EFFECTS OF GROUP INTERACTIVE BRAINSTORMING ON CREATIVITY

by

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Near Environments

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(ABSTRACT)

Corporations spend a great deal of time and money trying to facilitate innovation in their employees. The act of introducing something new, a product or service that is viable and innovative, is often increased by enhancing or nurturing creativity. Group interactive environments are perceived as enhancing creativity and, thus, believed to be important to management. Even though empirical evidence indicates that, for creativity, individuals perform better alone, group interactive brainstorming is still the technique most commonly used for enhancing creativity.

This experimental study investigated the effect of group verbally interactive brainstorming (social interaction) on creativity, not by comparing the number of ideas generated on a simple task in a brainstorming session, but by assessing creativity in the final product of a complex heuristic task. The purpose of this study was to compare the effect of group interactive brainstorming to individual brainstorming on individual creativity assessed in a final product.

The hypothesis which was tested in this study was that participation in group verbally interactive brainstorming prior to developing a design solution would not facilitate creativity in the final project more than individual brainstorming. Indeed, it was hypothesized that individuals brainstorming alone would produce more creative projects than individuals brainstorming in teams.

Participants were 36 interior design students in a FIDER accredited program at Virginia Tech. The Multidimensional Stimulus Fluency Measure (MSFM) was administered before beginning the experiment in order to determine individual differences in creativity. Subjects were randomly assigned to either a treatment group that participated in group verbally interactive brainstorming prior to developing a product individually, or a control group that participated in an individual brainstorming session. All subjects then created a

design project individually that was assessed for creativity by judges who were recruited from professional interior design organizations. Creativity was measured using the Consensual Assessment for Interior Design Creativity (Barnard, 1992). A post session questionnaire also was used to measure attitudes and perceptions of the subjects about the creative process.

Analysis of variance revealed no significant differences when creativity scores were compared between two brainstorming groups. That is, projects developed by interior design students did not differ significantly in creativity systematically between the two brainstorming techniques. When scores on the two dependent variables of secondary interest (novelty and appropriateness) were compared between groups they also did not differ significantly.

Responses to post-session questionnaires indicated that although students found it more difficult to generate ideas in a group, they still believed they would generate more ideas and preferred to generate ideas in a group rather than alone. However, when developing a project students preferred to work independently.

This study supports past research which suggests that group verbally interactive brainstorming does not enhance creativity. In this study, interactive brainstorming neither enhanced nor constrained creativity in the final product. The creativity scores were higher for those in the individual brainstorming condition, although not significantly so. This study also supports findings which indicate that people still believe they will generate more ideas in a group and that they prefer to generate ideas as a group.

DEDICATION

This is dedicated to my mother and father.

My mother taught me how to dream and to believe in myself. My father taught me about loyalty and how to see the world from a different perspective than others.
They made me realize that an education is a dream not available to everyone. Even though they did not have the formal education I have been priviledged to receive, I will always believe they were both smarter than I will ever be. Together they were quite a team.

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I am deeply grateful to my family for their unconditional love and support. My parents have always been "the wind beneath my wings". My children Jane-Kelli and Brian have encouraged me, surrounded me with laughter and the very best of times during this process. My sisters Barb and Jean who are kind, caring and gentle souls have always been there for me. The memory of my brother Donnie is always there for me too. I get the strength to be me from my family.

The joy of having friends who care is invaluable when things get difficult. I should thank the "steel magnolias" and honorary members Neal and Bob
who were there to pick me up when I needed it and Jeannie and Bill who have been my

cheerleaders for years. John Grable and Soyhun Joo were two other special friends who also helped me through the graduate school experience. All the students in the graduate office made the experience a joy. I am so grateful for Dove who was my friend, surrogate mother, and “keeper” during this journey. Jo Kerr your belief in me was the catalyst for this endeavor.

Finally, I would like to thank all those who participated in the data collection for this research. I appreciate the time and effort of Dr. Jeanette Bowker and Eric Weidegreen and the interior design students at Virginia Tech for the project creation sessions. I also would like to thank the judges for volunteering their valuable time to judge the projects for creativity.

Thank you Tom. You understood my motivation and encouraged me early in the pursuit of my dream.

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"Imagination is more important than knowledge." - Albert Einstein

CHAPTER I

Introduction

Creativity

"The history of civilization is essentially the record of man's creative ability. Imagination is the cornerstone of human endeavor... the reason for man's survival... and has caused him to conquer the world " (Osborn, 1957, p.vi). It is possible that the quality of our future depends, in large part, on innovative solutions to existing problems. An explanation of the previous statement lies in the evolution of memes. The cultural evolution of memes is an analogy to the biological evolution of genes. Memes are the units of information that are passed from one generation to the other for a culture to continue. Language, laws, and values are some examples of these memes. "It is these memes that a creative person changes, and if enough of the right people see the change as an improvement, it will become a part of the culture" (Csikszentmihalyi, 1996, p. 7). Therefore the evolution of culture depends, in part, on creativity. If creativity is a catalyst for cultural change, the cornerstone of human endeavor, and the reason for man's survival, the facilitation of creativity reaches importance on a global level.

When creativity is discussed generally, the element of novelty comes to mind; however, there are two major elements that are consistently a part of definitions of creativity. A creative solution to a problem is not just novel, it must also be appropriate. In accordance with the consensual assessment technique for judging creativity, developed by Amabile, creativity is the quality of products or responses judged to be creative by appropriate observers. Creativity may also be the process by which something judged to be creative is produced (Amabile, 1996). Therefore, creativity is both a quality present in a product and a process.

The descriptions used to understand and operationalize creativity in this study are based on descriptions in a book titled Creativity in Context (Amabile, 1996). In this book Amabile outlines a theory of social psychology for creativity, which is based on the research of others and her own research for the past 20 years. Amabile developed a theory of

social psychology in the hopes of providing a context in which social influences on creative behavior could be understood. She also describes a framework for the psychology of creativity which includes social psychology and outlines the contributions that social-psychological research can make to the understanding of the creative process. The social psychology of creativity is intended to be one working component of a comprehensive psychological theory of creativity. Therefore, the social psychology of creativity is not the answer to all questions; it should be integrated into a more comprehensive theory that includes personality traits and cognition (Amabile, 1996). Amabile's social psychology of creativity offers an appropriate framework for this study because this research seeks to answer a question about interaction, a social influence on creative behavior.

At the foundation of the social psychology of creativity is a componential model (Amabile,1996). Three components of creative performance in this model are domain relevant skills, creativity relevant skills, and task motivation. According to the componential model, domain relevant skills include knowledge, skills and talent related to a specific domain, and they have a direct correlation with creativity (Amabile, 1996). Knowledge of ergonomics, visual production, and mental imagery would be examples of domain relevant skills for the interior designer. Creativity relevant skills are the skills that make creativity possible. Some of the creativity relevant skills depend on personality traits and some, it appears, can be taught (Amabile, 1996). A cognitive style that allows one to understand complexities and think outside a pattern or paradigm, a knowledge of heuristics, and a conducive work style are examples of creativity relevant skills. Task motivation also plays a role in determining the quality of the creative response or product (refer to Figure 1 p. 19). Certain external constraints may negatively impact task motivation and certain types of extrinsic motivation may combine positively with intrinsic motivation (Amabile, 1996). Thus the extrinsic motivation or constraint found in the social and physical environments may support or constrain creativity. Therefore, environments encouraging interaction with others may support or constrain creativity.

Environments encouraging interaction with others or groups are pervasive in industry (Gibson, Ivancevich & Donnelly, 1994; Siau, 1995), and education (Benhamou, 1979). Employees are increasingly working in open offices, and open office designs have been

promoted as facilitating employee interactions (Shalley, 1995). Techniques for improving idea generation are continuing to be of interest to researchers and practitioners, and some consider that interaction might lead to mutual stimulation, learning, and synergy to produce new and valuable ideas (Valacich, Dennis & Connolly, 1994). Often interaction is used in hopes of facilitating creativity. Business executives complain that what business really needs are new ideas about how to stay competitive in a rapidly changing marketplace. They complain that teaching often falls short when it comes time to encourage students to generate another approach or new ideas for innovative and useful products and services. In other words, students are not learning how to be creative in a rapidly changing world (Sternberg & Lubart, 1995). If there is an interest in boosting the creative response in industry and if educators are interested in fostering creativity in students who will eventually work in industry, then a systematic investigation studying the influence of the social and physical environments seems appropriate. Does interaction support creativity? When and how does interaction support creativity? The identification of specific environmental factors that enhance creativity may allow us to better structure the organizational environment in order to facilitate needed creativity (Shalley, 1995). Thus, measuring the effect of interaction during brainstorming on the creative product may have an impact on how we structure environments to facilitate creativity. Interaction may have the effect of stimulating the production of new and useful services and products, or it may constrain the creative process resulting in a less creative product.

Group or Team Interaction

In recent decades, administrators and managers in many companies have adopted teamwork or a group interactive approach to task accomplishment and problem solving (Gibson et al., 1994). The old adage that two heads are better than one may be the prevalent attitude at the base of an interactive approach. Much office work is being accomplished in teams, committees, task forces, and project groups. When management is faced with a particularly important task, an interactive group likely will be assigned to perform it (Siau, 1995).

Sometimes the reason for encouraging interaction and teamwork is that one

individual cannot handle the complexity of the task or, other times a group interaction approach is used because management assumes that it will lead to a better quality product (Siau, 1995). Many times groups are expected to produce creative solutions, and often a creativity enhancing technique such as brainstorming is used to increase idea generation in the group (Gibson et al., 1994).

The interest in team work and interaction is not only realized in corporate organizations, but in academia as well. Teaching students to work collaboratively on group projects is a current trend on many college campuses. Participation in group projects is considered useful training because it not only allows the student an awareness of the cooperation needed to solve the problems in large scale projects, but it is also an activity in which they should expect to participate as practicing professionals (Benhamou, 1979).

In addition to useful training in preparation for the future, several other factors contribute to the formation of interactive groups. One factor contributing to collaborative efforts in academia may be the large amount of information currently available. The complexity of the nature of many problems today may require collaborative and cooperative work among specialists in particular areas (Benhamou, 1979). Motivation and productivity are words that are often linked to group work (Gibson, Ivancevich & Donnelly, 1994) which indicates that it could be a part of the human race against time that encourages some teamwork. Increasing motivation and productivity among workers should allow industry to meet closer deadlines and faster paced project schedules. For several different reasons society seems to be embracing the method of collaborative or group effort in the workplace and in education. Often the formation of verbally interactive teams is used to enhance creativity, as the brainstorming technique proclaims (Siau, 1995). However, idea generation is only one reason for forming task groups (Gallupe, Dennis, Cooper, Valacich, Bastianutti & Nunamaker, 1992).

Group Interaction and Creativity

The link between group interaction and creativity was popularized by Osborn when his book Applied Imagination was first published in 1953. Brainstorming is a group process of generating ideas in which there is no criticism (Aiken & Riggs, 1993). Osborn

claimed that interactive groups could generate more ideas than individuals working alone. He also claimed that the creative process involved two steps, idea generation and idea evaluation. In the idea generation step, the object is to produce the greatest number of ideas. According to Osborn, the more ideas that are generated in the first step, the more opportunity there will be to evaluate one as being useful in the second step of the creative process. Therefore, the brainstorming technique for generating ideas is one step in the creative process, and Osborn recommends group interaction for the facilitation of creativity. Group interaction in the brainstorming stage would arouse the interest of industry because of the importance placed on facilitating creativity.

Creativity is acknowledged to be an important part of doing business. The creative product attracts great interest because it is usually the visible and tangible outcome of the creative process (Slabbert, 1994). The creative product is often the source of profits and, consequently, a major reason for the survival of the organization. That is why industry invests a substantial amount of their profits in research and development for new products and innovation. The word “innovation” has become a key word associated with competition, survival, and product development (Abbey & Dickson, 1983). In response to the importance given to developing new and useful or creative products, different techniques believed to enhance creativity are being used by industry. Interactive brainstorming groups is one of the popular techniques being used to enhance idea generation in organizations and industry (Paulus, Dzindolet, Poletes, & Comancho, 1993). Siau (1995) reported that brainstorming is the most used group creativity technique.

Interior Design and Creativity

Innovation is important to business as a whole; however, innovation might be more relevant to the business of interior design because creativity is built into the definition of interior design by The National Council for Interior Design Qualification (NCIDQ).

The interior design profession provides services encompassing research, development, and implementation of plans and designs of interior environments to improve the quality of life, increase productivity, and protect the health, safety, and welfare of the public. The interior design process follows a

systematic and coordinated methodology. Research, analysis, and integration of information into the creative process result in an appropriate interior environment.

Creativity not only appears in the definition of interior design it is also indicated as a basic competency. The American Society for Interior Designers (ASID) and the Interior Design Educators Council (IDEC) members rated creativity as one of the top 30 competencies (29 on a list of 32) necessary for entry level design professionals (Myers, 1982).

