is within the intellectual capabilities of the members to perform.
7. Communication is instrumental. (Gouran, et al., 1993).

Salazar (2009) points out that these propositions were added to the functional perspective because of the impact social aspects can have on group performance. Salazar further explains that social aspects were warranted because, “group members often communicate outside of the

group setting. Members take breaks and text each other, they communicate in the hallway, over the phone, at the water cooler, on the golf course or at the organizational picnic" (p. 3).

From the inclusion of the seven social propositions researchers suggested that the functional theory would also benefit from an expansion to include social contexts impacting group communication and decision-making. Thus, again the functional theory received criticisms for the little consideration it gives to the social aspects of groups (Putnam & Stohl, 2000). Researchers have suggested that this is because functional theory is highly task focused and accounting for more social aspects of groups would allow for a larger context of group work to be considered in regards to decision quality (Putnam & Stohl, 2000). The argument that the functional theory has suffered by omission of social aspects of the group process, along with a shift in the approach to group communication has led to an additional expansion of the theory to include seven more social propositions that groups must accomplish in checklist format, these include:

1. Making clear the group's interest in arriving at the best possible idea.
2. Identify the resources necessary for making a quality decision.
3. Recognize possible obstacles to be confronted.
4. Specify the procedures to be followed.
5. Establish ground rules for interaction.
6. Employ appropriate interventions for overcoming cognitive or behavioral constraints the group may encounter.
7. Review the process by which the group comes to a decision and, if indicated, reconsider judgments reached, even to the point of starting over (Gouran, 2003).

By adding these conditions the functional theory currently consists of five task requirements, seven social propositions, and seven social conditions. In expanding the functional theory to include each of these components researchers claimed to have addressed concerns with the contextual critiques of the functional theory (Paulus, et al., 2005).

Composed of the three overarching assumptions about decision-making in groups, including the five core task requirements, seven social propositions, and now the seven contextual factors aided the functional theory/perspective in successfully increasing the amount of theoretically based group research done in communication (Gouran & Hirokawa, 1996). From this perspective stemmed the functional theory of group decision-making (Gouran & Hirokawa, 1983, 1996; Gouran, 2003). The functional theory of group decision-making holds similar goals to the functional perspective in that the purpose of the functional theory of group decision-making is to determine the process groups use to come to the most quality decisions given the communication that occurs in the group. The similarities between the functional theory and the functional perspective are so slim that some researchers have expressed concern that there is no difference between them (Paulus, Hirokawa, Ancona, Peterson, Jehm, & Yoon, 2005). Further, the functional perspective and the functional theory have been discussed interchangeably in much of the research, including research by the founders of both the functional approach and the functional theory (Gouran, 2003; Graham, Papa, & McPherson, 1997; Wittenbaum, Hollingshead, Paulus, Hirokawa, Ancona, Peterson, Jehn, & Yoon, 2005). Given that little if any, differences exist between the functional approach and the functional theory, and each being used interchangeably for one another, this investigation will refer to both as the functional theory.

Functional Theory of Group Decision-Making

Initially functional theory was conceptualized and investigated using exploratory methods by Hirokawa (1980). The goal of the functional theory was to identify the communication factors that contribute to effective and ineffective group decisions. The difference between these two groups is thought to be communication based in that groups who communicate to fulfill specific task requirements are thought to be more effective, and produce higher quality decisions (Gouran & Hirokawa, 1983, 1996; Hirokawa, Gouram, Julian, & Leatham,1993).

Support for the functional theory and the associated task requirements have commenced from two very different approaches. The first approaches functional theory in a supportive fashion, in establishing the link between fulfillment of task requirements and decision quality through experimental methods. The attempt to support the claims of the functional approach was attempted in a series of exploratory studies centered on the presence of patterns in decision-making groups (Gouran & Hirokawa, 1983). Typically, the studies attempting to verify outcomes of the functional approach were conducted with groups of three members who were given a specific issue to discuss and asked to come to a decision (Hirokawa, 1982, 1983a, 1983b, 1987). Experimental groups were video recorded and coders were trained to look for the presence of task requirements (Hirokawa, 1980). Researchers then analyzed the group decision to further determine if there were any relationships present between the fulfillment of task requirements or social propositions, and the effectiveness or quality of the group's decision. In general researchers were able to conclude that significant relationships were evident between the fulfillment of some task requirements and social propositions and also the effectiveness of group

decisions (Cragan & Wright, 1993; Graham, Papa, & McPherson, 1997; Hirokawa & Johnston, 1989; Orlitzky & Hirokawa, 2001; Hirokawa & Pace, 1983).

Relationships reported in exploratory experiments have shown support for the relationship between the fulfillment of task requirements and social propositions, and decision quality. However, findings across studies were inconsistent in that the fulfillment of the same requirements or propositions leading to decision effectiveness was not evident in any of the findings (Orlitzky & Hirokawa, 2001). Paulus, Hirokawa, Ancona, Peterson, Jehm, and Yoon (2005) suggested that some groups gave more attention or interacted to meet some task requirements more than others; however, the requirements and propositions receiving the most attention were not consistent across studies. Conclusions from this research might suggest that the communication in groups does lead toward the fulfillment of the task requirements outlined in the functional theory, but do not treat each component as equally important (Gouran & Hirokawa, 1983). As further support of the functional theory in group communication research each of the aforementioned studies in some way encourages that future group research might benefit from including the functional theory in some way. Researchers issued these claims because the method of these studies allowed them to observe through video recording that groups were engaging in a process similar to the one outlined by Gouran and Hirokawa (1983), but that significant relationships may not have highlighted this.

In addition to these exploratory studies, another line of research that added support to the continued use of the functional theory was a set of investigations into individual characteristics of group members that were then linked to the completion of certain task requirements and social propositions (Buchanan, 1997, Hirokawa, Ice, & Cook, 1988; Nakanishi, Johnson, & Covalt, 1984). Specifically, these studies sought to determine how preference for procedure, need for

control, interpersonal communication openness, and preference for structured sequences impacted the group's ability to fulfill task requirements and meet social propositions. Findings indicate that across these studies, as communication increases, the fulfillment of both task requirements and social propositions become more common.

Hirokawa, Ice, and Cook (1988) specifically found that groups composed of members holding a preference for working under a set procedural order were able to complete more task requirements and also come to higher quality decisions than groups composed of members who preferred a less structured method of group work. Along these same lines, group's consisting of members who reported a low need for control, and high levels of communication openness also made decisions of higher quality, although evidence for the fulfillment of social propositions was not overwhelming (Buchanan, 1997; Nakanishi, et al., 1984).

In exploring which task requirements groups fulfilled in coming to a final decision, idea quality has been a consistent indicator of performance when using the functional theory (Gouran & Hirokawa, 1983; Gouran, 2003). Idea quality is thought to be the end result of the functional decision-making process because the task requirements allow for groups to build a reservoir of possible solutions and then proceed to work through those solutions to arrive at a final, quality decision (Wittenbaum, et al., 2004). Commonly, idea quality has been defined in the functional theory as the likelihood that a final decision would be implemented (Leathers, 1972). This makes the rating of ideas by trained coders a reasonable operationalization of idea quality in experiments and determining the quality of ideas through methods such as case studies (Gouran, 1987).

In general, research supporting the continued use of the functional theory suggests that there is evidence to support that groups do fulfill certain task requirements and some social

propositions, and the fulfillment of these requirements and propositions does lead to the production of higher quality decisions (Cragan & Wright, 1993; Graham, Papa, & McPherson, 1997; Hirokawa & Johnston, 1989; Orlitzky & Hirokawa, 2001; Hirokawa & Pace, 1983). Some concern with this research is that findings are inconclusive about the consistency of task requirements fulfilled by groups. In one case, a group may spend more time working through certain requirements while in another instance a group may fulfill completely different requirements, but both groups are able to produce decisions of equal quality (Orlitzky & Hirokawa, 2001). Also, research has shown some reservation about grouping the five task requirements and the seven social propositions together as some research has indicated that the social propositions were scarcely a factor in the decision quality of the group (Buchanan, 1997; Nakanishi, et al., 1984). Thus, conclusions of these studies are able to recommend the functional theory for further study and use in research on decision-making groups, but lack the predictive validity to suggest specific testable propositions in relation to the fulfillment of specific task requirements or social propositions, and decision quality and effectiveness.

The second approach that research has taken in the support of the functional theory as a valid framework from which to judge decision-making groups is by way of case studies. In developing case studies centered on the functional theory, researchers focused on groups that made poor decisions rather than evaluating the decision quality of groups. These case studies attempted to highlight how one potential cause of such poor decisions could have been the low number of task requirements the group completed as part of their decision-making process (Gouran, 1984; Gouran, 1987; Gouran, 1990; Gouran, Hirokawa, & Martz, 1986; McKinney, 1985; Wicker, 1990).

Functional theory case studies included an evaluation of decisions made in events such as the Watergate scandal under President Richard Nixon (Gouran, 1984), communication prior to and following the NASA Challenger explosion (Gouran, 1987; Gouran, Hirokawa, & Martz, 1986), decisions regarding specific commissions on pornography (Gouran, 1990), and the assassination of President John F. Kennedy (McKinney, 1985). In each instance the purpose of highlighting the problematic decisions that accompanied each of these events was to indicate how closely, or not, groups accomplished the five task requirements. In each case study the components of the decision-making process is outlined in a way that makes an argument for the relationship between the fulfillment of the task requirements and the quality of a group decision.

Overall the functional theory is considered as a useful theory of group decision-making even without the details of the relationships between the task requirements and decision quality being specified. As with any line of research, especially in theory development, the functional theory has not gone without its share of criticism. Early concerns with functional theory were based on the ecological validity of the task requirements (Graham, Papa, & McPherson, 1997). This concern was short-lived as one basis for conducting case studies was to determine the reach of the functional theory to actual decision-making groups (Gouran, 1984; Gouran, 1987; Gouran, 1990; Gouran, Hirokawa, & Martz, 1986; McKinney, 1985; Wicker, 1990). Although each case study did not outline how the task requirements were used in each event, the fact that each decision could have been more effective by using the functional theory was enough to address concerns of realism.