Interior design educators (e.g., Portillo,1996) realize that activating interior design students' creative potential is essential to both growth and innovation in the profession. With the increasing awareness of barrier free design, fire and safety issues, legal and ethical liabilities, functional and aesthetic factors for working and living spaces, interior designers require a high degree of competency and creativity in order to solve interior design problems (Gardner & Weber, 1990). Barnard (1992) stated both definition and professional consensus include creativity as an essential competency for the interior designer. Thus, creativity is judged to be important in the education of future interior designers and in the practice of interior design by educators and practitioners.

Creativity is also considered to be an important part of the interior design product. The goal of research is to support "creative and innovative design ideas" that will improve the quality of people's lives (Hassell & Peatross,1991). The Foundation for Interior Design Education and Research (FIDER) is the organization responsible for accrediting post-secondary programs in interior design education in the United States and Canada (Hines, Abanese & Garrison, 1994). The recognition by FIDER of the need for creativity in interior design solutions is another indication of the importance of creativity in the design product (Dohr, 1982). Thus, it is indicated that both research and education should support creativity as a valuable part of the product in interior design.

The competency of creativity for the practicing interior designer is necessary to guide the course of interior design in the future. Cultural change occurs when the creative person changes the memes or units of information passed down from one generation to the next, and enough people see the change as an improvement, making it a part of the culture

(Csikszentmihalyi, 1996). Just as cultural change occurs from the creative transformation that receives approval and acceptance, so does the knowledge passed down in the domain of interior design change when the creative solution receives approval. The evolution of culture depends, in part, on creativity and, likewise, the evolution of the domain of interior design depends, in part, on creativity. Therefore, based on definition, professional consensus, product quality, and the future of the field, creativity is important to interior design.

The need for research in order to generate knowledge to support the profession should be a concern for both the educator and the practitioner (Dickson & White,1993). Representatives from interior design education, industry and practice participating in the Polsky Forum concluded that this lack of knowledge is threatening the existence of interior design as a profession (Dickson & White,1995). Therefore, representatives from interior design education, practice and industry have voiced a concern about developing a knowledge base for the profession of interior design, in order to support appropriate interior design solutions to current interior design problems.

The domain of interior design is making progress toward clarifying the knowledge base and perfecting the necessary skills specific to the domain. Self regulation through the use of FIDER for educational standards and the testing for minimal competency in the field through the NCIDQ (National Council for Interior Design Qualification) examination are two examples of this progress. The concern about defining the necessary domain specific skills and establishing minimum competencies is being addressed.

The next horizon to explore is the application of knowledge in an innovative, creative or inventive way. Creativity is as important as knowledge in interior design. Interior designers not only need to be fluent in their use of the skills such as drafting, rendering, and layout (Benhamou, 1979) they also need to possess the ability to be creative (Dohr, 1982). Discovering creativity relevant skills and creativity enhancing or facilitating techniques that prove to be valid is the complement to discovering and clarifying the domain specific skills. Both domain specific skills and creativity relevant skills are necessary when producing the creative product (Amabile,1996). Both are important to interior design education, practice, business, and to the direction for interior environments in the future.

The Problem

In response to the importance of developing new and useful or creative products, different techniques believed to enhance creativity are being used by industry. The use of group verbally interactive brainstorming (social interaction) to enhance creativity has been pervasive in industry (Gibson et al., 1994; Siau, 1995) and education (Benhamou, 1979). Although brainstorming is popularly perceived as an effective way of generating more ideas in a group, empirical evidence indicates that these verbally interactive groups have consistently produced fewer ideas than individuals working alone (Gallupe, Bastianutti & Cooper, 1991). Thus, industry and academia are using a technique to enhance creativity when empirical evidence does not support that claim.

Brainstorming may be misunderstood or misused. The success of brainstorming is often measured by the quantity of ideas generated about a simple heuristic task (Gallupe, Cooper, Grise, & Bastianutti, 1994). The idea generation stage is only one phase of the creative process. Therefore, only one phase of the creative process is being measured when the quantity of ideas is measured. Since the creative solution or product is often the source of profits or the catalyst for change, the success of group interactive brainstorming should also be measured by the creativity in the solution or product.

Because there is no published research in interior design to indicate that creativity in the solution to a design problem is facilitated by verbally interactive or group brainstorming, the present emphasis on group interactive brainstorming lacks credibility. The often used collaborative effort or interactive team approach to idea generation may not facilitate creativity in the product. If designers are to use team idea generation work styles in their practice and educators are to use a team idea generation technique in their program of instruction in an effort to enhance or facilitate creativity, should this technique be group verbally interactive brainstorming? Measuring group interactive brainstorming by creativity assessed in the solution to the design problem may capture the effect on the creative solution. The attempt to enhance or facilitate creativity in the product by using interactive brainstorming in the idea generation stage needs to be investigated and measured in

relation to the creative product to examine whether this is an effective technique to enhance creativity and improve the creative product.

The Purpose of This Study

The primary purpose of this study was to compare the effect of prior group verbally interactive brainstorming to individual brainstorming (independent variable) on the creativity (dependent variable) assessed in a solution to a design problem.

The Significance of the Study

Amabile (1996) theorized that the social and physical environments may support or constrain creativity. Thus, the identification of specific environmental factors that enhance creativity may allow us to better use the social and physical environment to facilitate creativity (Shalley, 1995). Measuring the success of group interactive brainstorming by assessing the final product rather than the quantity of the ideas produced in response to a simple task changes the focus of research. It aligns the research emphasis with the emphasis of industry, i.e., the creative product. By changing the dependent variable to the creativity assessed in the solution to a complex problem, research provides a more direct measure of the creative product, which may be the agent of change for society. By assessing the effect of socially interactive brainstorming as a creativity enhancing technique, we will discover new implications for how to better manage interactive teams or the social and physical environments to facilitate creativity. This research has implications for the structure of the organizational environment. It could also lead to the development of a better approach to creativity and verbally interactive groups in educational programs.

The Research Question

Does group verbally interactive brainstorming prior to individual development of a solution to a design problem have a greater effect than individual brainstorming on creativity assessed in the product?

The Hypothesis

According to Ward (1969) creative children use their environments more than less creative children for clues to problem solving. A “cue rich” or rich environment is one in which there are many cues to possible responses, i.e., objects and pictures that might suggest responses to the task at hand. Conversely a “cue poor” environment would have relatively few cues to possible responses (Ward, 1969). Assuming that the public perception that interactive brainstorming offers a richer environment is correct, this finding suggests that creative individuals may profit more from participating in an interactive brainstorming session than less creative individuals. Correspondingly, creative individuals may be expected to produce more creative products after participating in an interactive brainstorming session than creative individuals working alone or less creative individuals, whether they participate in a verbally interactive brainstorm session or work alone. If empirical evidence, which indicates that people generate more ideas alone than in verbally interactive groups, is correct, then creative individuals working alone may be expected to produce more creative projects. Contrary to popular perception, verbally interactive groups would not enhance creativity.

In the associative interpretation of the process of creative thinking, Mednick (1962) suggests the greater number of associations an individual has about the elements of a problem, the greater the probability he has of finding a creative solution. Thus, according to the associative interpretation of the creative process, if group interactive brainstorming reveals new ideas to an individual, those new ideas would enhance the probability of a creative solution. Therefore, those individuals participating in an interactive brainstorming session, if exposed to new ideas, should produce more creative products. The

associative theory also makes a link between individual differences and environmental influences. Therefore, an interaction may occur between individual differences in creativity and the environment in which the creative process takes place.

The work of Mednick and Ward suggests that a richer environment has a positive effect on creativity, and more creative individuals benefit more from richer environments than less creative individuals. Possible outcomes could be hypothesized based upon the work of Mednick and Ward in conjunction with the assumption that group interactive brainstorming environments supply a greater number of ideas to the participants. However, there is a disparity between the popular perception and empirical research. Recall that brainstorming is popularly perceived as an effective way of generating more ideas in a group (Gallupe et al., 1991), however, empirical evidence indicates that these verbally interactive groups have consistently produced fewer ideas than individuals working alone (Gallupe et al., 1991; Paulus et al., 1993; Siau, 1995; Stroebe, Diehl, & Abakoumkin, 1992). Therefore, group verbally interactive brainstorming would not enhance creativity. Further, if individuals working alone produce more ideas than individuals participating in group interactive brainstorming, the environment may be richer to those who generate ideas alone. If this is the case, those individuals working alone in the brainstorming sessions will produce more creative products. Further, those individuals who are more creative will produce more creative products after generating ideas alone than creative individuals participating in group interactive brainstorming or less creative individuals generating ideas alone. The creative individuals will produce more creative products working alone than creative individuals participating in group interactive brainstorming or less creative individuals, whether they participate in the group interactive brainstorming sessions or work alone. That is, there will also be an interaction between individual differences and the treatment effect (group or individual brainstorming).

The possibility that one could be exposed to ideas from the interactive group that would not have been generated from brainstorming alone may again lead to the assumption that the interactive brainstorming environment is a richer environment. However, empirical evidence would indicate that people who interact with others may not generate as many ideas themselves as they would alone. Therefore, the number of

possibilities would be reduced by verbally interactive brainstorming. Thus, participation in verbally interactive brainstorming would not enhance creativity.

"To the extent that the present experiment can be generalized, it must be concluded that group participation when using brainstorming inhibits' creative thinking" (Taylor, Berry & Block, 1958). If group participation in brainstorming inhibits creative thinking, then individuals brainstorming alone should produce more creative projects. Participation in verbally interactive brainstorming would not enhance creativity.

Other factors could possibly effect the results of this study. Success of the brainstorming technique is often measured by number and quality of ideas generated (Furnham & Yazdanpanahi, 1995; Gallupe et al., 1994; Paulus et al., 1993; Stroebe et al., 1992; Szymanski & Harkins, 1992). The task used is often a simple task such as, generating as many different uses as possible for a shoelace, a spoon, or a pencil (Price, 1993; Szymanski & Harkins, 1992; Thompson, Chaiken, & Hazelwood, 1993; Wright & Kacmar, 1994). This study changes the measurement of success for group interactive brainstorming from the number and quality of ideas generated to the creativity assessed in the product and the task from a simple to a complex heuristic one (creating and producing a three dimensional design which communicates a concept inspired by viewing a slide of a three dimensional space). This study also uses group interaction only in the idea generation phase of the creative process, and measures the performance of adult subjects instead of children. In addition, this study is domain specific for interior design.

The hypothesis which was tested in this study is that participation in group verbally interactive brainstorming prior to developing a design project will not facilitate creativity and indeed even inhibit the measured creative thinking of those who participate. Those subjects who participate in group interactive brainstorming prior to developing an interior design project individually will produce less creative projects than those who brainstorm alone and then produce an interior design project individually.

Chapter II

Review of Literature

Creativity and the Social Environment

Some creativity enhancing techniques are directed at improving the individual from within, while other techniques are aimed at improving the environment in which the individual performs. Changing conditions in the environment to influence creativity is referred to as the social facilitation or inhibition of creativity. Are group interactive environments, which are an important part of the workplace management style, classroom education, and the field of interior design, facilitating or inhibiting creativity? Since the group approach to idea generation and project development is prevalent (Siau, 1995) and the need to be creative in the development of solutions to design problems is vital (Portillo, 1996) the use of this group approach to brainstorming should be facilitating creativity.

"Social facilitation research has shown that the mere presence of others - either as coactors or as an audience - can impair performance on poorly learned or complex tasks, but enhance performance on well learned or simple tasks" (Amabile, 1996, p.181). If creative responses are new or unusual, the answers would not be well learned or programmed responses, they would be novel; therefore, the creative response may be inhibited by the mere presence of others. Accordingly, idea generation or brainstorming in groups with others present as co-actors or an audience would impair performance. Perhaps since idea generation is only one stage in the creative process, the phase of the creative process that requires idea generation or brainstorming should occur in groups and then individuals should
complete the creative process alone. Perhaps idea generation or brainstorming, one phase of the creative process, should not occur in groups; the presence of others might impair creative performance. The research is unclear.

Framework for the Study

Amabile has developed a social psychological theory of creativity published first in 1983 and updated in 1996. Her purpose was to lay a foundation for research about how the social environment influences creativity. Much research in the past has been done in identifying personality traits which are known to influence creativity (Amabile,1996). Other research has been done with cognitive skills. The cognitive skills necessary for creativity may be changed, but, over a period of time. “It is easier to enhance creativity by changing conditions in the environment than trying to make people think more creatively” (Csikszentmihalyi, 1996). The environment can be changed easily, and it has an impact on creativity (Amabile,1996). Identifying factors in the environment that enhance creativity may lead to a more expedient approach to facilitating creativity.

Amabile believes that, in the past, the psychological study of creativity was hampered by narrowly focused research of a single theoretical concern. She further explains that some of the single theoretical concerns focused on in research have been the distinctive personality characteristics of creative people, the special cognitive abilities associated with creativity, or the social environments that hinder or foster creativity. According to Amabile, research on creativity done with a single focus, no matter how valid, has fragmented the theoretical base for research in the psychology of creativity (Amabile, 1996). Her componential model was intended to be a comprehensive theory of creativity, a context in which the construct of creativity could be examined.

Figure 1 shows the components of creative performance and Figure 2 shows the componential model of creativity.

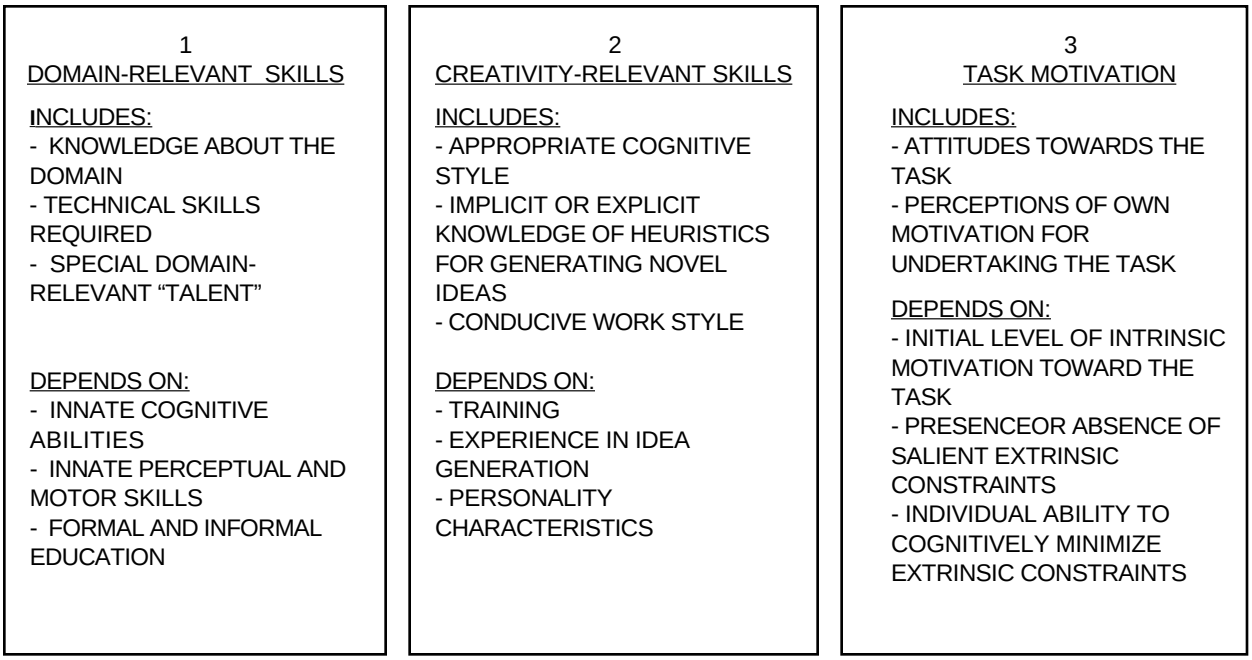


Figure 1. Components of Creative Performance

Note. From Creativity in Context by Teresa M. Amabile , 1996, Boulder, CO: West View Press Inc.

The Components of Creative Performance

In the componential model three components are necessary for creative performance: domain relevant skills, creativity relevant skills, and task motivation (refer to Figure 1). What is possible for an individual to accomplish is equal to the level of his or her domain relevant skills and creativity relevant skills. What an individual will attain is equal to domain relevant skills and creativity relevant skills in concert with intrinsic or task motivation levels (Amabile, 1996).

Domain relevant skills, the first of three components in Amabile's model, are the basis for performance in a given domain. For example, in the "domain" of interior design some domain relevant skills would be interior design skills such as drafting, rendering, knowledge of codes, and interior materials. There is a high correlation between creativity and proficiency in domain relevant skills (Amabile,1996). This component encompasses knowledge of facts, issues, opinions, principles, paradigms, methods for solving problems, and aesthetics relevant to the specific domain. This set of skills depends on the innate capabilities of the individual and his or her formal and informal education. Domain skill knowledge will allow for good or appropriate performance; however, a great deal of domain skill knowledge does not insure creativity (Amabile, 1996). Therefore, more than skills and knowledge are necessary to produce the creative solution.

Creativity relevant skills comprise the second component in the model. Creativity relevant skills are the skills that make creativity possible. This component consists of a cognitive style that includes the ability to understand complexities and to "break set" or do the unexpected or choose the uncharted path when problem solving. A knowledge of heuristics is also valuable. A definition for heuristics is a method used to reduce the search for an answer. An example of a heuristic for creativity would be, one set forth in the creativity enhancing technique of synectics, "Make the familiar strange" (Gordon, 1968). This heuristic is the act of taking a familiar entity and placing it in an unfamiliar framework in order to get new and very different insights into a problem. A heuristic is used to hasten the novel idea or solution. It might be as simple as turning a picture or floorplan upside down in order to see it in a new way. A work style that supports creativity is the third element, and personality

traits that are associated with creativity is a fourth element in this component. Intrinsic motivation is a factor that plays a prominent role in Amabile's framework. Some of these creativity relevant skills are personality traits and some, it appears, can be learned. Some examples such as fluency, flexibility, risk-taking, originality, and playful exploration may respond favorably to training (Amabile,1996). Therefore, if some of these skills can be learned, the creativity relevant skills are not all innate, and they can be improved or enhanced.

Task motivation is the third component of this model. Motivational variables determine an individual's approach to a given task, and within the componential model task motivation is composed of two elements. An individual has a baseline motivation for the task. This motivation comes from within and may be categorized as a personality trait motivation. The second type of task motivation is the individual's perception of why he or she engages in the task in a specific instance. The baseline attitude can be discovered when the individual involved assesses how well the task matches his current interests (intrinsic motivation). The individual's perceptions of why he or she engages in a task in a specific instance are largely dependent upon extrinsic social and environmental factors (extrinsic motivation). This is the state of his or her motivation level in a given instance. Engaging in the task for the sake of being involved with the task is intrinsic motivation. The level of task motivation is the baseline motivation which varies indirectly in relation to the extrinsic motivation. A theory within the social-psychological framework is that extrinsic controls serve to inhibit creativity and intrinsic motivation serves to facilitate creativity (Amabile, 1996). Thus, according to this theory it would be important to maximize intrinsic motivation and minimize extrinsic motivation when the creative response is desired.

These three components of creative performance are a part of the Componential Model of Creativity shown in Figure 2. Amabile relates these three components to five stages of the creative process in her model.

The Temporal Componential Model of Creativity

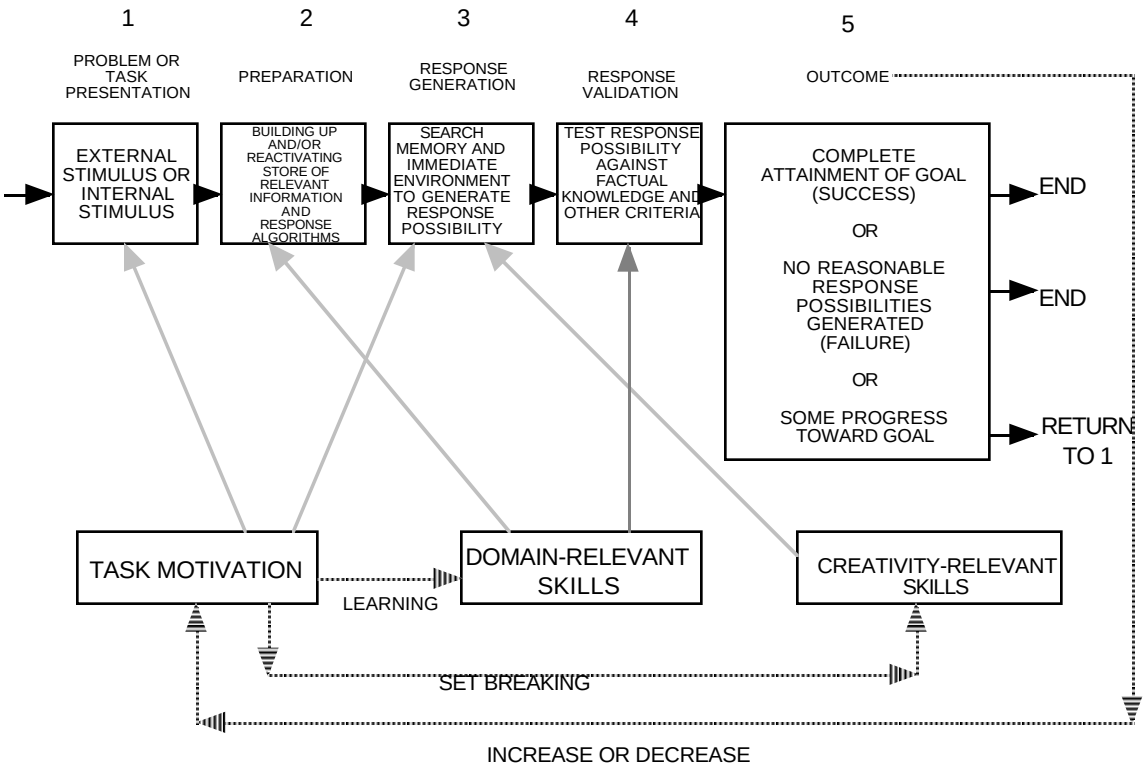
The temporal componential model of Amabile's theory could be verbally represented by describing five stages of engagement in a task. Figure 2 shows the

componential framework for creativity. Figure 3 shows the revision of the componential model. The first stage of engagement in a task is the presentation of the problem or task, and task motivation is influential in this stage. Amabile revised this to state task identification instead of task presentation. Stage number two is preparation. Domain specific skills have an influence here. The third stage is response generation, and both task motivation and creativity relevant skills play a part in this stage. The fourth stage is response validation and domain specific skills enter into the decision of appropriateness in this stage. Amabile revised this stage to include communication along with validation. The fifth stage is the outcome and at this point the decision making in stage four is judged as successful, a failure, or some progress toward the goal. If success or failure is the judgment, then the temporal model ends. If some progress is assessed, then there is a return to stage one to reengage in the task or problem. A major revision of the model was the inclusion of social environments as a direct influence on task motivation (see Figure 3). All three components of the model - creativity relevant skills, domain specific skills, and task motivation - must be present in some level for creativity to take place, and the levels of each of the three components will determine the level of creativity.

The definitions of creativity, the dependent variable, for this study will be taken directly from the social-psychological framework. For definitions of creativity and other definitions related to brainstorming, the independent variable, and other variables related to this study refer to Appendix A.

Figure 2. Componential framework of creativity. Broken lines indicate the influence of particular factors on others. Solid lines indicate the sequence of steps in the process. Only direct and primary influences are depicted here.

Note. From Creativity in Context by Teresa M. Amabile, 1996, Boulder, CO: West View Press Inc.



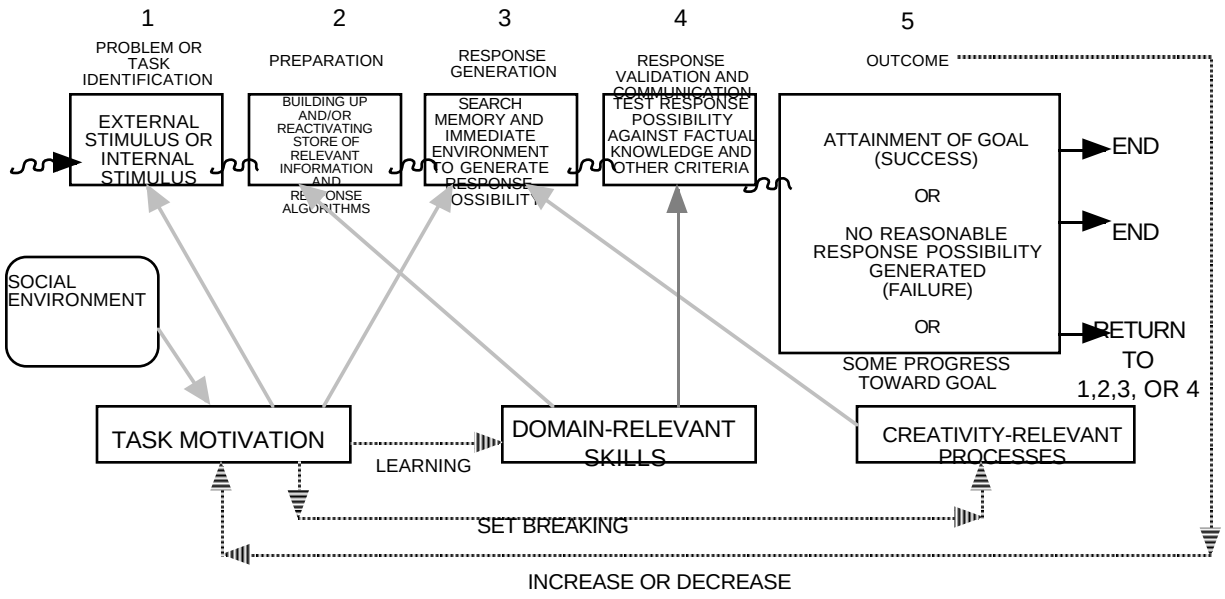


Figure 3. Revision of the componential framework of creativity. Broken lines indicate the influence of particular factors on others. Wavy lines indicate the steps in the process (where large variations in the sequence are possible). Only direct and primary influences are depicted.