In addition to the evidence provided by the case studies, two studies directly addressed the ecological validity of the functional theory, and reported that of the components, the five task requirements held a strong link to processes used in actual decision-making groups (Papa &

Graham, 1990; Propp & Nelson, 1996). By testing the components of the functional theory in an organizational setting, researchers (Propp & Nelson) were able to verify the uses of the five task requirements, although the social propositions were not as prevalent. As for the core task requirements of the functional theory, issues of ecological validity have been, for the most part, addressed.

Other critiques of the functional theory have focused on the method used to study the relationship between task requirements and decision quality. The first critique addresses the conceptualization and operationalization of decision quality (Reinig & Briggs, 2008; Golderberg & Wiley, 2011). Studies conclude that a majority of attempts to capture idea quality rely on one of two methods. First, studies either compare the ideas generated or decisions made by the group to the existing ideas that are currently in place in an organization. The second method for evaluating idea or decision quality is to have experts rate the quality of each idea or decision (Levine, 1996). Reinig and Briggs point out that the first of these two methods is most likely measuring idea accuracy instead of idea quality. One issue with measuring idea accuracy is that if an organization is using a low-quality idea, the fact that a group was able to come up with the same idea does not make that a quality idea. Although there is some concern with bias in using experts, the use of multiple coders has received support in evaluating idea quality (Leathers, 1972).

Based on Leathers' (1972) ideas having more than one rater reduced bias and personal influence that might be an issue with individual experts or judges. Studies employing Leathers method of multiple judges have been restricted to studies of policy (Graham, Papa, & McPherson, 1997). Such studies are able to use multiple judges to determine if an idea or decision is able to contribute to current policy in an organization. Expanding this method of

rating quality to decision-making and ideation groups may provide a more agreed upon, reliable measure of idea quality. Thus, this study will use a multiple-rater system to measure idea quality based on the extent that each idea is able to address the issue presented to the group. Further, these ideas will be ranked on a scale ranging from 1 to 4 and previously introduced by Reinig and Briggs (2008).

At first glance it appears that researchers using the functional theory have done an adequate job addressing concerns with the theory (Gouran, 2003; Graham, et al., 1997; Paulus, et al., 2005). However, with the growing number of propositions and contexts addressed by the functional theory researchers started to question if the functional theory may have to large of a scope based on the original purpose in creating the theory (Klein, 2013). Reverting to the original purpose in developing the functional theory, the design of the theory was to consider what factors contribute to effective or ineffective decisions in task groups (Gouran & Hirokawa, 1983). Gouran and Hirokawa indicate that at the urging of others, the social propositions were added in an attempt to account for social factors that might affect the workings of a task group (Gouran & Hirokawa, 1996). Further, social groups and task groups have been found to have such differences, that group researchers have split much of their work based on whether their focus is on social or task groups (Forsyth, 2010), and some suggest social and task groups are rarely investigated together (Klein, 2013). The difference in social and task groups might indicate that a theory attempting to include aspects of both groups could experience difficulty, or be trying to cover too many scenarios. This claim has some support based on findings of previous research that has consistently shown that task requirements are used in decision-making groups who come to quality ideas (Cragan & Wright, 1993; Graham, Papa, & McPherson, 1997; Hirokawa & Johnston, 1989; Orlitzky & Hirokawa, 2001; Hirokawa & Pace, 1983), while

studies are hesitant to claim the same about the social propositions (Buchanan, 1997; Nakanishi, et al., 1984). Also, studies determining the validity of the functional theory in organizations have also established the validity of the task requirements while the social propositions were unable to be verified to the same extent (Propp & Nelson, 1996). Considering the original design of the functional theory, the difference in social and task components of groups, and the research that is more supportive of the five task requirements than of the social propositions, this study will focus on the five task requirements independent of the social propositions in determining the usefulness of the functional theory to inform brainstorming techniques.

Functional Theory & Brainstorming

At face value, the five task requirements of the functional theory and Osborn's brainstorming technique may be seen as two distinct processes. Brainstorming as Osborn (1957) outlined it is a process for the sole purpose of generating a large number of ideas related to an issue facing a group. Researchers have agreed that brainstorming is a useful part of the overall decision-making process, but not the phase of the process where a decision is made. Brainstorming has been classified as more of an initial stage that is assumed to be part of each decision-making process (Lehrer, 2012). Granted this assessment of brainstorming is accurate, the desired outcome of brainstorming is to develop a list of ideas, which will result in a group ultimately coming to a high quality decision. This outcome is not so different from the goal of the process outlined in the functional theory.

The functional theory (Gouran & Hirokawa, 1983) was designed to evaluate the decisions groups make, specifically the communication factors that lead groups to making decisions of the highest quality. Although the process is perhaps more in depth, and involves more steps, including decision-making and evaluation phases, the focus on quality decisions is one

commonality between Osborn's (1957) brainstorming technique and Gouran and Hirokawa's functional theory. In addition to striving for a common outcome brainstorming and the functional theory complement one another in two distinct areas.

As evident in his brainstorming rules, Osborn was certain to eliminate any evaluation of ideas during a brainstorming session. This does not mean that ideas generated during a brainstorming session are not ever evaluated. Osborn suggests that brainstorming groups might return after a specified amount of time and revisit ideas at a later decision-making stage of the group process (1957). One issue with Osborn's suggestion for later evaluation is that the process for that evaluation is not included in his writings as his text tends to outline brainstorming as a stand-alone process. Complimentary to Osborn's technique, a closer examination of the functional theory might suggest that what Osborn's brainstorming technique lacks in a later evaluation process the functional theory provides with the five task requirements.

A second complementary area between these two processes is found in the third task requirement of the functional theory. Task requirement three states that groups are to identify a relevant and realistic set of alternatives, or ideas. At this point in the process of the functional theory it appears that groups are being instructed to brainstorm. The issue here is that there are no guidelines or instruction on the procedure for accomplishing this third task requirement. What the functional theory lacks here, Osborn outlines in detail in his process. Thus by investigating Osborn's brainstorming technique and the functional theory together, a better understanding of both the brainstorming and decision-making processes may be gained. The purpose of this dissertation is to evaluate Osborn's brainstorming technique along with the task requirements of the functional theory, in doing so the gap addressed by this research project is two-fold. First, by using the functional theory in combination with Osborn's brainstorming technique the issues of

realism in brainstorming research and the atheoretical nature of much group communication research can both be addressed.

The second contribution of this dissertation will be to theoretically replicate Osborn's claims about his brainstorming process against other processes that include idea generation. After nominal groups were found to consistently outperform interacting groups some researchers were quick to dismiss Osborn's claims completely in search of an entirely new brainstorming technique (Rossiter & Lilien, 1994). The search for a new brainstorming technique was largely atheoretical and in some cases consisted of a new process for idea generation being presented without ever being tested or any supporting evidence being presented for the new process (Kohn & Smith, 2011; Madsen & Finger, Jr., 1978; Mongeau & Morr, 1999; Nelson, Petelle, & Monroe, 1974; Rossiter & Litlien, 1994). Introducing the functional theory to the area of brainstorming allows for a comparison of Osborn's technique to other idea generation processes. Possible results of this comparison may further validate Osborn's claims in suggesting that groups who followed Osborn's rules outperformed groups following other sets of rules for idea generation; the opposite is also possible. Regardless, the merger of the task requirements of the functional theory and Osborn's brainstorming technique allows for past issues of realism and atheoretical research to be addressed as well as the testing of Osborn's claims against a new process for idea generation. In order to test the performance of brainstorming groups using the functional theory, and address the concerns of realism raised by past researchers, three different brainstorming techniques will be tested in this study.

The first technique to be tested is Osborn's (1957) four rules of brainstorming. Osborn's rules outline a simple and concise process that centers on idea quantity. The second technique will be drawn from the five task requirements of the functional theory (Gouran & Hirokawa,

1983). The third technique will be a merged technique created by introducing Osborn's four rules of brainstorming into the five task requirements of the functional theory (See Appendix A for the criteria of the three brainstorming techniques). Specifically Osborn's brainstorming steps will be added to the third task requirement for further instruction on how this requirement should be met by.

Based on past research that suggests group history may impact the performance of brainstorming and decision-making groups, along with the evidence for higher brainstorming performance in cases of a longer induction of group history (Levine, et al., 2014) the following hypotheses are proposed:

H1: Groups with a history of interaction will generate more ideas than groups without history.

The relationship outlined in H1 will be manifest in the following ways:

H1a: Groups with a history of interaction who brainstorm according to Osborn's rules will generate more ideas than groups without history who brainstorm according to Osborn's rules.

H1b: Groups with a history of interaction who brainstorm according to the task requirements of the functional theory will generate more ideas than groups without history who brainstorm according to the task requirements of the functional theory**.**

H1c: Groups with a history of interaction who brainstorm according to a merged technique of Osborn's rules and the task requirements of the functional theory will generate more ideas than groups without history who brainstorm according to a merged technique including Osborn's four rules and the task requirements of the functional theory.

Given that the functional theory is based on the assumption that the more communication that occurs in the group the better that group performs, it is likely that there will be a difference in the performance of groups across the three different brainstorming techniques as each may allow for different amounts of communication to occur in the group. Based on the assumptions of the functional theory performance can be assumed to increase as the allowance for communication also increases, thus the following hypothesis are posed:

H2: Groups brainstorming according to the five task requirements of the functional theory will generate more ideas than groups brainstorming according to Osborn's rules.

H3: Groups brainstorming according to the merged technique of Osborn's rules and the five task requirements of the functional theory will generate more ideas than groups brainstorming according to the five task requirements and Osborn's rules alone.

Idea Quality

As represented in the previous hypotheses, and based on past research, idea quantity has been the dominant outcome variable in judging the performance of brainstorming groups (Levine, 1996). Several possible reasons exist for the number of ideas being the primary variable of interest, of which include the ease of determining the number of ideas. As long as ideas are recorded, researchers can simply count the number of ideas groups generated. Another reason is that idea quantity is the unmistakable priority in Osborn's (1957) brainstorming technique. Some researchers have noted concerns with this emphasis, suggesting that such a priority on idea quantity only takes away from other outcome variables that might be just as informative about the brainstorming process (Bolin & Neumann, 2006; Parnes & Meadow, 1959). In decision-making literature, idea quality is defined as the likelihood that an idea will solve the issue at hand without creating extraneous issues (Reinig & Briggs, 2007). Primarily, the focus on idea quantity

leaves idea quality without as much emphasis even though idea quality appears to be what is of most consequence. For example, a brainstorming group that is able to produce extensive ideas might only produce a few quality ideas. Depending on the situation, this brainstorming group might not be as valuable to an organization as a brainstorming group who produces a lower number of ideas, but has most of their ideas rated high in quality.

Upon closer examination of Osborn's strict adherence to idea quantity, it only appears that Osborn's focus is on idea quantity alone and nothing else. However, Osborn makes the claim that by focusing on quantity, quality will also be affected. Osborn stated, "The more ideas we tentatively conceive by way of alternative possibilities, the more likely we are to hit upon the idea or ideas which will solve our problem" (1957, p. 151). Osborn's thinking is that a positive relationship exists between the number of ideas and the quality of ideas generated in brainstorming sessions. This being the case, the issue then is not that Osborn's technique omits idea quality, but rather the relationship between idea quality and quantity. Levine et al., (2014) conducted a study testing the relationship between idea quality and idea quantity and found that as idea quantity increased so did idea quality without any evidence for a diminishing return. Based on this finding, and the idea that Osborn claims idea quality and quantity should be reflected in similar ways the following hypotheses are proposed:

H4: Groups with a history of interaction will generate higher quality ideas than groups without history.

The relationship outlined in H4 will be manifest in the following ways:

H4a: Groups with a history of interaction who brainstorm according to Osborn's rules will generate higher quality ideas than groups without history who brainstorm according to Osborn's rules.

H4b: Groups with a history of interaction who brainstorm according to the task requirements of the functional theory will generate higher quality ideas than groups without history who brainstorm according to the task requirements of the functional theory**.**

H4c: Groups with a history of interaction who brainstorm according to a merged technique of Osborn's rules and the task requirements of the functional theory will generate higher quality ideas than groups without history who brainstorm according to a merged technique including Osborn's four rules and the task requirements of the functional theory.

As is hypothesized with idea quantity, it is likely that there will be a difference in the performance of groups across the three different techniques on idea quality as well. As the major premise of the functional theory is that communicating to fulfill the task requirements increases the likelihood of a quality group performance the more focus the group gives to the task requirements of the functional theory the more quality their ideas should be, thus:

H5: Groups brainstorming according to the five task requirements of the functional theory will generate higher quality ideas than groups brainstorming according to Osborn's rules.

H6: Groups brainstorming according to the merged technique of Osborn's rules and the five task requirements of the functional theory will generate higher quality ideas than groups brainstorming according to the five task requirements and Osborn's rules alone.

Chapter 3: Method

Participants

416 participants were recruited from undergraduate courses at a large southeastern university. The sample included 184 males and 232 females, 70 freshman, 128 sophomores, 134 juniors, and 84 seniors. The age of participants ranged from 18 to 52 with an average age of 21. Participants were recruited from undergraduate courses in Communication Studies and also from the Families Studies major that routinely required students to work in groups as part of the course curriculum. Participants were assigned to brainstorming groups consisting of either four (n = 34) or five (n = 56) members. A total of 90 groups were recruited and participated in this study (n=90). Data was collected from 90 groups to reach a total of 15 groups in each cell of the 3x2 ANOVA used to test hypothesis. Considering the difficulties in reaching large sample sizes in group research, 15 groups of four or five members in each cell was considered adequate to allow analysis to indicate significant differences between cells if any be present.

Procedure

To adequately determine any performance difference between brainstorming groups across the experimental conditions participants were assigned to groups of four or five members. Prior to the brainstorming session, but after groups had been assigned, each group was randomly assigned a packet of materials (See Appendix B for research script). Each packet contained directions for the brainstorming session (Appendix C), an outline of one of the three brainstorming techniques and a topic to brainstorm about (Appendix D; E; & F), and a sheet of lined paper for recording ideas, evaluation criteria (should the group be working according to the functional theory or merged technique) and other thoughts. Brainstorming technique was randomly assigned among the experimental groups. One third of the groups was assigned to

brainstorm according to Osborn's four rules (n = 30), one third of the groups was assigned to brainstorm according to the five task requirements of the functional theory (n = 30), and the final third was assigned to brainstorm according to a merged technique including both Osborn's rules and the five task requirements (n = 30). These instructions, along with the remaining materials were printed on two different colors of paper to help participants through the brainstorming process. All instructions for brainstorming, regardless of technique, and the topic for brainstorming were printed on light blue paper. The sheets of lined paper for recording ideas and other thoughts were printed on yellow paper. Groups were instructed not to open their packet and review the materials until instructed.

After all groups had been assigned a packet of materials, groups were given five minutes to review the blue papers (instructions & topic) in detail. After five minutes the groups were instructed to begin brainstorming according to the process they just reviewed, and were given 15 minutes to generate ideas. Groups were given time updates at five-minute intervals during the brainstorming session. After 15 minutes groups were instructed to stop brainstorming and return both the blue and yellow materials to their manila folder. Following completion of the brainstorming session all group members completed a questionnaire that included questions designed to measure how well they believed their group followed the brainstorming technique they had been assigned, some demographic items, and a manipulation check question asking how many interactions the group had prior to the brainstorming session. Following the completion of the questionnaire, participants were asked to add their responses to the manila folder and return all materials to the researcher. Participants were allowed to ask questions regarding the brainstorming session and dismissed to return to their scheduled activities.

After the brainstorming session all ideas were counted and typed into a separate document for later coding of idea quality (Appendix G). The purpose of transferring all ideas into a separate document that was comprised of a single list of all ideas was to avoid any bias that coders might have toward handwriting, number of ideas generated or any other attributes that might have been noticed by allowing coders to read through the ideas of each group during the coding process. At the completion of data collection, the idea quantity of each group was calculated as well as all ideas prepared for coding of idea quality.

History Induction

To give the time needed for groups to develop an adequate and realistic history together groups assigned to the history condition were placed in groups of four or five during the first week of the Fall semester of an academic term (n = 45 groups). Groups of four were present for two reasons: first, the number of students enrolled in the course did not evenly equal out to allow all groups to have five members; or second, due to absences on the day of the brainstorming session some groups of five only had four members present. In the case that any group only had three members present at the brainstorming session groups were allowed to participate in the brainstorming activity, however the data collected from these groups was not used in this study. After being assigned to groups during the first week of the Fall semester, history groups worked together at least one time per week on in class assignments. In several instances these in class assignments required groups to meet outside of the classroom. After 11 weeks of regular interaction in and out of the classroom these groups were brought together to complete the brainstorming procedure described above.

The remaining groups were composed of members who had no history working together and thus compose the zero-history condition (n = 45 groups). These group members were

organized into groups of four or five during the first two weeks of the Spring academic semester approximately 3-5 minutes prior to the brainstorming session and reported little to no history of interaction amongst one another. By organizing zero-history groups during the first two weeks of the course and having groups organized minutes prior to the brainstorming session any potential history building by these groups was minimal, and also reflected in the number of times groups reported they had interacted together.

Manipulation Checks

To ensure that the manipulations in this study were effective, there was several manipulation checks that researchers put in place to ensure variables were induced and/or controlled in the desired manner. The first of these manipulation checks was to ensure that groups were indeed recognizing that they had previous interactions with their same group members in the history condition. Likewise, manipulation checks were put in place to ensure that groups who made up the zero-history condition were indeed strangers to one another in that they had zero to little interaction together prior to the brainstorming session. To ensure the history or zero-history induction was perceived by group members all participants were asked to report the number of times their group had interacted prior to the brainstorming session. Those group members who were part of history groups reported that on average their group had interacted 9.3 times over the 11 weeks with the reported number of interactions ranging from 1 to 40. In contrast participants in the zero-history condition reported that they interacted on average 1 time with their group with the reported number of interactions ranging from 0 to 6. Results of an independent t-test indicate that history groups reported interacting significantly more than zero-history groups, $t(88) = 12.89$, $p < .01$.

The second manipulation check put in place was to determine the extent to which each group actually followed the brainstorming technique they were assigned during the brainstorming session. All group members responded to a three-item scale designed to determine if groups accomplished all of the steps in their brainstorming technique. The three items were scaled from 1 to 5 using a Likert scale ranging from strongly disagree to strongly agree. The scale was coded so that higher scores reflected more complete adherence to the assigned brainstorming technique. Reliability of the three items was calculated to be .87 (Cronbach's α) (See Appendix H for measure). Across all conditions and techniques participants reported that groups did complete the steps in their assigned brainstorming process (M = 4.72, SD = .65). To further insure that groups completed their assigned brainstorming technique, the mean score from the three-item measure was compared against the midpoint of the scale (3) and found to be significantly higher ($t(415) = 54.27$, $p < .01$). Additionally of the 60 groups that were assigned to brainstorm according to the five task requirements and the merged technique, 47 (78%) had clearly marked evaluation criteria and 49 (82%) had clearly circled a final decision. This indicates that a large majority of the groups did follow their assigned processes as evidenced by the completion of later steps in their assigned brainstorming technique. From this manipulation check, it appears that groups were able to accomplish their assigned brainstorming technique on a consistent basis across all conditions and techniques.

A final check between the performance of four-person and five-person teams is necessary to determine if group size had any impact on brainstorming performance. Two independent samples t-test were used to determine any differences in idea quality or idea quantity between groups of four or five. Results of the t-tests indicate that there was no significant difference in idea quantity between groups of four (M = 13.71, SD = 6.62) and groups of five (M =14.46 , SD

= 8.44), $t(88) = -.48$, $p > .05$, ns. Likewise, results indicate that there was also no significant difference in idea quality between groups of four (M = 3.11, SD = .43) and groups of five (M =3.06 , SD = .43), $t(88) = .53$, $p > .05$, ns. Considering the manipulation checks regarding group history, the completion of assigned brainstorming techniques, and the lack of significant differences between groups of four members and groups of five members confidence is high that all variables were induced and controlled appropriately.