Note. From Creativity in Context by Teresa M. Amabile , 1996, Boulder, CO: West View Press Inc.

The revision of Amabile's componential framework of creativity includes the addition of another primary influence, the social environment. Although the social environment is depicted as being a direct primary influence on task motivation, it is also an influence on the third stage of the creative process, response generation, through the impact on task motivation. Response generation is described as a search from memory and the immediate environment to generate response possibilities. The immediate environment would include both the physical environment and the social environment. Therefore, the social environment, whether interactive or non-interactive may also impact the response generation stage. Consequently, the use of group interaction in an effort to enhance the social environment and thereby facilitate creativity during the response generation stage, popularly referred to as brainstorming, may have an effect on creativity. The effect of group interactive brainstorming on creativity is the focus of this research.

Brainstorming

The link between group interaction and creativity was popularized by Osborn (1957) when his book Applied Imagination was published. His employees participated in the first brainstorming sessions in 1939, and then coined the word brainstorming, which is still being used today. Osborn claimed, and others support his claim that interactive groups could generate many more ideas than individuals working alone.

The first test of Osborn's claim that groups could generate more ideas than the same number of individuals working separately was done by Taylor, Berry, and Block (1958). They defined individuals working alone (with the results of the individual work added together to equal the number of interacting group members for comparison) as a nominal group (Dennis et al.,1993; Taylor et al., 1958). Working separately is still referred to as nominal groups. Much research has been done comparing verbally interactive groups to nominal groups when brainstorming; however, those studies have not confirmed Osborn's claims that interactive groups could generate many more ideas than individuals working

alone. Empirical research has indicated that individual or nominal group brainstorming is more effective than verbally interactive brainstorming groups. A study done by Paulus, Larey and Ortega (1995) supported the findings of Taylor, Berry and Block (1958) who were the first to do research and claim that nominal brainstorming was more productive than group verbally interactive brainstorming. Diehl and Strobe (1987) in a study on production loss in brainstorming groups also replicated the results of Taylor, Berry and Block (1958). "The most prominent group creativity method is undoubtedly, brainstorming. For the past thirty years, however, a sizable body of empirical data has indicated the failure of verbal brainstorming to live up to its apparent promise" (Siau, 1995, p. 213). Therefore, in spite of the popular use of brainstorming to enhance creativity, empirical evidence has shown that individual brainstorming is more productive than the group interactive brainstorming method. Because of the emergence of this disparity between the early claims made by Osborn about group creativity and the subsequent empirical evidence, studies are still needed to understand the reasons for this disparity.

Why are two heads not better than one? More than one phenomenon has been identified to explain the reasons for the failure of group interactive brainstorming to produce more ideas than nominal brainstorming. Three phenomena (social loafing, evaluation apprehension, and production blocking) were discussed by Gallupe and collegues (1991) in a study on unblocking brainstorming. One of the phenomena called "social loafing" was explained by Gallupe. As Gallupe notes, individual effort when participating in a group is not as readily identifiable and group participants do not perform as well when their individual efforts are not identified. Social loafing may inhibit the number of ideas generated because individual efforts are not identified in group brainstorming.

If effort can be identified, it can be evaluated. However, identifying and evaluating individual effort also may be problematic. Research has suggested that expecting evaluation can have a negative impact on intrinsic motivation and creativity (Amabile, 1996). Experimenter evaluation, coactors evaluation, or self evaluation in group brainstorming are potential explanations for that finding. When Shalley (1995) investigated evaluation with a creativity goal it actually increased creativity. Results from a study done by Szymanski and Harkins (1992) to examine self evaluation demonstrated that the potential for self evaluation

was an inhibitor for creativity (9.3 = M) and a facilitator for productivity (29.7 = M). These results reinforced earlier findings by Bartis, Szymanski, and Hawkins in 1998, that the potential for experimenter evaluation increased the number of responses while the lack of evaluation potential facilitated creativity or quality of ideas (Szymanski & Harkins, 1992). The problem of social loafing without identifying individual efforts, decreases productivity, or adding evaluation adds the problem of possibly inhibiting creativity. Consequently, social-psychological influences sometimes increase productivity and stifle creativity.

Another phenomenon that has been tested for the effect on group verbally interactive brainstorming is "evaluation apprehension", which occurs when people working in verbally interactive groups withhold ideas because they fear that others will find the idea of no worth (Gallupe et al., 1991). When members of a group cannot interject their ideas anonymously evaluation apprehension is likely to affect the input. Results from a study done with electronic brainstorming, (50 =M) where members

reported less evaluation apprehension than those in non-electronic brainstorming, (39.8 = M) indicate that the generation of ideas goes up when the ideas are entered anonymously. It was suggested in this study that evaluation apprehension had a negative effect on the performance of the verbally interactive group and the effect grew as the group size grew (Gallupe et al., 1992). Therefore, when more people are added to the group, fewer ideas are generated per person. Also, this indicates that when evaluation apprehension is removed from group brainstorming, the negative effect is lessened.

"Production blocking" occurs when one member of an interactive group gets an idea and someone else is talking, thereby blocking the attempt to enter that idea. Several studies using an electronic technique (computer networking) for brainstorming, which does not require verbal interaction, have discovered an increase in the number of ideas generated due to the loss of production blocking. Production blocking is deemed responsible for some of the poor performance of verbally interactive brainstorming groups when compared to nominal brainstorming groups (Dennis &Valacich,1992; Gallupe et al., 1991; Gallupe et al., 1994; Valacich et al., 1994). First, empirical evidence indicates that fewer ideas are generated in group verbally interactive brainstorming than individual

brainstorming. Second, research has identified reasons for the decrease in the number of ideas produced in a group.

Despite the empirical evidence that group interactive brainstorming is less productive than nominal brainstorming, group interactive brainstorming is still perceived as being more productive. Since 1958 when Taylor, Berry, and Block first rejected Osborn's claim that group interactive brainstorming could double the number of ideas the average person could think of alone, research has consistently replicated findings that suggest a rejection of his (Osborn's) claim (Furnham & Yazdanpanahi, 1995). Gallupe, Bastianutti and Cooper (1991) stated that more than half of the published studies showed that interactive groups of four or more produced significantly fewer ideas than nominal groups.

Group brainstorming remains a popular technique in industry. Most individuals believed they would generate more ideas in a group than alone. People take credit for a disproportionate amount of the brainstorming ideas when they are generated in an interactive group (Paulus et al., 1993). People who generate ideas in a group have difficulty distinguishing their ideas from others (Strobe et al., 1992).

Perceptions of brainstormers in an organizational setting were no different. Although results were consistent with the past and group brainstormers generated only about half of the number of ideas as a similar number of individuals or nominal groups, people believed they would be more effective in a group than alone (Paulus et al., 1995). In one study, for example, electronic and non electronic brainstorming and nominal and interactive groups were compared. Electronic groups were more productive ($M = 51.6$) than interactive groups ($M = 42.5$) when number of ideas generated was measured. However, interacting groups felt better (more satisfied and more confident in the quality of their ideas) about their idea generating process than non interacting groups. When interacting groups were compared with nominal groups interacting groups felt they were more comfortable, more motivated, had greater opportunity to express ideas, and had more ideas than they actually expressed (Gallupe et al., 1991). This "illusion of group effectivity" refers to the belief that groups can stimulate creativity. Therefore, even though the research is clear and much has been replicated, a prevalent perception about the productivity of interacting groups continues. What is the difference between interactive groups and electronic groups?

When comparing verbally interactive groups to electronic groups the face to face verbal interaction is replaced with an interaction with ideas (words) generated by others which appear on a computer screen.

Electronic brainstorming is a new technique used for brainstorming. Computers are networked so that the ideas of the group members can be entered from one participant's computer and shown on the screens of other group members. The ideas can be entered anonymously and simultaneously; however, visual access to the ideas of others is maintained via the computer screen. The ability to enter ideas anonymously may remove evaluation apprehension and production blocking, two reasons suspected for decreased idea generation in face to face verbally interactive brainstorming. The research with the group electronic brainstorming technique indicates that the electronic brainstorming (EBS) groups outperform (in terms of number of ideas generated) the verbal groups, and the performance difference grows as the group size grows (Aiken & Riggs, 1993; Dennis et al.,1993; Gallupe et al.,1994; Gallupe et al.,1991; Valacich et al., 1994; Gallupe et al., 1992). Computer-based groups also outperformed the nominal groups (Valacich et al.1994). An idea emerging from an article published in a recent research journal suggested that although a group using EBS outperforms (number of ideas generated) both verbal and nominal groups, this EBS group might not be a "group," but a collection of individuals who interact with an evolving set of ideas rather than with other individuals (Nagasundaram & Dennis, 1993). Therefore, idea generation is facilitated not by the interaction with others, but by exposure to the ideas of others. This could simply be considered a "cue-rich" environment (Ward, 1969). Because of this research, can we say that a cue rich environment is a facilitator and that verbal interaction with others is an inhibitor? Strobe, Diehl, and Abakoumkin (1992) found that even though group members were consistently less productive than individuals who worked alone, they felt facilitated by the presence of others, enjoyed the experience more, and were more satisfied with their performance. Perhaps the subjective feelings of satisfaction that arise from working with others has a greater impact on the final product than the number of ideas generated in conjunction with other's ideas on a computer screen. This feeling of subjective satisfaction with face to face interaction vs. an interaction with the ideas of others on a computer screen in relation to

creativity assessed product might warrant investigation.

Measures of Creativity

Many studies of brainstorming or idea generation have several different measures of creativity. Some that have been used are number of non-redundant ideas, number of superior responses, a rating on the quality of the ideas (Stroebe et al., 1992) percentage of superior responses; a creativity production rate; and a self rating of imaginativeness (Furnham & Yazdanpanahi, 1995). Many studies have measures that are based on number of ideas generated (Szymanski & Harkins, 1992; Gallupe et al., 1994). Some of these studies that use number of ideas as a measure label the results under the word "productivity" (Paulus et al., 1993). However, productivity is different from creativity as evidenced in the study done by Szymanski and Harkins (1992) which revealed that evaluation increased productivity while it inhibited creativity. Subjects when given a self evaluation/creativity directive were less creative than when a no self evaluation/creativity directive was given and the quality of ideas generated was measured. Subjects who were given a self evaluation/numbers directive produced significantly more ideas than those given a no self evaluation/numbers directive and the number of ideas was measured. Therefore, productivity was enhanced by self evaluation and creativity was negatively impacted by self evaluation. Another creativity measure that has been used less often is the "consensual assessment" technique or expert judges ratings of creativity (Shalley,1991). Measurements that count the number of ideas generated in a brainstorming session may give rise to different results than the assessment of the final product. Using the number of ideas generated is only one way to measure the success of brainstorming. Therefore, another important measure for the success of brainstorming is the creativity assessed in the final product.

Creativity Tasks

Tasks that are often used in research about brainstorming are simple heuristic tasks (Szymanski & Harkins, 1992; Gallupe et al., 1994). Generating uses for an object is a common task assignment. Examples of the objects used are a knife, a detached doorknob,

a paper clip, an empty soda can, a shoelace, and a pencil (Szymanski & Harkins, 1992; Thompson et al., 1993; Price, 1993). Solving five letter anagrams was another simple heuristic task that was used (Wright & Kacmar 1994). Research on social facilitation of creativity has indicated that the presence of others - either as coactors or as an audience - can have a negative impact on performance of poorly learned or complex tasks; however, they may enhance the performance on well-learned or simple tasks (Amabile, 1996). Design problems and their solutions are multifaceted or complex heuristic tasks. Therefore, research should include the more complex heuristic task because the results may differ from the simple task.

There are conflicting opinions among researchers about the effect that the presence of others will have on creativity (Amabile, 1996). On a simple heuristic task no significant difference was found in the performance between individuals and participants whose efforts are pooled to form a group product (Amabile, 1996). Price did research with motivation and group effects and when the motivation arousal level of the subjects was reduced coactive working conditions produced higher performance than the low motivation collective working conditions (Price,1993). When social and contextual factors, which have been theorized to significantly influence creativity, were examined by Shalley (1995), she found that the highest creativity happened when individuals worked alone with a creativity goal and they expected to be evaluated. Thus, evaluation, when informational, with a creativity goal will facilitate creativity (Shalley, 1995). Shalley (1991) also found that a given creativity goal facilitates creativity, but depresses productivity, and a productivity goal depresses creativity. That is, when anything socially or contextually diverts attention from the task, it will be detrimental to creativity. Therefore, in some instances there were no differences in creative performance levels when in the presence of others and in other studies there were differences in creativity when subjects worked alone, or in coactive, or interactive environments. The level of motivation may have an impact on the creative response when in the presence of others. Also the type of task may have an effect when working in the presence of others. It would appear that motivation, the type of task, the type of goal assigned, and the type of evaluation may all influence the creative response during group interaction. These factors and others, not mentioned and perhaps not yet discovered, may

have an influence that would result in the conflicts in the literature about groups and creativity. These conflicts are yet another reason to pursue research in this area.