Instruments

Idea quantity. As in past brainstorming research, idea quantity was measured simply as the number of ideas groups were able to generate. Ideas were considered as independent statements that included only a single solution. For example, if a group recorded the idea, "more parking on campus for commuter students and motorcycles" this was counted as two ideas, one for commuter parking and one for motorcycle parking. The number of ideas generated was tallied for each group.

Idea quality. At the conclusion of a rather lengthy debate among group researchers regarding adequate operationalization of idea quality, Reinig and Briggs (2007) suggested that idea quality be rated using multiple coders, and done so on a system of anchor points. As this suggestion has generated confidence in the measurement of idea quality this process was used to measure idea quality in this study. As suggested by Reinig and Briggs (2007) idea quality was measured on a four-point scale with lower scores representing low quality ideas and higher scores representing high quality ideas. Each score was also associated with an anchor point, or an explanation of idea characteristics that would qualify a given idea to receive the associated score. For example, an idea would be ranked a 4 if the idea is "easily implemented and if it solves the problems

(eliminates unacceptable symptoms) completely without creating new unacceptable symptoms" (Reinig & Briggs, 2007, p. 410) (See Appendix I for the complete coding scheme).

To calculate the idea quality for each group, three independent coders were recruited to code all ideas generated by all groups. Coders met three times during the process to ensure that each understood the coding procedure to be used and to discuss coding differences. During the first meeting coders were trained on the process of determining idea quality and given the same 20% of ideas to code independently (25 ideas). Coders then reconvened to discuss idea rankings and resolve any differences between the coders. Following this second meeting coders ranked all 124 ideas for idea quality. An Intra-Class Correlation was calculated to determine the inter-coder reliability after all ideas had been coded and rankings were determined to be highly reliable with one another (ICC = .91).

Chapter 4: Results

To address the hypotheses suggested, two 3x2 ANOVAs were run to determine the difference in idea quantity and quality as influenced by the history condition and brainstorming technique. H1 suggested that overall, groups with a history of interaction will generate more ideas than groups without history and that this difference would be reflected across each of the three brainstorming techniques (H1a, H1b, & H1c). Omnibus results of a 3x2 ANOVA indicate a significant effect for group history on idea quantity, $F(1, 88) = 6.19$, $p < .05$, $\eta^2 = .06$. Post hoc analysis was run using a Scheffé's test and indicated that no significant main effects were present for history across the three brainstorming techniques. Scheffé's post hoc test was selected because it is among the most conservative post hoc tests, meaning that by using Scheffé's test, the likelihood of committing type one error is minimal.

Results of the 3x2 ANOVA were also used to test H2 and H3. Results indicate a significant main effect for brainstorming technique on idea quantity $F(2, 88) = 7.63$, $p < .05$, $\eta^2 = .14$. Running Scheffé's post hoc analysis did indicate that groups brainstorming according to Osborn's technique significantly outperformed groups brainstorming according to the task requirements of the functional theory $t(58) = 4.10$, $p < .01$, $r = .47$. Thus, H2 is not supported. Findings also indicate that groups brainstorming according to the merged technique significantly outperformed groups brainstorming according to the task requirements on idea quantity $t(58) = 3.14$, $p < .01$, $r = .38$, but did not generate more ideas than groups brainstorming according to Osborn's technique $t(58) = .59$, $p > .05$, *ns*. Based on these results H3 is partially supported. See Table 1 for results of the 3x2 ANOVA.

Table 1
ANOVA Table, Idea Quantity

	SS	DF	MS	F	Sig.	η^2
History Condition	313.60	1	313.60	6.19	.02	.06
Brainstorming Technique	773.62	2	386.81	7.63	.01	.14
Interaction	32.07	2	16.03	.32	.73	.01
Error	4257.87	84	50.69			
Total	5377.16					

H4 suggested that overall groups with a history of interaction will generate higher quality ideas than groups without history and that this difference would be reflected across each of the three brainstorming techniques (H4a, H4b, & H4c). Omnibus results of a 3x2 ANOVA indicate that a significant effect for group history on idea quality is not present, $F(1,88) = 1.78$, $p > .05$, *ns*.

H5 and H6 were also tested using a 3x2 ANOVA to determine any difference in the number of ideas generated across the three brainstorming techniques. Results of the 3x2 ANOVA indicate no significant effect for brainstorming technique on idea quality $F(2, 88) = 1.62$, $p > .05$, *ns*. Thus, H5 and H6 are not supported. See Table 2 for 3x2 ANOVA results.

Table 2
ANOVA Table, Idea Quality

	SS	DF	MS	F	Sig.	η^2
History Condition	.32	1	.32	1.78	.19	.00
Brainstorming Technique	.57	2	.29	1.62	.21	.00
Interaction	.43	2	.23	1.21	.31	.00
Error	14.89	84	.18			
Total	16.21					

Chapter 5: Discussion

This study was designed to address two primary issues facing interacting brainstorm research. The first is the lack of theory driving research toward the development or expansion of brainstorming techniques. The second is a concern with the level of realism induced by past research in an attempt to further what is known about the performance of brainstorming groups. By introducing the functional theory, both of these areas may be addressed and future, theoretical implications may inform the practice of brainstorming in organizations. To address these concerns, an experiment was conducted to determine the effect of group history and brainstorming technique had on the number of ideas and the quality of ideas that brainstorming groups were able to generate in a single brainstorming session.

Idea Quantity

H1 suggested that groups with a history of working together would generate more ideas than groups who did not have a history of working together. Specifically this difference between history and zero-history groups would be reflected in that history groups brainstorming according to Osborn's rules, the task requirements of the functional theory, and the merged technique, would generate a higher number of ideas than zero-history groups brainstorming according to the same set of criteria. Overall, results did support H1in that history groups did generate more ideas than zero-history groups. However, post hoc analysis indicated that no significant difference was found between the history groups and zero-history groups across the different brainstorming techniques; thus, H1a, H1b, and H1c were not supported. These findings support past research that suggested an increase in group member history together may impact group performance when compared with groups whose members are complete strangers coming into the brainstorming session (Blomstrom, et al., 2008; Bouchard & Hare, 1970; Jablin,

Sorensen, & Seibold, 1978). The general finding that history groups outperform zero-history groups also supports more recent research in support of extending the amount of time given to groups to develop history prior to a brainstorming session (Levine, et al., 2014). Perhaps the most impactful suggestion based on these findings is the increase in understanding why past brainstorming experiments produced the results they did. Much of the past brainstorming research has been inconclusive on what factors of brainstorming actually increase performance and results overall were unable to increase what was known about the nuances of brainstorming. Based on the performance of history groups over zero-history groups, these results could suggest that one reason past findings of brainstorming results were unable to show support for Osborn's claims due to the lack of a proper induction of history prior to a brainstorming session of the experiment. Specifically, by allowing for more than a few minutes of interaction prior to a brainstorming session, a more lengthy induction of history might have resulted in findings more in line with Osborn's claims rather than findings contradictory to them. In any manner, the findings addressing H1 suggest the importance of an accurate and adequate history induction in experimental group brainstorming research.

The sub-hypotheses included in H1 were tested to gain a better understanding of the differences between history and zero-history groups across the brainstorming technique assigned to the group. These hypotheses suggested that in all techniques, history groups would generate more ideas than zero-history groups. Post hoc analysis indicates that history groups did generate more ideas than zero-history groups across the brainstorming techniques; however, these differences, although nearing conventional levels of statistical significance (.05), were not statistically significant.

A review of the means and standard deviations might offer an explanation for these results as the standard deviations for idea quantity are rather large. Given the nature of the ANOVA test, high levels of within group variance, even when compared with high levels of between group variance tend to result in non-significant results. A review of past brainstorming research reveals that high standard deviations are consistent across studies as groups generally come up with a wide range of ideas resulting in large amounts of within group variance. Thus, large standard deviations may be common-place in brainstorming experiments and a contributing factor to why several brainstorming investigations were unable to identify characteristics that contribute to the performance of one brainstorming group over the other. Specifically in evaluating Bouchard's line of brainstorming research (1972a, 1972b), significant differences in performance based on differences of group size, sex of group members, and other factors may have been clouded by large standard deviations.

A different interpretation of the large standard deviations in some of the brainstorming groups might also be an indicator of a range of creativity. Osborn designed the brainstorming process as a method for increasing creativity in group members and one alternative explanation for large standard deviations in groups following Osborn's rules is that creativity was at work in varying levels, thus resulting in a large swing in productivity of those groups. Either way, brainstorming is a process that results in a range of ideas being generated for use by organizations and, as is evident by these results, groups did generate a wide variety in terms of number of ideas generated.

H2 and H3 are based on the assumption of the functional theory that more communication is better. This is because the more a group communicates, the more likely it is to meet the specific task requirements outlined in the theory. As such, brainstorming techniques

that allow or outline a process that grows the opportunity for communication within the group should also result in higher performance. Following this argument, H2 suggests that groups following the functional theory should generate more ideas than groups following Osborn's steps. Results indicate that H2 is not supported. The opposite was found - groups brainstorming according to Osborn's rules generated significantly more ideas than groups following the task requirements. One possibility is that because Osborn's rules, although simple, are able to create an environment of open communication void of evaluation and the result of such an environment is that groups are able to generate a large number of ideas. The task requirements may restrict some communication as groups who are aware of the task requirements might refrain from outside discussions and furthering communication to accomplish the task requirements. Overall, these findings may indicate that one way to help groups generate a high number of ideas is to limit the structure of the brainstorming technique given to the group.

Other implications of these results show support for Osborn's original claims that group brainstorming according to his process did outperform other groups following different brainstorming procedures. After initial results indicated that nominal groups outperform interacting brainstorming groups with regular consistency (Taylor, et al., 1958; Lamm & Trommsdorf, 1973) some researchers sought to revise Osborn's brainstorming technique, or re-write a method for idea generation completely (Madsen & Finger, Jr., 1978; Rossiter & Lilien, 1994). Findings addressing H2 suggest that Osborn may have been correct in claiming that his four rules of brainstorming were superior to other idea generation techniques. As evidenced by the results here, groups brainstorming by Osborn's rules did outperform groups generating ideas in accordance with the task requirements of the functional theory. Findings suggest that a search for "new" or revised techniques that do not consider Osborn's four rules may be unwarranted in

light of the departure from nominal groups due to realism and the continued evidence in support for the use of Osborn's technique.

H3 suggests groups brainstorming according to the merged technique would generate more ideas than groups following both Osborn's steps and the task requirements. This hypothesis was suggested based on the same assumptions that were used to guide H2; that more communication is better. Based on results, H3 is partially supported. Results indicate that groups following the merged technique did generate more ideas than groups following the task requirements, but did not generate more ideas than groups following Osborn's rules. These findings may suggest that Osborn's technique could be the most adequate for creating an open communication environment that lends to idea generation. This is due to the design of the merged technique being a mixture of the functional theory's task requirements and the four rules designed by Osborn. Results addressing H3 suggest that perhaps the restriction of communication to accomplish the task requirements actually limited the ability of groups to generate a high number of ideas. In comparison with the task requirements alone, the merged technique that also included Osborn's rules was potentially able to allow for groups to communicate more openly and actual accomplish the task requirements more effectively than following a brainstorming procedure where they were instructed specifically to meet the five task requirements. Again, support for the use of Osborn's technique is evident in several of the findings associated with idea quantity both in regards to brainstorming technique, and group history.

Practical implications of the results centered on idea quantity are similar to those outlined in Osborn's book (1957). Osborn designed brainstorming as a conference for collecting ideas. Whether generated ideas were for immediate or later use was not as crucial as was the adherence

to the four rules outlined in his ideation process. Thus, for organizations facing projects, issues, or tasks that could be addressed by drawing from a large reservoir of ideas, they may want to consider the use of Osborn's technique for ideation groups used within their organization. Over time, organizations may be able to store a large number of ideas on a variety of topics that would afford them the opportunity to draw from in times of need. Osborn also suggested that the larger the idea pool, the more likely it is that the idea able to address or solve an organizations issue is present in the pool. Based on this claim, organizations that are able to use brainstorming to create such a pool of ideas likely have several quality ideas as part of the overall list of ideas generated. Based on the results of addressing idea quantity, organizations that employ the use of Osborn's brainstorming technique will benefit from a large list of ideas that might be useful in addressing both immediate and later concerns.

Idea Quality

Past research has established the association between idea quality and quantity as being positive and even in some cases with the growth in the number of ideas leading to an increase in the overall quality of those ideas (Girota, Terwiesch, & Ulrich, 2010; Levine, et al., 2014; Osborn, 1957; Reinig & Briggs, 2007). Based on these arguments, all of the hypotheses centered on idea quality were designed to be very similar to those addressing idea quantity. Although sharing a similar rationale, there is a striking difference in the results of idea quantity versus those of idea quality. Based on results there is little to no statistical difference in the quality of ideas generated across history and zero-history groups, nor across brainstorming technique. Overall, history groups did not generate higher quality ideas than zero-history groups, nor did history groups generate more ideas than zero-history groups across any of the brainstorming techniques. Thus, H4, H4a, H4b, and H4c are not supported. Results also indicated that there was

no difference in idea quality as brainstorming technique changed meaning that H5 and H6 are also not supported.

One potential explanation for the lack of difference in idea quality among the remaining conditions could be the restriction of range in the scaling of idea quality. Based on a somewhat lengthy argument involving the proper conceptualization and operationalization of idea quality, researchers settled on an anchor-point style measure of idea quality ranging from one to four (Briggs & Reinig, 2007; Goldenberg & Wiley, 2011; Reinig & Briggs, 2008; Reinig, Briggs, & Nunamaker, 2007). This ranking system of idea quality was designed so that each idea would receive a quality score based on whether the idea addressed a given issue or problem without bringing up new or larger issues. The lack of findings in this study might indicate that a one to four scale is not adequate enough to reflect the variance that is present in the quality of ideas. This argument suggests that variance in idea quality between the conditions is present, but raters were unable to accurately capture that variance due to the design of the rating instrument.

Further evidence for this argument is found in the descriptive statistics for idea quality. Standard deviations of idea quality appear to be extremely small, leading to the possibility that coders were unable to distinguish between ideas based on the limited available options for assigning a quality score. Ideas produced by groups for improving a university campus ranged from building waterslides as a method for transportation between buildings (low quality idea), and students being able to use their student I.D. card for purchases at athletic events (high quality idea). Based on these two examples it appears that at face value these ideas need be separated by more than three anchor points. Although the design of using anchor points to measure the quality of each may be reliable and valid, perhaps a larger scale is in order to accurately allow for the coding of such a wide range of ideas.

Overall the impact of group history and brainstorming technique are not as conclusive as the results of idea quantity; however, these results do suggest that the continued study of idea quality is needed. The continued study of idea quality may be even more appropriate as it is likely that idea quality is of more importance to organizations and groups than idea quantity. Presented with two types of groups, one who is able to generate a large numbers of ideas without any promise of quality ideas, versus a group who is only able to produce a small number of ideas, but a majority of the ideas are high in quality, an organization might favor the later. Considering the best possibility, researchers who are able to identify the conditions under which groups are able to produce a large number of ideas, a majority of which are high in quality would be of most benefit to an organization. Thus, not only should idea quality be of value in future research, but the brainstorming process as a whole.

Limitations

There are several limitations to this study. As mentioned above, idea quality was coded using a four-point scale by coders who were not part of the experiment in any capacity other than coding ideas for quality. Two limitations are present with coders, the first is the restriction of range issue with the idea quality scale. Second is the possible involvement coders had with the brainstorming topic. Coders, although not involved in the research design or being aware of any hypotheses suggested in this study were students who were currently attending the university that groups were brainstorming about. As a result some coder bias may have been present when coding ideas that were aimed at the coder's major, dorm, or student organization resulting in a more favorable quality assessment.

As part of the recruitment of participants high enrollment undergraduate courses were used because these courses implemented group work into the course curriculum. During the

brainstorming session, the use of high enrollment lecture courses led to groups brainstorming within close proximity to one another. Although groups were following difference brainstorming techniques the range of ideas, thoughts, and even technique steps may have had an influence across groups. Given the manipulation checks indicating that groups were able to follow the steps outlined in their brainstorming technique the rate of idea generation and the focus of other groups may have impacted the attention given to the brainstorming process by other groups.

A final limitation was evident in the large standard deviations of idea quantity, specifically regarding the techniques outlining Osborn's rules. Large standard deviations may have contributed to the lack of statistically significant differences between history and zero-history groups on idea quantity.

Future Research

Future research should consider once again re-operationalizing idea quality. This may come in the form of an expanded scale for rating idea quality. A lengthy debate as to the appropriate operationalization of idea quality is present in the literature. Thus, the results of this study should add to the argument in that debate suggesting that idea quality is difficult to measure based on the subjective nature of the construct. However, the results presented and data collected could also be used to aid in the development of a more objective measure of idea quality. Also, coders should be completely independent of both the brainstorming experiment and the brainstorming topic, replication of this study using coders who have no affiliation with the university or the research design would be preferable.

Future research on brainstorming groups may also want to consider separating groups by brainstorming technique during the brainstorming session for data collection. By having groups together who are brainstorming according to the same set of rules or guidelines groups may be

more focused on the brainstorming processes and not on other groups. For example some groups brainstorming according to the longer merged technique may have been aware that other groups appeared to be finished or close to finishing because unknown to them the other group was working according to Osborn's rules. Members in the merged technique group may have lost focus because they were more aware of other groups than they were of their own tasks. By separating groups for data collection by brainstorming technique there is no reason that groups should experience perceived inequity in technique, requirements, time, or effort required during the brainstorming session.

A final focus of future research might be centered on rectifying the non-significant findings associated with H1a, H1b, and H1c. Due to rather large standard deviations, there was no significant difference found in idea quantity across history/zero-history groups or the brainstorming techniques. As a means to account for these large standard deviations, researchers might consider omitting the highest and lowest performing groups as a way of decreasing the overall standard deviations. One method for doing this would be to omit the group data from groups who generated ideas that were more than two standard deviations higher or lower than the average number of ideas generated.

Contribution

This dissertation makes three primary contributions to what is known about brainstorming groups in organizations and the measure of idea quantity and quality. The first is the support for Osborn and his original claims made about brainstorming and brainstorming performance according to his four rules. Results suggest that rather than disregarding Osborn's claims and looking for new methods of producing ideas using groups, as some suggest, that Osborn's claims were substantiated by the findings of this study. This suggests that perhaps past

research was unable to replicate Osborn's claims because of the trouble inducing group factors that accurately reflected Osborn's groups.

The second and third contributions of this dissertation concern what is known about the measure of idea quality. The inconclusive results regarding the differences and coding of idea quality presented in this study will add to the body of literature that is currently aiming to develop a more useful measure of idea quality. Specifically that if an objective measure of idea quality is going to be presented, the range of that measure must be expansive enough to allow the variance in idea quality to be measured without becoming too broad or vague of a measure. Finally, the ideas collected during the brainstorming session of this study will be extremely useful in assessing alternative methods for measuring idea quality. At the conclusion of completely analyzing the ideas collected during this study much more should be known about the measurement of idea quality.

Overall, this study has addressed the issues it was designed to address which is the lack of theory and realism in previous brainstorming research that led to incompatible results between interacting brainstorming groups. As indicated by the results of this study, group history and brainstorming technique are able to address issues of realism while including the use of the functional theory addresses the lack of theory. Further, using different brainstorming techniques allowed for results to address the soundness of Osborn's technique against potentially "new" techniques. Findings show strong support for the claims made by Osborn and the continued use of his brainstorming technique, especially when the goal of a brainstorming session is idea quantity and to some extent even idea quality.

References

Allen, N. J., & Hecht, T. D. (2004). The 'romance of teams': Toward an understanding of its psychological underpinnings and implications. *Journal of Occupational and Organizational Psychology, 77*, 439-461.

Barki, H., & Pinsonneault, A. (2001). Small group brainstorming and idea quality: Is electronic brainstorming the most effective approach? *Small Group Research, 32*, 158-205.