Summary

Much of the research done with group creativity has been done under the topic of brainstorming. Brainstorming research often covers only one stage of the creativity process, specifically, idea or response generation. Research done on verbally interactive group performance indicates that individuals or nominal groups perform (in terms of number of ides generated) better than verbally interactive groups (Taylor et al., 1958; Paulus et al., 1995). However, there is a prevalent use of verbally interactive groups in task assignment, both in organizations and industry (Paulus et al., 1995; Siau, 1995). Studies have identified production blocking, social loafing, and evaluation apprehension as major reasons why verbally interactive groups consistently do not perform as well (number of ideas generated) as nominal groups or individuals (Gallupe et al., 1991; Szymanski & Harkins, 1992; Gallupe et al., 1992). However, research also indicates that there remains a perception by participants that they are performing better in verbally interactive groups (Paulus et al.,1993; Stroebe et al., 1992). Recent studies examining brainstorming have used an electronic technique (EBS). EBS techniques involving the use of the computer have improved group performance when the number of ideas generated is measured. With this technique EBS groups outperform verbally interactive groups and nominal groups (Aiken et al., 1993; Dennis et al., 1993; Gallupe et al., 1991; Gallupe et al., 1992; Gallupe et al., 1994; Valacich et al., 1994). Although using electronic brainstorming techniques improves the group performance, the question has been raised whether EBS groups qualify as interactive groups or are simply a collection of individuals who interact with an evolving set of ideas rather than with other people (Nagasundaram & Dennis, 1993). Thus, the studies using EBS techniques could be testing a “cue-rich” environment (Ward, 1969), rather than a socially interactive environment.

The measures used for determining brainstorming success have often been based on the number of ideas generated (Strobe et al., 1992). Yet, idea generation may be but

one step in the creative process; however, the number of ideas generated in one stage of the creative process is labeled creativity. Amabile (1996), for example, identifies five different steps in the creative process: problem identification, preparation, response generation, response validation and communication, and finally the outcome.

In industry as well as academia often the main concern is the creativity in the final product. The natural next question is: what happens after the ideas are produced (Gallupe et al., 1994)? Amabile defines four other stages to complete the creative process. Shouldn't researchers be using a measure of the final solution or product instead of or in addition to the number of ideas generated? Should studies be designed in order to separate the measures of productivity and creativity because they are not the same thing? Should the type of task be changed? Tasks used in research projects with group creativity are often simple heuristic tasks. Most projects in interior design are multifaceted complex tasks. Since the tasks in interior design are often more complex, shouldn't interior design studies be measuring the complex heuristic task? Should the measurement for creativity be taken beyond the measurement of ideas generated and test for creativity in the final product? The final product is, after all, the result of the creative process.

Within the literature and in industry, inconsistencies between empirical research and prevailing ideas about the effect of group verbally interactive brainstorming are pervasive, frequent, and repetitive without resolution. Research indicates people brainstorm better alone; however, industry uses the approach that brainstorming is better when done as a group. The uniformity of successive results in empirical research which indicate that verbally interactive brainstorming does not enhance creativity has not had an effect on public perceptions and events in industry. In other words, industry continues to use verbally interactive brainstorming in an effort to enhance, creativity and the public perception that more ideas are generated in a verbally interactive group continues to prevail despite empirical evidence to the contrary. The results of research are diametrically opposed to perceptions and practices and they continue without resolution. The effect of socially interactive environments on creativity needs clarification in order to resolve this paradox. Because there are gaps in the knowledge concerning the links between group interactive brainstorming and creativity, the relationship between these two factors should continue to

be examined.

The framework for this study, which was explained in the literature review, is Amabile's social-psychological theory. Out of this theory comes both the componential model used to define creativity for this study and the method (consensual assessment technique) for measuring creativity, the dependent variable. The social facilitation or inhibition of creativity by participating in verbally interactive group brainstorming prior to the development of a solution to a problem (a complex heuristic task) will be examined in this study. A participation group versus a no participation group in verbally interactive brainstorming before development of a solution to a problem will be compared on creativity assessed in the solution. This study investigated whether there would be a difference between the creativity rating scores on design solutions produced by individuals who first participated in verbally interactive brainstorming and the scores on design solutions produced by individuals who first participated in individual brainstorming.

Chapter III
Methodology

An experimental design was used to determine whether group interactive brainstorming would generate higher levels of creativity than would be generated using individual brainstorming. Subjects in the treatment group participated in group verbally interactive brainstorming before individually developing a solution to a design problem. The control group subjects developed a solution to the same design problem after participating in individual brainstorming. Brainstorming (group verbally interactive or individual) was the independent variable, and creativity was the dependent variable. The Multidimensional Stimulus Fluency Measure (MSFM) was used to measure individual differences in creative thinking abilities before subjects were randomly assigned to either the treatment or control group. The scores on the MSFM later served as a covariate in order to increase the statistical power when testing the effect of the treatment (social interaction). After the solutions to the design problem were generated, the Consensual Assessment Technique adapted for use in the field of interior design (Barnard, 1992) was used to measure the creativity that was apparent in the solution, the final project.

Instruments to be Used

Multidimensional Stimulus Fluency Measure

The instrument used to measure individual creativity and determine individual differences for this study was the MSFM (see Appendix B). Developed by Moran, Milgram, Sawyers and Fu (1983), the test was used in conjunction with an abbreviated form of the Holtzman Inkblot test and an abbreviated version of The Metaphoric Triads Test in a study done by Sawyers and Canestaro (1989). The assessment used in their study consisted of three tests: Ideational fluency (MSFM), Fantasy (Holtzman Inkblot), and Metaphoric comprehension (Metaphoric Triads).

Ideational fluency (MSFM) has three sub tests: Patterns, Instances and Uses. In the Patterns section, subjects list their interpretations of two dimensional shapes. They list all the things that a given pattern could be. In the second sub-test subjects are asked to list instances of different categories of things such as a listing of round things. In the third sub-test of the ideational fluency test, subjects are to list uses for common objects. Responses are scored as either popular or original depending upon the frequency with which the answer is given. If the answer is given less than 5% of the time, it is classified as original, and if it is given more than 5% of the time, it is considered a popular response. The total popular and original responses are then calculated across all three sections.

In a study on creativity and achievement in design courses (Sawyers & Canestero, 1989), ideational fluency, especially original ideational fluency, was found to relate to design grades and a comprehensive lab project in interior design. Popular fluency was significantly correlated to the course grade ($r = .25$, $p < .05$) and to the final project grade ($r = .33$, $p < .01$). Original fluency scores were significantly correlated with the course grade ($r = .27$, $p < .01$) and with the final project grade ($r = .41$, $p < .001$).

That is, students with high grades also scored high on ideational fluency. Because Ideational fluency (MSFM) was the test that was found to relate to design grades (based on course projects) and the comprehensive lab project (Sawyers & Canestaro, 1989) only the MSFM was administered in this study. Neither the Fantasy nor the Metaphoric comprehension tests used by Sawyers and Canestaro (1989) were administered in this study.

Consensual Assessment of Interior Design Creativity

The dependent variable in this study, creativity, was derived from the Consensual Assessment Technique (CAT), developed by Amabile (1996). The CAT instrument was designed to measure creativity when defined as a quality present in a product. Amabile has completed 30 separate studies using CAT, and throughout, the inter-judge reliabilities were consistently above .70. When tested in the artistic domain (Appendix C), CAT inter-judge reliabilities on the creativity variable ranged from .72 to .93 (Barnard, 1992).

This measurement technique (CAT) which was developed by Amabile was

adapted for use with interior design projects by Barnard (1992). In her study, the Consensual Assessment of Interior Design Creativity (CAIDC; Appendix D) was found to be a reliable measure, and was used to measure the dependent variable in this study. The method that Barnard used for testing this measurement technique (CAIDC) entailed two parts: (1) subjects (interior design students) were asked to complete an interior design project in a day long charette, and (2) judges rated the finished projects for creativity. The judges rated the projects on twelve dimensions: creativity, novelty, originality, complexity, technical merit, functionality, craftsmanship, artistic merit, thematic expression, appropriateness of solution, aesthetic appeal, and liking. Judges were provided a nine point scale (1 = very low ; 9 = very high) for rating on each dimension. The level of agreement among judges, inter-judge reliability, then was assessed. It was found to be acceptable (generally above .70). In Barnard's (1992), study inter-judge reliability when rater's used their "own subjective definition" on the creativity variable, was .95 (Appendix C). From a review of the 30 studies done by Amabile using the CAT, a minimum of 10 judges was required to obtain high levels of reliability on collage projects (Appendix C). The results of Barnard's (1992) study using the CAIDC required a minimum of six judges to obtain a minimum reliability (.70). Because of the similarities of results obtained by Amabile on artistic projects and Barnard's initial study done with interior design projects, the requirement of ten judges was used in this study to assure reliable results in the domain of interior design (Barnard, 1992).

When the CAIDC is used, expert judges' ratings on creativity indicate a relative degree of the presence of creativity in an individual's project or product. The judges' ratings are interpreted correctly only in comparison to other projects in the sample, not by comparison to some absolute standard for creativity in the domain (Barnard,1992).

There are two parts to the CAIDC, the Project Statement (see Appendix D) and the Dimensions of Judgment for Interior Design Projects (see Appendix E & F). The first part of the CAIDC, The Project Statement, was used in the production of the interior design project. The second part of the CAIDC, The Dimensions of Judgment for Interior Design Projects, was used to categorize the ratings of the judges on the dimensions of creativity, novelty and appropriateness. Refer to page 51 for futher explanation of the dimensions of

judgement.

Questionnaires

A post session questionnaire also was used to assess differences in preferences, motivation, interest, confidence, satisfaction, and perceptions. Questions such as, “How satisfied are you with the idea generation process your group used?” were included (see Appendix G). Responses were recorded on a 7-point scale (1 = definitely dissatisfied, 7 = very satisfied,). Questions were the same for each subject, but wording was adjusted to refer to the specific brainstorming (group interactive or individual) experience. For example, “How satisfied are you with your own (individual) or the (group interactive) idea generation process that you used for this project?” Questions were added to explore subjects perceptions about working in groups and the project assignment. Twelve questions were asked about satisfaction, confidence, difficulty, comfort, participation, motivation, apprehension, opportunity, and more ideas. The questionnaire was based on one used in a previous study on brainstorming (Gallupe, et al.1991).

Participants in the Study

Subjects

Subjects participating in the study were 36 undergraduate interior design students enrolled in two sections of the Design Fundamentals 2 interior design class. This is the second required class in a sequence of two basic design studios for beginning students. The design fundamentals course objectives include the investigation and application of the elements and principles of design along with creative expression in two-dimensional and three-dimensional compositions. Students are required to execute, present and critique approximately twelve projects throughout the semester that explore methods of graphic communication. Journals are required from the students which chronicle their visual thinking or the process required for developing solutions for each of the major class projects. Related classroom exercises and sketching are also required for this course. Projects include such topics as visual diagraming, composition analysis, line, pattern, structure, connections,

layering, composition, negative and positive space, value scales, texture rendering, lettering, shape, form and function, and the development of concepts in relation to all projects which begin with two-dimensional design and progress to three-dimensional design over the course of the semester. The level of development of these design students should allow them to formulate a concept for a non-literal reinterpretation of an actual interior space and execute a three dimensional design which captures the essence of the original space. They should be able to translate their concept into a successful design, in another scale and with other materials, that does not mimic the original inspiration, but communicates a fresh and creative interpretation of the source. Students enrolled in Design Fundamentals 2 have all been enrolled in the same courses, and can be assumed to have similar educational experiences in interior design.

Judges

The ten judges rating creativity included representatives from both education and practice. The Consensual Assessment Technique assures that all judges be familiar enough with the domain to have developed, over a period of time, some implicit criteria to assess creativity and technical goodness (Amabile,1996, p. 42). Design professionals from the two sub-categories of educator and practitioner were selected from membership lists published by the corresponding professional organizations.

The Interior Design Educators Council (IDEC) corporate membership was used as a base for selecting expert-judges from academia. IDEC Corporate membership is granted after two years of experience as an educator and was used to determine the minimum standards for the expert judges who were educators. Those members who are also faculty members at four year interior design programs in the state of Virginia formed a pool from which judges from the education category were chosen.

The American Society of Interior Designers (ASID) and the (IIDA) professional membership list was used to qualify the expert-judges from practice. ASID Professional membership is granted based on completion of two years of work experience and passing of the NCIDQ exam. This served to determine minimum levels of experience for the

judges in practice.

Judges from the two groups were obtained by phone. A phone call was made, using the yellow pages of the phone book to locate practitioners who were either members of ASID or IIDA, to explain the study, the judging tasks, and to ask for volunteers. Educators who were within a convenient traveling radius were determined from the list of IDEC members and the name and location of the institution where they were currently teaching. A second phone call to verify dates, times, and details of judging confirmed the commitment of judges who had agreed to participate in the study.