Blomstrom, S., Boster, F. J., Levine, K. J., Butler, E. M. J., & Levine, S. L. (2008). The effects of training on brainstorming groups. North Dakota Journal of Communication, Speech & Theatre, 21, 41-50.

Bolin, A. U., & Neuman, G. A. (2006). Personality, process, and performance in interactive brainstorming groups. *Journal of Business and Psychology, 20*, 565-585.

Bouchard Jr., T. J. (1969). Personality, problem-solving procedure, and performance in small groups. *Journal of Applied Psychology Monographs, 53*, 1-29.

Bouchard Jr., T. J. (1972a). Training, motivation, and personality as determinants of the effectiveness of brainstorming groups and individuals. *Journal of Applied Psychology, 56*, 324-331.

Bouchard Jr., T. J. (1972b). A comparison of two group brainstorming procedures. *Journal of Applied Psychology, 56*, 418-421.

Bouchard Jr., T. J., & Hare, M. (1970). Size, performance, and potential in brainstorming groups. *Journal of Applied Psychology, 54*, 51-55.

Bouchard Jr., T. J., Barsaloux, J., & Drauden, G. (1974). Brainstorming procedure, group size, and sex as determinants of the problem-solving effectiveness of groups and individuals. *Journal of Applied Psychology, 59*, 135-138.

Briggs, R. O., & Reinig, B. A. (2007). Bounded ideation theory: A new model of the relationship between idea-quantity and idea-quality during ideation. *Presented at the annual Hawaii International Conference on System Siences*, Manoa, HI.

Buchanan, K. (1997). *Control and openness in communication in group decision-making.* Unpublished doctoral dissertation, University of Denver, Denver, CO.

Burkart, K. (2009, April). Fortune 500 companies gather from green 'brainstorm'. www.mnn.com Retrieved July, 2013 from http://www.mnn.com/green-tech/research-innovations/blogs/fortune-500-companies-gather-for-green-brainstorm.

Comadena, M. E. (1984). Brainstorming groups: Ambiguity, tolerance, communication apprehension, task attraction, and individual productivity. *Small Group Behavior*, *15*, 251-264.

Cragan, J. F., & Wright, D. W. (1993). The functional theory of small group decision-making: A replication. *Journal of Social Behavior and Personality*, *8*, 165-174.

Dennis, A. R., & Williams, M. L. (2003). Electronic brainstorming. In P. B. Paulus & B. A. Nijstad (Eds.), *Group creativity: Innovation through collaboration*. New York, NY: Oxford University Press, pp. 160-180.

Dennis, A. R., Valacich, J. S., Connolly, T., & Wayne, B. E. (1996). Process structuring in electronic brainstorming. *Information Systems Research*, *7*, 268-277.

DeRosa, D. M., Smith, C. L. & Hantula, D. A. (2007). The medium matters: Mining the long-promised merit of group interaction in creative idea generation tasks in a meta-analysis of the electronic group brainstorming literature. *Computers in Human Behavior*, *23*, 1549-1581.

Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology, 53*, 497-509.

Diehl, M., & Stroebe, W. (1991). Production loss in idea-generating groups: Tracking down the blocking effect. *Journal of Personality and Social Psychology, 61*, 392-403.

Dillon, P. C., Graham, W. K., & Aidells, A. L. (1972). Brainstorming on a "hot" problem: Effects of training and practice on individual and group performance. *Journal of Applied Psychology*, *56*, 487-490.

Dugosh, K. L., Paulus, P. B., Roland, E. J., & Yang, H. C. (2000). Cognitive stimulation in brainstorming. *Journal of Personality and Social Psychology, 79*, 722-735.

Dunnette, M. D., Campbell, J., & Jaastad, K. (1963). The effect of group participation on brainstorming effectiveness for two industrial samples. *Journal of Applied Psychology, 47*, 30-37.

Girota, K., Terwiesch, C., & Ulrich, K. (2010). Idea generation and the quality of the best idea. *Management Science*, *54*, 591-605.

Goldenberg, O., & Wiley, J. (2011). Quality, conformity, and conflict: Questioning the assumptions of Osborn's brainstorming technique. *The Journal of Problem Solving*, *3*, 96-118.

Gouran, D. S. (1984). Communicative influences related to the Watergate cover-up: The failure of collective judgment. *Central States Speech Journal*, *35*, 260-268.

Gouran, D. S. (1987). The failure of argument in decisions leading to the "Challenger disaster": A two-level analysis. In J. W. Wenzel (Ed.), *Argument and critical practices: Proceedings of the fifth SCA/AFA conference on argumentation* (pp. 439-448). Annandale, VA: Speech Communication Association.

Gouran, D. S. (1990). Factors affecting the decision-making process in the Attorney General's commission on pornography: A case study of unwarranted collective judgment. In R. S. Rodgers (Ed.), *Free speech yearbook 28* (pp. 104-119). Carbondale, IL: Southern Illinois Press.

Gouran, D. S. (1991). Rational approaches to decision-making and problem solving discussion. *Quarterly Journal of Speech, 77*, 343-358.

Gouran, D. S. (2003). Communication skills for group decision making. In J. O. Greene & B. R. Burleson (Eds.), *Handbook of communication and social interaction skills* (pp. 835–870). Mahwah, NJ: Lawrence Erlbaum.

Gouran, D. S. & Hirokawa, R. Y. (1983). The role of communication in decision-making groups: A functional perspective. In M. S. Mander (Ed.), *Communications in transition* (pp. 168-185). New York, NY: Praeger.

Gouran, D. S. & Hirokawa, R. Y. (1996). Functional theory and communication in decision-making and problem-solving groups. In R. Y. Hirokawa & M. S. Poole (Eds.), *Communication and group decision-making* (pp. 55-80). Thousand Oaks, CA: Sage.

Gouran, D. S., Hirokawa, R. Y., & Martz, A. E. (1986). A critical analysis of factors related to decisional processes involved in the Challenger disaster. *Central States Speech Journal, 37*, 119-135.

Gouran, D. S., Hirokawa, R. Y., Julian, K. M., & Leatham, G. B. (1993). The evolution and current status of the functional perspective on communication in decision-making and problem-solving groups. In S. A. Deetz (Ed.), *Communication yearbook 16* (pp. 573-600). Newbury Park, CA:Sage.

Graham, E. E., Papa, M. J., & McPherson, M. B. (1997). An applied test of the functional communication perspective of small group decision-making. *Southern Communication Journal*, *62*, 269-279.

Harkins, S. G. (1987). Social loafing and social facilitation. *Journal of Experimental Social Psychology*, *23*, 1-18.

Harper N. L., & Askling, L. R. (1980). Group communication and quality of task solution in a media production organization. *Communication Monographs*, *47*, 77-100.

Henningsen, D. D., & Henningsen, M. L. M. (2013). Generating ideas about the uses of brainstorming: Reconsidering the losses and gains of brainstorming groups relative to nominal groups. *Southern Communication Journal*, *78*, 42-55.

Hirokawa, R. Y. (1980). *A function-oriented analysis of small group interaction within effective and ineffective decision-making groups: An exploratory investigation.* Unpublished doctoral dissertation, University of Washington, Seattle, WA.

Hirokawa, R. Y. (1982). Group communication and problem-solving effectiveness I: A critical review of inconsistent findings. *Communication Quarterly*, *30*, 134-141.

Hirokawa, R. Y. (1983a). Communication and problem-solving effectiveness II: An exploratory investigation of procedural functions. *Western Journal of Speech Communication*, *47*, 59-74.

Hirokawa, R. Y. (1983b). A descriptive investigation of the possible communication-based reasons for effective and ineffective group decision making. *Communication Monographs*, *50*, 363-379.

Hirokawa, R. Y. (1985). Descussion procedures and decision-making performance: A test of a functional perspective. *Human Communication Research*, *12*, 203-224.

Hirokawa, R. Y. (1987). Why informed groups make faulty decisions: An investigation of possible interaction-based explanations. *Small Group Behavior, 18,* 3-29.

Hirokawa, R. Y., & Johnston, D. D. (1989). Toward a general theory of group decision-making: Development of an integrated model. *Small Group Behavior*, *20*, 500-524.

Hirokawa, R. Y., & Pace, R. C. (1983). A descriptive investigation of the possible communication-based reasons for effective and ineffective group decision-making. *Communication Monographs*, *50*, 363-379.

Hirokawa, R. Y., Ice, R., & Cook, J. (1988). Preference for procedural order, discussion structure, and group decision performance. *Communication Quarterly*, *36*, 217-226.

Hollingshead, A. B., Wittenbaum, G. M., Paulus, P. B., Hirokawa, R. Y., Ancona, D. G., Peterson, R. S., Jehn, K. A., & Yoon, K. (2005). A look at groups from the functional perspective. In M. S. Poole & A. B. Hollingshead (Eds.), *Theories of small groups* (pp. 21-51). Thousand Oaks, CA: Sage.

Isaksen, S. G., & Gaulin, J. P. (2005). A reexamination of brainstorming research: Implications for research and practice. *Gifted Child Quarterly*, *49*, 315-329.

Jablin, F. M. (1981). Cultivating imagination: Factors that enhance an inhibit creativity in brainstorming groups. *Human Communication Research, 7*, 245-258.

Jablin, F. M., & Seibold, D. R. (1978). Implications for problem-solving groups of empirical research on 'brainstorming': A critical review of the literature. *The Southern Speech Communication Journal*, *43*, 327-356.

Jablin, F. M., & Sussman, L. (1978). An exploration of communication and productivity in real brainstorming groups. *Human Communication Research, 4*, 329-337.

Jablin, F. M., Sorensen, R. L., & Seibold, D. R. (1978). Interpersonal perception and group brainstorming performance. *Communication Quarterly*, *26*, 36-44.

Lamm, H., & Trommsdorff, G. (1973). Group versus individual performance on tasks requiring ideational proficiency (brainstorming): A review. *European Journal of Social Psychology*, *3*, 361-388.

Landsberger, H. A. (1955). Interaction process analysis of professional behavior: A study of labor mediators in twelve labor-manager disputes. *American Sociological Review*, *20*, 566-575.