Procedure

Groups

Students in the classes were randomly assigned to either the treatment group or the control group by selecting every other person from the class roll. Each group received information on brainstorming (see Appendix H), but students in the treatment group were asked to brainstorm in pairs of two, while those students in the control group brainstormed individually. Folding doors in the studio classroom were closed and divided the treatment group from the control group while they brainstormed. Brainstorming sessions for each group lasted 30 minutes. All subjects developed their respective design solutions individually for the remainder of the time allotted.

Setting

The physical setting was 2 adjoining studio classrooms used for interior design courses. Two rooms were used for the sessions in order to insure adequate space for the treatment group to meet separately from the control group (refer to Figure 4). Individually assigned drafting tables were allotted for each student during creation of the project, and collaboration was not permitted among any students during the design development phase.

Preparation for the session

One week in advance of the project creation session, the class instructor explained general guidelines for participation in the MSFM and the project development session to the students. Participation in the session and the MSFM was mandatory as a part of the fulfillment of class requirements. The time schedule was announced for both the MSFM and the project development session. The materials and tools to be supplied by the students for the project development session included such items as: paper, pens and pencils, metal straight edge with cork backing, X-acto knife with blades, self healing cutting board, scissors, rubber cement, glue stick, and white glue (such as Elmers). Students were told to meet in the classroom next to the studios on the assigned day at the regular class meeting time, and that the purpose of the session was to produce a solution for a design problem which would be further described to them on the day of the session. They were told the completed project should demonstrate their ability to produce a unique and innovative solution to the proposed problem. Specific reference to the goal of creativity was mentioned. It was announced that awards would be given for the projects judged to be the three most creative. The literature suggests that external constraints or controls can lead people to view work as extrinsically motivated and this is detrimental to intrinsic motivation which is important in boosting creativity (Amabile,1996). However, "monetary reward given for a task about which the subject has no choice can enhance creativity (perhaps by inducing positive affect), but monetary reward offered to the subject in exchange for his consent to do the task can undermine creativity", (Amabile p. 171, 1996). Students had no choice in doing this task, it was considered a part of the course requirements. Therefore, offering a reward for the top three most creative projects should have a positive effect on creativity. Students were also told that they would complete the project individually.

The MSFM was administered several days before the project creation session. At the end of a regular class session approximately one hour and twenty minutes was allotted for the students to take the test. The researcher administered the test and explained that there were no wrong answers and students were to generate as many ideas as possible and be as creative as possible. All students finished and handed in their papers before the time limit ran out.

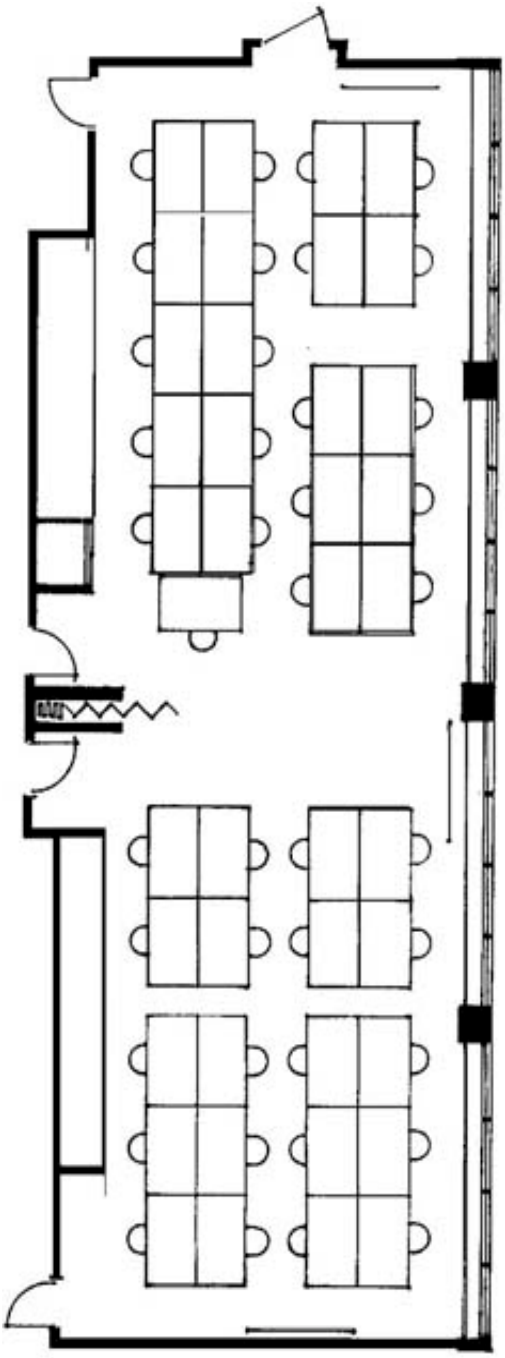


Figure 4. Plan View Classroom space (not to scale)

CAIDC project statement

Participants who engaged in the task of producing the design projects were required to use the written project statement (Appendix D) in order to develop the projects. The CAT developed by Amabile and CAIDC (Barnard, 1992) require that the project or task must be open-ended enough to permit considerable flexibility and novelty in responses. The design task must lead to the creation of a project that can be made available to judges for assessment. The task should not depend on skills that some individuals in the subject group have developed more fully than other participants. Consequently, the task assignment in this study was designed to stimulate creativity and followed a problem format similar to other assignments used in the course syllabus for HIDM 1106 Design Fundamentals 2. The problem description and requirements, found in the project statement, provided the guidelines for participants to develop a solution to a design problem which was assessed for creativity.

The task assignment focused on the use of the elements and principles of design and domain specific skills with a creativity goal. The task was designed to provide a maximum opportunity for creative solutions. The assignment expressed in the project statement (Appendix D) described the purpose of the project along with a presentation format for the design solution. The project statement also suggested the design should be an imaginative solution to the problem. Materials used to execute the solution to the problem were supplied so that students would all work in the same medium and with the same color limitations.

Subjects were asked to visually and verbally communicate the completed design solutions. A brief written statement explained the problem set up for the design project (Appendix D). The projects which were student generated were to be non-literal, three-dimensional design (for examples refer to Appendix K) solutions to a problem presented in a class session. The problem presented was designed to stimulate creativity.

Project creation session

The creation session was administered and monitored by the instructor of the course in conjunction with the researcher. The instructor and the researcher met the students in a

lecture classroom, and instructed the students to look for their names on a list outside the doors in order to determine in which side of the studio classroom they had been assigned a drafting table for this day. Visible individual nameplates bearing the specific subject's name identified the drafting table assigned to the individual. Materials (one 24" x 36" sheet of newsprint paper to be used for generating ideas during the brainstorming session, a packet of five colors of mat board each 16" x 20" to be used to develop the project, and the project statement) supplied for the students had been distributed to their assigned drafting tables in advance. The five colors of mat board were light beige, medium beige, taupe, black, reflective gold, and the back of all the boards were white. Two slide projectors containing the slide to be used as the inspiration (refer to project statement, Appendix D) were in place at opposite ends of the studio (refer to Figure 4). The two screens used for the slide projections are located in the plan view drawing of the studio classroom, one at the top of the plan and the other at the bottom of the plan.

At the beginning of the session, the slide projectors were switched on to show the slide to the subjects. The researcher read aloud the project statements while the subjects followed along with their copies. The instructor and the researcher answered questions concerning the project statements for the whole group. The folding acoustical screen used to divide the studio into two sections was then closed. The instructor distributed the brainstorming instructions and answered questions about procedures for the verbally interactive teams (assigned to one side of the room). The researcher distributed the brainstorming instructions and answered questions about procedures for the subjects who generated ideas individually (assigned to drafting tables on the other side of the folding room divider).

Once the 30 minute period of time allotted to brainstorming had elapsed, the need to divide the subjects as to treatment and control groups was over and the dividing wall was opened. All students working in the same room made it easier to monitor the session and retrieve the projects at the end of the allotted time. The subjects were instructed to work individually to develop their solutions to the project statement during the rest of the session. A statement was made that questions about solutions would not be entertained during the session. An attempt was made to create an atmosphere that was relaxed, friendly, and

helpful. This atmosphere was designed to help alleviate stress about the situation.

The treatment group and the control group were allowed three hours to develop the design solution. When the projects were complete, a code number was assigned to each student's design solution. After the projects were submitted, official consent forms (Appendix I) were signed and small cash awards for selected projects were reiterated and explained. Students were asked to fill out the brief post session questionnaire containing 12 questions (Appendix G). The questionnaires were designed to assess the subjects' preferences for working in groups or alone. Subjects' perceptions about motivation, interest, confidence, difficulty of the task, and the brainstorming sessions were also included. The researcher distributed and collected the questionnaires as the subjects handed in their projects and before the subjects left the session.

Project Judging Sessions

Project judging sessions were scheduled on a weekend following the creation session. The judging sessions took place in a studio room similar to where the projects were created. Ten judges, four educators and six practitioners, were scheduled to come to the site at staggered times. Drafting tables were arranged in order to give the judges visual and easy physical access to the projects. Projects were numbered and the written concepts were displayed next to corresponding designs. A table was set up at the entry to the space so that the judges could receive their instructions and rating sheets at the door (see Appendix J). The instructions listed and explained the 12 dimensions of judgment used for rating interior design projects using the CAIDC. The three to be rated for this study were highlighted and a form for rating each was provided to the judges.

Dimensions of judgment for interior design projects

The Dimensions of Judgment for Interior Design Projects is the second part of the instrument. This was the written rating criteria used by the interior design experts for judging projects created by the students. In Barnard's study (1992), the dimensions rated on projects for the field of interior design included Creativity, Novelty, Originality, Complexity, Technical merit, Functionality, Craftsmanship, Artistic merit, Thematic expression,

Appropriateness of solution, Aesthetic appeal, and Liking. For this study, judges were asked to rate the projects on creativity and two other dimensions - novelty and appropriateness (see Appendices E & F) because Amabile's conceptual definition of creativity includes both these dimensions. These are the two conspicuous features or characteristics (novelty and appropriateness) that are associated with the definition of the creative product (Barnard, 1992). Because of the association of those two dimensions with the definition of creativity, the global dimension of creativity was rated, and also the two sub dimensions that create the consensual definition of creativity were rated. For descriptive definitions of these dimensions refer to Appendices E and F.

Each judge was provided a clipboard with the instructions for project judging, the project statement, the dimensions of judgment for interior design projects, and the individual rating sheets for each dimension, which were randomly prearranged for each judge and labeled with that judge's identifying number.

The judging session was administered by the researcher. As the judges arrived at the prearranged staggered times, the researcher met the judges at the table by the entry to the room. The judges were given their clipboards, and the researcher answered all questions before the judge began the rating. Judges were instructed to rate all projects on one dimension before going on to the next dimension and to rate projects by comparison with one another rather than by an external standard for work in the field. They were instructed to proceed in some random order through the display of projects. All assessments were made independently without collaboration. After the rating process the judges were asked to check to see if all rating slips were complete. Judges were given a letter of appreciation after the judging session along with more information on the purpose of the study.

Data Analysis

Creativity scores for each of the projects were entered into the computer by the treatment and the control groups which were dummy coded (1= group brainstorming and 0 = individual brainstorming). Results of the pretest (Multidimensional Stimulus Fluency Measure) were used as covariates. Analysis of covariance was used to analyze the data.

Chapter IV
RESULTS

The purpose of this research was to test the effect of interactive brainstorming on creativity, using a design problem. The MSFM was given to subjects two weeks prior to the project creation session, in order to determine individual differences in creativity. Subjects were randomly assigned to participate in either a verbally interactive, group brainstorming session (team of 2), or an individual brainstorming session. The purpose of these sessions was to generate ideas for the project. Ultimately, all subjects produced individual solutions to the design project, which were rated for creativity by independent jurors. Following the completion of the design solutions, each participant completed a questionnaire regarding motivation, idea generation methods, and attitudes about the project.

The purpose of this chapter is to describe the statistical results relevant to the data compiled in this investigation. The next section contains tables and text used to report and clarify the findings in this study.

MSFM

The data from the MSFM consisted of two scores: original responses and popular responses, both parts of ideational fluency. The original plan had been to evaluate the effect of the treatment conditions using ANCOVA, with the two pretest measures (original and popular responses) serving as covariates.

Table 1 reports the descriptive statistics for the two covariates (original and popular responses) and the dependent variable (creativity) for the two treatment conditions. Inspection of the means and standard deviations of the covariates in Table 1 shows only modest mean differences between the two groups on these two covariates. Indeed, ANOVAs applied to the covariate means shown in Table 1 yielded p-values >.60 for both. It was hoped that use of ANCOVA would increase the statistical power of the test of the treatment effect on the dependent variable; unfortunately, this expectation was not fully realized and the source of the problem is shown in Table 2.

Table 1 Descriptive Statistics for the Covariates and Dependent Variable, Creativity, by Treatment Category

Treatment Category		Covariates: Original Response	Covariates: Popular response	Dependent Variable: Creativity
Independent Brainstorming	$\bar{\bar{X}}$	27.61	74.44	57.31
	(SD)	(19.33)	(22.26)	(14.58)
Group Brainstorming	$\bar{X}$	29.11	70.78	50.89
	(SD)	(13.71)	(20.39)	(13.73)

Note: individual N = 18
group N = 18
Total N = 36

Table 2 reports the correlation between covariates (MSFM scores) and the dependent variable (creativity). Inspection of the correlation reported in Table 2 shows that neither covariate correlated greater than .30 with the dependent variable, but were strongly correlated with each other. It has been demonstrated that power will not generally be enhanced unless the covariate correlates at least .3 with the dependent variable (Elashoff, 1969). Therefore, ANCOVA was abandoned in favor of a simple ANOVA. The results of this ANOVA are summarized in Table 4.

Table 2

Correlation between Covariates and the Dependent Variable, Creativity

	1 Original	2 Popular	3 Creativity
1 Original Response	1.0	.66*	.28
2 Popular Response		1.0	.02
3 Creativity Variable			1.0

Note: N = 36
* p< .01

Test of The Hypothesis

The hypothesis tested in this study was that participation in group verbally interactive brainstorming prior to developing a design solution would not facilitate creativity in the final project more than individual brainstorming. Indeed, it was hypothesized that individuals brainstorming alone would produce more creative projects than individuals brainstorming in verbally interactive teams prior to developing an interior design project independently.

The treatment group represented those subjects who participated in the group interactive brainstorming session (social interaction) prior to developing the solution to the design problem. The control group represented those subjects who participated in an individual brainstorming session (no social interaction) before developing the design solution.

Table 3 reports the descriptive statistics for the dependent variable of primary interest (creativity) and two other dependent variables of secondary interest (novelty and appropriateness) by the two treatment conditions. Inspection of the means and standard deviations of the variables in Table 3 shows that the mean for creativity was slightly higher (57.31 vs. 50.89) for independent brainstorming, but, there was no significant difference between the groups. There was also no significant difference between mean scores for either novelty (56.72 independent vs. 52.33 group) or appropriateness (55.38 independent vs. 53.72 group).

Table 3 Descriptive Statistics for the Dependent Variable, Creativity, Novelty, and Appropriateness by Treatment Category

Treatment Category		Dependent Variable: Creativity	Novelty	Appropriateness
Independent Brainstorming	$\bar{\bar{X}}$	57.31	56.72	55.39
	(SD)	(14.58)	(11.98)	(14.50)
Group Brainstorming	$\bar{X}$	50.89	52.33	53.72
	(SD)	(13.73)	(11.75)	(13.68)

Note: individual N = 18
group N = 18
Total N = 36

The results of the ANOVA applied to the three dependent variables are reported in Table 4. Scores generated from the CAIDC instrument were entered as the dependent variables. The 10 judges rated the projects on three dimensions in this study: the dependent variable of primary interest creativity, and two other dependent variables of secondary interest novelty, and appropriateness. A nine point scale (1 = very low; 9 = very high) was provided for rating each of the dimensions. The reliability coefficients for the ratings of the ten judges in this study were calculated using the SPSS computer package and were found to be: (.81 = creativity) (.69 = novelty) and (.76 = appropriateness). Although the reliability scores for this study are lower than Barnard's (1992), the number of judges used was fewer than her study. As shown in table 8 (Appendix C) the reliability scores for the judges in Barnard's study decrease as the number of judges decrease. In reference to the reliability coefficients from Amabile's studies, shown in table 7 (Appendix C), Barnard states, "...Reliable assessments of verbal creativity using storytelling were achieved with as few as three judges, artistic creativity investigations using collages usually required at least 10 judges" (Barnard, 1992, p. 80). Barnard used .70 or greater as an acceptable range for reliability scores in her study. Based on this information 10 judges were used to rate creativity, novelty and appropriateness in this study. The main variable of interest in this study, creativity (.81) was well within the acceptable range. However, the inter-rater reliability estimate for appropriateness (.76) was a modest score and novelty (.69) was outside the acceptable range.

The results of the ANOVA did not indicate a significant difference between the treatment group and the control group in creativity ratings (see Table 4; $F = 1.85$, $df = 1$, $p = .183$). That is, the control group did not score significantly higher than the treatment group on creativity. Thus, the null hypothesis was not rejected. Accordingly, the research hypothesis of this study that individuals brainstorming alone will produce more creative projects than individuals brainstorming in verbally interactive teams prior to developing an interior design project independently was not supported. For the range of scores on the dependent variable creativity and the MSFM refer to (Appendix L).

The two other dimensions rated by the judges were also entered into the computer using ANOVA in order to determine if differences existed between groups when either

novelty or appropriateness was used as the dependent variable. Results of the ANOVA using appropriateness as the dependent variable also did not indicate a statistical difference in the group means ($F = .13$, $df = 1$, $p = .73$). When novelty was used as the dependent variable, results were not statistically significant either ($F = 1.23$, $df = 1$, $p = .28$). Thus, none of the three variables (creativity, novelty, or appropriateness) were indicated to be significantly different between the two groups - individual and group brainstorming. Although, scores for each move in the expected direction.

Table 4 Summary of Analysis of Variance Applied to the Dependent Variable Creativity and the Two Dimensions of Novelty and Appropriateness

Creativity

Source	S S	DF	MS	F	F-probability
Between Groups	370.56	1	370.56	1.85	.183
Within Groups	6818.35	34	200.54		
Total	7188.91	35			

Novelty

Source	S S	DF	MS	F	F-probability
Between Groups	173.36	1	173.36	1.23	.275
Within Groups	4791.61	34	140.93		
Total	4964.97	35			

Appropriateness

Source	S S	DF	MS	F	F-probability
Between Groups	25.00	1	25.00	.126	.725
Within Groups	6755.89	34	198.70		
Total	6780.89	35			

*Significant, p<.05

Results From the Questionnaires

Table 5 reports the frequencies and percentages of the responses to two questions that addressed the subjects' preferences for working in a group versus working independently. As seen in Table 5, most preferred to work in a group for generating ideas, almost 64% overall. However, when asked whether they would prefer to work alone or in a group to develop a design project the majority (58%) of the subjects preferred to work alone. Thus, more people preferred to generate ideas as a group, but when developing a project the majority of the subjects indicated they would rather work independently. Although interesting, a chi-square analysis revealed that these preferences for working alone or in groups did not differ significantly between treatment conditions.

Table 5

Frequencies and Percentages of Items 1 - 2 of the post session questionnaires by Treatment Groups

Questions	Group Brainstorming N	%	Individual Brainstorming N	%	Total N	%
Rather generate ideas						
alone	5	27.7%	7	38.8%	12	33.3%
in a group	13	72.2%	10	55.5%	23	63.9%
(missing)	0	0	1	5.5%	1	2.8%
	18	100%	18	100%	36	100
					Chi-Square	.40
Rather develop design projects						
alone	11	61%	10	55.5%	21	58.4%
as a group	7	38.8%	7	38.8%	14	38.8%
(missing)	0	0	1	5.5%	1	2.8%
	18	100%	18	100%	36	100%
					Chi-Square	.89

Table 6 presents the means and standard deviations for the experimental and control groups on questionnaire items that assess motivation, interest, confidence, difficulty, and satisfaction. The question, “How difficult was the idea generation task?”, yielded a significantly higher mean for the group brainstorming condition than for the control condition (4.67 vs. 3.81). Subjects who generated ideas alone more strongly agreed, (M = 5.67) with the statement that they felt they would have generated more ideas in a group. Those who brainstormed in a group less strongly agreed, (M = 4.06) when asked if they felt they would have generated more ideas alone. Hence, those who generated ideas as a group, even though they felt they had greater difficulty, were less inclined to agree that they would have generated more ideas alone. However, those students who brainstormed alone, with less perceived difficulty, felt more strongly that they would have generated a greater number of ideas in a group.

Table 8

One Way Anova Analysis. Means and Standard Deviations of Items 3 - 12 on the Post session Questionnaires by Treatment and Control Groups.

Question Keywords (Dep. Var.)		Treatment Group Brainstorming N = 18	Control Individual Brainstorming N = 18	F	Probability
Motivated Solution Project	M	5.22	5.11	.06	.82
	SD	1.40	1.45		
Interest Project	M	5.44	5.50	.02	.89
	SD	1.42	.92		
Confident Project	M	4.72	4.53	.16	.69
	SD	1.57	1.36		
Difficulty Project	M	4.28	4.11	.14	.71
	SD	1.32	1.37		
Satisfaction Idea Generation	M	4.94	5.00	.01	.91
	SD	1.83	1.03		
Confident Quality Ideas	M	5.39	5.44	.02	.89
	SD	1.42	.98		
Difficulty Idea Generation	M	4.67	3.81	4.16	.05*
	SD	1.14	1.38		
Motivated Idea Generation	M	5.28	5.03	.36	.55
	SD	1.18	1.31		
Opportunity Express Ideas	M	5.50	5.06	1.78	.41
	SD	1.51	1.66		
Feel Generate More Ideas Alone/ group	M	4.06	5.67	9.35	.004*
	SD	1.63	1.53		

Note: the higher the value, the stronger the perceived attitude (ie., greater satisfaction)
7 point scale
$p \geq .05$

Summary of Results

The purpose of this study was to measure and compare the effect of group brainstorming versus individual brainstorming on creativity. When two brainstorming techniques were used and creativity scores were compared between those two groups, there were no significant differences. Therefore, projects developed by interior design students who participated in group brainstorming did not differ significantly in creativity ratings from projects of students who brainstormed individually.

Novelty and appropriateness, two other dimensions which were used as a two- part definition of creativity for this study, were rated along with creativity. Although the ratings of these two dimensions were highly correlated with the creativity rating, neither was significantly different as to groups. That is, when the two variables of novelty and appropriateness were compared by treatment and control groups there were no significant differences

Two significant differences were found in responses on the questionnaire relative to the group brainstorming technique. First, students who participated in group brainstorming found the idea generation task significantly more difficult than those students who brainstormed alone. Second, although those who brainstormed alone found the task easier, they felt more strongly that they would have generated more ideas in a group than those in group brainstorming felt that they would have generated more ideas alone. The second response supported the popular idea of being able to generate more ideas in a group even though the first response indicated a greater difficulty when generating ideas in a group.

Chapter V

Summary and Conclusions

The purpose of this chapter is to summarize the study, the methodology, and the results. A discussion of the results and recommendations for further study follows.

Summary of the Study

The primary purpose of this study was to compare the effect of verbally interactive group brainstorming (social interaction) to individual brainstorming (no social interaction) on creativity (the dependent variable) as measured in solutions to a design problem. A true experimental design was used, and Amabile's social-psychological theory was used as a framework for the concept of creativity. Barnard's (1992) Consensual Technique for Creativity Assessment for use in the field of interior design, called CAIDC, was used to measure creativity in the product. There are two parts to the CAIDC, the Project Statement (Appendix D) and the Dimensions of Judgment for Interior Design Projects (Appendix E & F). The Project Statement was used by the subjects, during the brainstorming and project creation session, in the production of the interior design project, which was then judged for creativity. The second part, the Dimensions of Judgment for Interior Design Projects, was used to categorize the ratings of the expert-judges on the dimension of creativity and two other dimensions (novelty and appropriateness) of the projects. The Multidimensional Stimulus Fluency Measure (Moran et al., 1983) was used to assess individual differences in creative thinking abilities of the subjects before they were randomly assigned to either a treatment or control group. The scores from the MSFM were used as a covariate to reveal more clearly the variance due to the effect of the treatment.

Participants in the study were 36 undergraduate interior design students at Virginia Tech who developed the design projects to be assessed for creativity. The projects were rated for creativity by 10 expert-judges; some were interior design educators and some were practicing interior designers.

The project creation sessions were held during a regularly scheduled class period.

Subjects were randomly assigned to either a treatment group or a control group. The treatment group participated in verbally interactive brainstorming for a period of 30 minutes, in teams of two. The subjects in the control group brainstormed individually for the same amount of time. After performing the brainstorming exercise, subjects developed their respective design solutions individually.

Subjects were asked to complete a post-session questionnaire before leaving the session. The questionnaire was derived from one used in a previous study on brainstorming (Gallupe et al. 1991), and included questions about satisfaction, confidence, difficulty, motivation, interest, and preferences.

Projects were judged on a weekend following the creation session. Ten jurors were scheduled at staggered times to judge the projects on three of the dimensions of judgment for interior design projects (creativity, novelty and appropriateness).

The MSFM was to be entered as a covariate and ANCOVA was to be used to analyze the data; however, the MSFM did not correlate highly enough with the dependent variable for the use of ANCOVA to be valuable. Consequently, ANCOVA was relinquished in favor of a simple ANOVA. Individual ratings by the jurors for each of the projects produced by members of the groups were coded and analyzed using SPSS analysis of variance.