Lanzetta, J. T., & Roby, T. B. (1960). The relationship between certain group process variables and group problem-solving efficiency. *The Journal of Social Psychology*, *52*, 135-148.

Leathers, D. G. (1972). Quality of group communication as a determinant of group product. *Speech Monographs*, *39*, 166-174.

Lehrer, J. (2012). *Imagine: How creativity works*. Boston, MA: Houghton Mifflin Harcourt.

Levine, K. J. (1996). *The effects of procedure, priming, and peers on brainstorming*. Unpublished doctoral dissertation, Michigan State University, East Lansing, MI.

Levine, K. J., Heuett, K. B., & Reno, K. M. (2013, November). *Cohesion, involvement, group type, and priming: Do these variables impact idea quality in brainstorming?* Paper presented at the annual meeting of the National Communication Association, Washington D. C.

Levine, K. J., Heuett, K. B., & Reno, K. M. (2014, May). *Re-Operationalizing history groups in brainstorming: Validating Osborn's claims.* Paper presented at the annual meeting of the International Communication Association, Seattle, WA.

Litchfield, R. C., Fan, J., & Brown, V. R. (2011). Directing idea generation using brainstorming with specific novelty goals. *Motivation and Emotion, 35*, 135-143.

McKinney, B. C. (1985). *Decision-making in the President's Commission on the Assassination of President Kennedy: A descriptive analysis employing Irving Janis's groupthink hypothesis.* Unpublished doctoral dissertation, Pennsylvania State University, University Park, PA.

McLeod, P. L., & Lobel, S. A. (1992). The effects of ethnic diversity on idea generation in small groups. *Academy of Management Best Practices Proceeding* (pp. 227-231).

Mennecke, B. E., & Valacich, J. S. (1998). Information is what you make of it: The influence of group history and computer support on information sharing, decision quality, and member perceptions. *Journal of Management Information Systems, 15,* 173-197.

Mongeau, P. A., & Morr, M. C. (1999). Reconsidering brainstorming. *Group Facilitation: A Research and Applications Journal, 1,* 14-20.

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology, 12,* 3-23.

Nakanishi, M. (1990, November). *Group communication and decision-making effectiveness: A test of the functional perspective.* Paper presented at the annual meeting of the Speech Communication Association, Chicago, IL.

Nakanishi, M., Johnson, K. M., & Covalt, T. L. (1984, November). *Group interaction processes, task structure, and group decision-making effectiveness.* Paper presented a the annual meeting of the Speech Communication Association, Chicago, IL.

Nijstad, B. A., Stroebe, W. & Lodewijkx, H. F. M. (1991). Cognitive stimulation and interference in groups: Exposure effects in an idea generation task. *Journal of Experimental Social Psychology, 38*, 535-544.

Orlitzky, M., & Hirokawa, R. Y. (2001). To err is human, to correct for it divine: A meta-analysis of research testing the functional theory of group decision-making effectiveness. *Small Group Research, 32*, 313-341.

Osborn, A. F. (1957). *Applied imagination*: *Principles and procedures of creative problem solving*. New York, NY: Charles Scribner's Sons.

Papa, M. J., & Graham, E. E. (1990, November). *A test of the ecological validity of the functional communicative perspective of small group decision-making.* Paper presented at the annual meeting of the Speech Communication Association, Chicago, IL.

Paulus, P. B., Hirokawa, R. Y., Ancona, D. G., Peterson, R. S., Jehn, K. A., & Yoon, K. (2005). A look at groups from the functional perspective. In M. S. Poole & A. B. Hollingshead (Eds.), *Theories of small groups: Interdisciplinary perspectives* (pp. 21-62). Thousand Oaks, CA: Sage.

Paulus, P. B., Larey, T. S., & Ortega, A. H. (1995). Performance and perceptions of brainstormers in an organizational setting. *Basic and Applied Psychology*, *17*, 249-265.

Propp, K. M., & Nelson, D. (1996). Problem-solving performance in naturalistic groups: A test of the ecological validity of the functional perspective. *Communication Studies*, *47*, 35-45.

Putnam, L. L., & Stohl, C. (2000). Bona fide groups. In M. S. Poole & A. B. Hollingshead (Eds.), *Research methods for studying groups* (pp. 211- 234). New York, NY: Routledge.

Reinig, B. A., & Briggs, R. O. (2008). On the relationship between idea-quantity and idea-quality during ideation. *Group Decision and Negotiation, 17,* 403-420.

Reinig, B. A., Briggs, R. O., & Nunamaker, J. F. (2007). On the measurement of ideation quality. *Journal of Management Information Systems, 23,* 143-161.

Robins, R. S. (1960). Brainstorming re-evaluated. *Journal of Communication, 101* 147-152.

Rossiter, J. R., & Lilien, G. L. (1994). New "brainstorming" principles. *Australian Journal of Management, 19,* 61-72.

Rotter, G. S., & Portugal, S. M. (1969). Group and individual effects in problem solving. *Journal of Applied Psychology, 53,* 338-341.

Salazar, A. J. (2009). Functional group communication theory. In S. J. Littlejohn & S. Foss (Eds.), *Encyclopedia of communication theory* (pp. 417-421). Thousand Oaks, CA: Sage.

Seibold, D. R., McPhee, R. D., Poole, M. S., Tantia, N.E., & Canary, D. J. (1981). Argument, group influence, and decision outcomes. In G. Ziegelmuller & J. Rhodes (Eds.), Dimensions of argument: Proceedings of the second summer conference on argumentation (pp. 663-692). Annandale, VA: Speech Communication Association.

Steiner, I. D. (1972). *Group processes and group productivity.* New York, NY: Academic Press.

Steward, T. A. (1997). *Intellectual capital: The new wealth of organizations*. Garden City, NY: Doubleday.

Sutton, R. L., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly, 41,* 685-718.

Taylor, D. W., Berry, P. C., & Block, C. H. (1958). Does group participation when using brainstorming facilitate or inhibit creative thinking? *Administrative Science Quarterly, 3,* 23-47.

Wicker, T. (1990). *One of us: Richard Nixon and the American dream.* New York, NY: Random House.

Wittenbaum, G. M., Hollingshead, A. B., Paulus, P. B., Hirokawa, R. Y., Ancona, D. G., Peterson, R. S., Jehn, K. A., & Yoon, K. (2004). The functional perspective as a lens for understanding groups. *Small Group Research, 35*, 17-43.

Appendices

Appendix A

Table 3
Brainstorming Techniques

Technique	Author	Actions
Osborn's Technique	Alex Osborn (1957)	1. Above all else, groups focus on generating the highest number of ideas possible. 2. Group members should share all ideas, no matter how wild or outlandish they may appear. 3. No evaluation or judging of ideas should take place during the brainstorming session. 4. Group members should "piggy-back" on each other's ideas, or use previously suggested ideas to drive the generation of similar, related ideas addressing the same issue.
Task Requirements (Functional Theory)	Dennis Gouran & Randy Hirokawa (1983)	1. Show correct understanding of the issue to be resolved. 2. Members determine the minimal characteristics any alternative, to be acceptable, must possess. 3. Members identify a relevant and realistic set of alternatives. 4. Members carefully examine the alternatives in relationship to each previously agreed upon characteristic of an acceptable choice. 5. Groups select the alternative that analysis reveals to be most likely to have the desired characteristics.
Merged Technique	Alex Osborn (1957), Dennis Gouran & Randy Hirokawa (1983)	1. Show correct understanding of the issue to be resolved. 2. Members determine the minimal characteristics any alternative, to be acceptable, must possess. 3. Members identify a relevant and realistic set of alternatives. A. Above all else, groups focus on generating the highest number of ideas possible. B. Group members should share all ideas, no matter how wild or outlandish they may appear. C. No evaluation or judging of ideas should take place during the brainstorming session. D. Group members should "piggy-back" on each other's ideas, or use previously suggested ideas to drive the generation of similar, related ideas addressing the same issue. 4. Members carefully examine the alternatives in relationship to each previously agreed upon characteristic of an acceptable choice. 5. Groups select the alternative that analysis reveals to be most likely to have the desired characteristics.

Appendix B

Research Script:

Materials: In each folder will be two colored packets, one blue and one yellow.

Researcher*:* Hello, my name is Kyle Heuett, and I am a Ph.D. student in Communication Studies. Today you are going to participate in a group study about the improvement of Tennessee's campus.

If History Groups: Would you please get together with the group you have been working with this semester *(Should be 5 members in most groups, some may have 6).*

If Zero-History Groups: You should each have been assigned into a group of 4 or 5 members.

--Allow time for participants to get into groups--
OR
-- Confirm each participant has been assigned into a group—

After groups are formed, ask groups to send one member to the front to receive a folder for each group. Instruct groups not to open their folder until all group members have returned to their seat with the folder. After each group has a folder, proceed through the following instructions.

Researcher: In your folders will be a blue packet, a yellow packet. The blue forms explain the directions for this activity, the steps you will follow to brainstorm, and the topic to brainstorm about. Yellow forms are for recording your ideas and other thoughts. Please open your folder and read the BLUE forms together as a group, do not worry about the yellow forms yet. You have 5 minutes to read the blue forms only.

--Allow 5 minutes for participants to read blue forms together--

Researcher: Now that everyone is familiar with the activity and brainstorming topic, you have 15 minutes to brainstorming. Remember, follow the steps in your folder as closely as you can. If you have any questions raise your hand and I will come to your group. If you finish brainstorming early please wait until the 15 minutes are up.
If participants ask if each group has the same steps for brainstorming, researchers should answer that all groups have the same number of steps to complete.

--Allow 15 minutes for participants to brainstorm—
(researcher gives time updates at 5 minute intervals)

Researcher: 15 minutes is up. Please finish up what you are working on and return the blue and yellow forms to the folder. Once you have your folder back together please choose one member of the group to return it to me.

Make sure to thank participants upon return of materials, answer questions and dismiss participants to return to scheduled activities.

Appendix C

Directions: Your group will be participating in a brainstorming session and be asked to follow a specific set of rules. Each group has received a brainstorming folder; in this folder you will find a blue packet and a yellow packet. When instructed by the researcher, please make sure the group discusses each packet.

Each brainstorming folder has the following material:
1) The specific rules that your group should follow during the brainstorming session.
2) An issue that your group will be brainstorming about.
3) A sheet to record your ideas.
4) A sheet to record additional thoughts.

*Please keep all material together, when the group activity is complete please gather all materials into the manila folder, and return the folder to the researcher.

Appendix D

(Osborn)

Brainstorming Rules

Please follow these rules as strictly as possible during the brainstorming session. Read all rules completely as a group, and then move on to brainstorming according to this procedure:

1. The group should focus on generating the highest number of ideas possible.

2. All ideas should be shared, no matter how wild or outrageous they might appear.

3. Group members are NOT to evaluate or judge any ideas during the session.

4. Group members should piggy-back off one another's ideas. For example, if one member is sharing an idea that "clicks the light on" for another member, that member is encouraged to share their idea, even if it is similar.

Please follow the steps above to brainstorm on the question:

How can the University of Tennessee improve campus life for students?

Appendix E

(Functional Theory)

Brainstorming Technique

Please follow these rules as strictly as possible during the brainstorming session. Read all rules completely as a group, and then move on to brainstorming according to this procedure:

1. Make sure that all group members completely understand the brainstorming topic.

2. Generate as many ideas as possible about how to address the topic.

3. Create 3-5 evaluation criteria that can be used to evaluate good from mediocre ideas. (Example: Good ideas might be cost effective; or good ideas will be applicable to a large number of people where other ideas might have a limited scope).

4. Compare the ideas generated in step 2, to the criteria made in step 3 to narrow down the number of ideas.

5. Circle the one or two ideas that the group feels would best address the issue.

Please follow the steps above to brainstorm on the question:

How can the University of Tennessee improve campus life for students?

Appendix F

(Merged Technique)

Brainstorming Technique

Please follow these rules as strictly as possible during the brainstorming session. Read all rules completely as a group, and then move on to brainstorming according to this procedure:

1. Make sure that all group members completely understand the brainstorming topic.
2. Generate as many ideas as possible about how to address the topic.

To complete step two, follow these 4 rules when generating ideas:

a. The group should focus on generating the highest number of ideas possible.

b. All ideas should be shared, no matter how wild or outrageous they might appear.

c. Group members are NOT to evaluate or judge any ideas during the session.

d. Group members should piggy-back off one another's ideas. For example, if one member is sharing an idea that "clicks the light on" for another member, that member is encouraged to share their idea, even if it is similar.

3. Create 3-5 evaluation criteria that can be used to evaluate good from mediocre ideas. (Example: Good ideas might be cost effective; or good ideas will be applicable to a large number of people where other ideas might have a limited scope).

4. Compare the ideas generated in step 2, to the criteria made in step 3 to narrow down the number of ideas.

5. Circle the one or two ideas that the group feels would best address the issue.

Please follow the steps above to brainstorm on the question:

How can the University of Tennessee improve campus life for students?

Appendix G

Complete List of Ideas

Table 4

Complete List of Idea Frequency & Quality Scoring

Idea	Frequency	Quality Score
1. Increase the number of parking spaces	80	3
2. More variety of food on campus	35	4
3. Make UT a wet campus	31	3
4. Renovate old buildings as opposed to building new ones	28	2
5. Expand the number of stops on the T-bus system	27	2
6. Plant more trees on campus	22	4
7. Free student tickets to football games	22	4
8. Fix air conditioners in classrooms	16	3
9. Allow for VolCard to be used for purchases on the strip	16	4
10. Healthier food options on campus	15	4
11. Stop construction on campus	14	1
12. Reduce the price of parking passes	13	2
13. Decrease the price of textbooks	11	1
14. More green areas on campus (grass areas)	11	3
15. Decrease tuition	10	1
16. Expand wireless internet on campus	10	3
17. Renovate dorms	10	2
18. Retrain UTPD	9	2
19. Lower prices at POD markets	9	1
20. Free printing stations for students	9	2
21. Increase police presence on campus	8	3
22. More bike lanes	8	4
23. Repair sidewalks	8	4
24. Widen the strip to four lanes	7	3
25. More pedestrian bridges over busy streets	6	3
26. Escalator on the hill	6	1
27. Students use VolCard for purchases at sporting events	6	3
28. Better advisors	6	4
29. Do not require students to have a meal plan	6	3
30. More outlets in classrooms	6	3
31. Less construction during semester, more during summer	5	3
32. Offer more classes in each major	5	4
33. More study areas	5	4
34. More trash cans on campus	5	4
35. Start a campus clean-up initiative	5	3
36. Change the location of student seating at sporting events	5	3
37. Do something about the homeless people on/near campus	5	2
38. POD stores need to be more accessible	4	2
39. Build a waterslide on campus	4	1

Table 4 Continued

Idea	Frequency	Quality Score
40. Improve the student health center	4	2
41. More student jobs on campus	4	3
42. More outside study areas	4	3
43. Bring back some version of the “money wall”	4	2
44. Better landscaping	4	4
45. Free scantrons for exams	4	3
46. Tear down the statue on the pedestrian walkway	3	2
47. Renovate stairs on the hill	3	3
48. Give students golf carts	3	1
49. More student entrances at Neyland Stadium	3	2
50. More water stations outside	3	2
51. Covered walkways	3	1
52. More crosswalks	3	2
53. A park for students	3	1
54. More scholarship opportunities	3	4
55. Focus more on regular students and not only on athletes	3	3
56. Segway rentals	3	1
57. Better lighting in the fort	3	4
58. More bike rentals	3	4
59. More stable email	3	3
60. Let students know where tuition is going	2	4
61. Electronic tickets for sporting events	2	3
62. Lower the price of parking tickets	2	2
63. Build More Starbucks	2	2
64. Acquire a men’s soccer team	2	1
65. Get rid of all roads on campus	2	1
66. Free Slushie machines	2	1
67. More time between classes	2	3
68. No loose-leaf textbooks	2	2
69. Student houses	2	1
70. Picnic tables	2	3
71. Put a sauna in TRecs	2	2
72. Sleep pods on campus	2	1
73. Open grass field for student recreation	2	3
74. Chairlifts on campus	2	1
75. Require more office hours of faculty	2	4
76. Repave roads on campus	2	2
77. Make the architecture in buildings match	2	2
78. More funding for student clubs	2	3
79. Fishing from fountains on campus	1	1
80. Wishing wells on campus	1	1

Table 4 Continued

Idea	Frequency	Quality Score
81. Petting zoo	1	1
82. Free food for students	1	2
83. Require students to be involved with at least one club	1	3
84. Better system for teacher evaluations	1	3
85. Extend the hours the library is open	1	4
86. Allow food trucks on campus	1	2
87. Underground walkways for bad weather	1	1
88. Less traffic lights	1	3
89. Baseball porch for tickets only	1	2
90. Functional UT mobile application	1	4
91. All frat houses need roofs	1	1
92. Vending machines on each floor of dorms	1	3
93. Public skating rink	1	1
94. Dirt bike course	1	1
95. Student transportation provided to away sporting events	1	2
96. Make dorms co-ed	1	3
97. Less TA's more professors teaching classes	1	3
98. Less online homework	1	2
99. Remove Freshman dorm requirement	1	2
100. Get rid of One-Stop	1	1
101. More rocks for students to paint on	1	3
102. Expand TRec hours	1	3
103. Build a monorail on campus	1	1
104. Install moving sidewalks	1	1
105. More accessible farmers market	1	4
106. Put cafeterias in all dorms	1	2
107. Provide dorm room insurance	1	1
108. Plant orange and white flowers on the hill	1	4
109. Provide signs informing how full parking lots are	1	4
110. Classroom houseboats	1	1
111. Giant hot tub	1	1
112. Online courses included in tuition	1	2
113. Improve One-Stop	1	3
114. Install Gatorade fountains instead of water fountains	1	1
115. All professors be required to know how to use BlackBoard	1	3
116. Less booting of cars	1	1
117. Enforce 30 minute parking on campus	1	3
118. Make sure instructors know how to use clickers	1	4
119. More built in snow days	1	2
120. Open dining halls on the weekends	1	3
121. Put cameras in parking garages	1	4

Table 4 Continued

Idea	Frequency	Quality Score
122. More security boxes for emergencies	1	4
123. Increase use of social media by UT	1	4
124. Combine MyUTK and BlackBoard into one website	1	2

Appendix H

Directions: Please *rate your group* based on the statements below. **1 = strongly disagree, 2 = disagree, 3 = are neutral, 4 = agree, or 5 = strongly agree.**

1. Our group completed all of the steps in the brainstorming process outlined in our folder.

1 2 3 4 5

(R) 2. Our group was unable to complete one or more steps in the brainstorming process we were given.

1 2 3 4 5

3. The steps in our brainstorming process were completed fully.

1 2 3 4 5

*(R) indicates recoded item

Appendix I

Coding Guide for Idea Quality

Participants were asked to list as many ideas as possible about how the University of Tennessee could improve its campus. The following criteria are to be used to determine the quality score of each unique idea.

- An idea receives a score of 4 if it is easily implemented and if it solves the problem (eliminates unacceptable symptoms) completely without creating new unacceptable symptoms.

- An idea receives a score of 3 if it is easily implemented and would ease most symptoms considerably, but would not completely eliminate them or if it would be difficult to implement, but would completely solve the problem.

- An idea receives a score of 2 if it would be very difficult to implement and would solve some of the problem considerably but would not completely eliminate it, or if it is easily implemented, but would only have minor, marginal improvement in terms of solving the problem.

- An idea receives a score of 1 if it would be impossible to implement or if it does not solve any of the problem to any degree.

Vita

Kyle B. Heuett has been involved in various groups ranging from scout groups to sports teams throughout his life. As a participant in these groups Kyle garnered an interest in how groups perform, specifically how groups can perform well in one circumstance and relatively poorly in a seemingly similar circumstance. This led Kyle to pursue a research program centered on group performance and the process of group ideation and decision-making. Kyle's research interests include the study of barriers to group communication and the brainstorming process that groups engage in as part of a larger organization. In general Kyle's research reflects his own interest in learning more about the group processes that lead to successful group communication and performance.