Group interactive brainstorming did not yield higher creativity than individual brainstorming. The difference between this study and the majority of studies that investigated brainstorming and creativity is that this study examined the question from the quality of the end product rather than the typical quantity of ideas generated in the ideation stage of the creative process. Although students found it more difficult to generate ideas in a group they still believed they would generate more ideas and preferred to generate ideas in a group rather than alone. However, when developing a project students preferred to work independently.

Discussion

This study supports past research which suggests that group verbally interactive brainstorming, contrary to Osborn's (1957) claim, does not enhance creativity. The results indicated that a verbally interactive group process in the ideation stage of the creative process did not enhance creativity in the product. Indeed, the creativity scores were higher for those in the individual brainstorming condition, although not significantly so. This study also supports findings which indicate that people still believe they will generate more ideas in a group and that they prefer to generate ideas as a group. None of the findings of past empirical research which are contrary to popular perception and practice has diminished the use of group verbally interactive brainstorming as an effort to enhance creativity. Industry and education continue to employ this technique to increase creative responses when research continually shows that group verbally interactive environments actually constrain the ability to generate ideas. The literature indicates that group interactive brainstorming negatively impacts creativity, but, the findings of this research did not support the literature. The results of this study indicated that verbally interactive brainstorming neither enhanced nor interfered with the creative process.

Lack of Significant Differences

One possible reason that could be given for the lack of a significant difference between the treatment group and the control group might be that creativity is difficult to define and even more difficult to measure. Quantifying a concept which is elusive and qualitative is a challenge.

A second reason could be because of the change in the difficulty of the task. Instead of measuring a simple heuristic task as many studies in the past have done, this study measured creativity resulting from a complex heuristic task. A change in the task from a simple heuristic task to a complex heuristic one may alter the effect of the environment. One social environment can impair performance on a complex heuristic task while the same environment will enhance performance on a simple heuristic task (Amabile,1996). Therefore the change of complexity in the task could have affected the results of this study.

Time constraints on the MSFM and the brainstorming sessions could have affected

the results. Perhaps the students were not allowed enough time to fully complete the exercises to the best of their ability, this could have put a ceiling on the scores of the MSFM and restricted the range of scores on ideational fluency. Thus, restricting the range of individual differences revealed in the covariate. The brainstorming sessions if not managed exactly as Osborn (1957) had intended and if the time limit allowed was too brief (thirty minutes) for complete idea generation to occur this may also have restricted the range of creativity scores. Therefore, the difference between groups, especially with a small sample size, would have been more diffcult to uncover.

The offer of a reward for the top three most creative projects may have altered the intrinsic motivation level in such a way as to depress individual creativity levels which would also restrict the range of creativity scores. The literature suggests that external constraints or controls can lead people to view work as extrinsically motivated and this is detrimental to intrinsic motivation which is important in boosting creativity (Amabile,1996). However, "monetary reward given for a task about which the subject has no choice can enhance creativity (perhaps by inducing positive affect), but monetary reward offered to the subject in exchange for his consent to do the task can undermine creativity", (Amabile p. 171, 1996). Students had no choice in doing this task, it was considered a part of the course requirements. Therefore, offering a reward for the top three most creative projects should have a positive effect on creativity. Still, some of the conclusions in the literature are contradictory. Thus, this offer of a reward could be another reason for the lack of a significant difference between the treatment and control group.

Another possible reason for the lack of a significant difference between the groups could stem from the small number of subjects (2) in the group interactive brainstorming condition. Empirical research has identified some reasons why groups do not generate more ideas than individuals working alone and evaluation apprehension is one. Evaluation apprehension occurs when people who work in groups withhold their ideas because they fear that others will find the idea of no worth. Diehl and Strobe (1987) suggested that evaluation apprehension had a negative effect on the verbally interactive group and the negative effect grew as the group size grew. The interactive brainstorming in this study was done in teams of two. Evaluation apprehension may have had a greater negative effect on

the subjects who participated in the verbally interactive brainstorming treatment if the team size had been 4 or 6 instead of two. In that case, the evaluation apprehension experienced in verbally interactive brainstorming may have had a greater negative effect on the end product.

Production blocking is another reason identified for the reduced number of ideas generated in group verbally interactive environments. Production blocking occurs when one member of the group gets an idea and someone else is talking, thereby blocking the attempt to enter that idea (Dennis et al., 1992; Gallupe et al., 1991; Gallupe et al., 1994; Valacich et al., 1994). Again, if the number of team members had been increased in the group verbally interactive brainstorming session the negative effect of this phenomenon may have been increased and the effect of verbally interactive brainstorming may have had a bigger impact on the creativity assessed in the final project.

The negative or positive impact of group verbally interactive brainstorming in the initial stage of the creative process may have been overcome in the later stages of the creative process which, in this study were done independently. A study involving verbal interaction throughout all stages of the creative process may shed more light on this.

Other reasons that could be given for the lack of a significant difference between the treatment and control group might be that the sample size was too small and the effect size was too small for the statistical method used to reveal a difference between the treatment and control group. Further research with larger samples would help to reduce this concern.

MSFM Explanation

The MSFM scores consisted of two parts, the popular answers score and the original answers score. These scores were highly significantly correlated with one another. Both scores are intended to be measures of the individual trait creativity, so therefore they should correlate highly with one another. However both scores failed to correlate significantly with creativity in the final product (the dependent variable). A possible reason for the failure to correlate with the creativity scores for the product could be a weakness in the methodology. The scoring of the MSFM was done by the researcher alone. Had the MSFM been scored by more than one person and the mean scores used, the needed

level of correlation for use as a covariate may have been indicated. This measure was used in other studies (Sawyers & Canestaro, 1989), and found to be correlated at an acceptable level with grades on a creative final design project.

Survey Explanation

When asked whether they would prefer to work alone or in a group to generate ideas the majority of the subjects preferred to work in a group. Strobe, Diehl, and Abakoumkin (1992) found that even though group members were consistently less productive than individuals who worked alone, they felt facilitated by the presence of others, enjoyed the experience more and were more satisfied with their performance. Perhaps the subjective feelings of satisfaction with the process used are influential enough in the end product to continue using an enhancement technique that simply elevates the feelings of satisfaction. A satisfied worker may be a more productive worker. Could it also be that a person more satisfied with the process used to enhance creativity is also more creative?

The total responsibility is removed from an individual when ideas are generated as a group. Thus, the pressure to perform in order to bring about results would be lessened. Although this removal of responsibility is one of the causes of “social loafing”, which has been hypothesized to be one of the reasons for generating fewer ideas in a group, the group experience may be more preferable because of it. The prevailing perception that we generate more ideas in a group may influence preferences for idea generation in a group. People take credit for more ideas than they actually generate in a group interactive environment (Paulus et al., 1993; Strobe et al., 1992). Therefore, people may prefer a group because they feel they will perform better in a socially interactive environment whether they actually do or not.

This response could indicate that we are social creatures and prefer to interact with others whether it improves our performance or not. Are people simply gregarious and would rather interact even if it does not improve the number of ideas they can generate? It would appear that this assumption has merit.

The preference to generate ideas in a group was accompanied by the indication that most individuals still believe that they would generate more ideas in a group than alone.

The combination of these two responses may help to explain the continuing popularity of the interactive brainstorming technique in spite of the results of empirical research. This finding supports other studies where group brainstormers generated only about half the ideas as nominal brainstormers, but still believed they would brainstorm more effectively as a group than alone (Paulus et al., 1995). Osborn's claim that group interactive brainstorming could double the number of ideas the average person could think of alone has been well publicized and convincing. His claim still predominates as the popular belief, even against empirical evidence to the contrary. Is the benefit of group interactive brainstorming a latent response that needs time to incubate? Is it not apparent in the current data because we are not designing the research properly in order to answer the question? Is it because people take credit for ideas that are not theirs (Paulus et al., 1993), when working in an interactive group? Even though this study indicated that the interactive brainstorming made no significant difference in the creativity ratings on the interior design projects, participants still preferred to generate ideas as a group; furthermore, most participants still believed that they would generate more ideas in a group than alone. This is an interesting paradox which was indicated in the literature review. The "illusion of group effectivity" refers to the belief that groups can stimulate creativity, even though this belief is in opposition to the empirical research.

Those subjects who participated in group brainstorming indicated a significantly greater difficulty generating ideas than those who brainstormed alone. This suggests that it is more difficult to generate ideas in a group than it is to generate ideas alone. This finding supports Gallupe, Bastianutti, and Cooper (1991) who found in his study comparing electronic and non electronic brainstorming that non electronic interacting groups found the idea generation task most difficult. Therefore, working in an interactive group may not make idea generation easier but, in fact, make it more difficult. Social loafing, which occurs in a group because individual effort is not as easily identified and therefore some participants do not perform as well, could be frustrating to the individual who is really trying. The idea generation task could seem more difficult when others in the group do not make an effort and one participant feels they have to generate all the ideas. Being distracted by others talking when one is trying to generate his own ideas could also add to the perceived

difficulty. Personality clashes within groups could also be the cause of perceived difficulty. The difficulty associated with idea generation in groups could reflect the concept that growth is difficult. Engaging in a learning experience which offers an exposure to new ideas is considered more difficult than not considering new ideas. Perhaps the exposure to new ideas in a group environment is difficult because growth is an unsettling experience. The next logical question to add to this questionnaire would be, "Why do you feel this way?" Some of this speculation might be eliminated.

When asked whether they would prefer to work alone or in a group to develop a design project, the majority of the subjects preferred to work alone. That was the opposite of their preferences when asked about idea generation. The idea generation stage in the creativity process occurs early and the development of a project occurs later in the process. Amabile (1996) points out in the Componential model of creativity that the response generation stage is a different stage from the response validation stage (refer to figure 2). This study indicated that there was a difference in preference for interactive group work in relation to the stage of the creative process. Although the majority of subjects preferred to generate ideas as a group, they preferred to work alone when testing or validating these ideas. Thus, according to preference, the creative process should not be totally performed in one social environment. The environment that best enhances creativity may not be a single answer, but instead a series of environments should be used depending on the stage of the creativity process. Subjects preferred self evaluation and validation of the ideas generated over the process of group evaluation and validation. Perhaps the concept development stage should be designed to occur in a socially interactive environment and the evaluation stage should occur in private.

Some researchers have concluded that creativity is domain-specific, and thus most efficiently measured by evidence of creativity in a product specific to the domain (Barnard,1992). Therefore, generalizing the results of this study beyond the domain of interior design should be done with caution. Further, until the study has been replicated, generalizing and making assumptions beyond this study should be done with careful attention to all circumstances relating to the research design and the findings. If this study is replicated more research should focus on the continuing use of group verbally interactive

brainstorming prior to developing an interior design project. Because the practice of using group verbally interactive brainstorming to enhance creativity is so widespread, this evidence to the contrary, could have extensive negative implications for accepted practices in education, and industry. If group verbally interactive brainstorming does not enhance creativity assessed in the final interior design product, why do we continue to use it for that purpose? However, more research must be done in order to decide if verbally interactive brainstorming

really does or does not enhance creativity in the final product. Has industry introduced brainstorming at a different stage in the creative process and with a different methodology that actually does bring positive results in relation to creativity? Because this study did not reject the null hypothesis does not mean that the findings proved the null was true. There was insufficient evidence to reject. More research needs to be done in order to clarify whether verbally interactive face to face brainstorming enhances creativity or not.

Future Research

What are the implications of brainstorming for business, the teaching of interior design, and the practice of interior design? The implications are that industry and academia could be using a technique that may not prove to be useful as indicated in the research findings. We continue to practice and believe in a technique that has not been shown, by empirical research, to enhance creativity. We may be using a technique that has no effect upon or, perhaps, may even constrain creativity. Either way, the continuing use of group verbally interactive brainstorming may not be reinforcing our goal of enhanced creativity. Our approach to encouraging and enhancing creativity should evolve. Research and practice should be in agreement regarding methodologies and technologies surrounding creativity in order to insure that both social and physical aspects of the environments we design to enhance creativity actually are accomplishing our objectives.

Further research is needed to define the most preferred and effective environment to enhance creativity in relation to the different stages of the creative process. Team interactive spaces may be better used for the enhancement of the early stage of creativity however, individual private environments may be best in evaluation stages of the creativity process.

Research could be done comparing the results from the use of the simple heuristic task and the complex task. Does the environment surrounding subjects who have been assigned a simple task affect creativity in the same way when a complex heuristic task is performed? Is interactive brainstorming more successful when used to generate ideas for a complex task than a simple task?

Introducing verbally interactive brainstorming into the creative process at different stages could be examined. Brainstorming in order to develop a concept may be successful while brainstorming after the development of a concept may be less of an enhancement for creativity in the final product. Perhaps interactive brainstorming could be introduced into the creative process more than once in order to be more of an enhancement for the creative product. There are five stages in Amabile's temporal componential model, interactive brainstorming could be tested in each stage in order to look at the effect on creativity in the product. The way in which verbally interactive brainstorming is introduced may have an effect on creativity. If it is introduced in a matter of fact way to subjects with little or no prior experience brainstorming, the results might be very different from introducing a strong course on how to brainstorm successfully and afterward introducing verbally interactive brainstorming with a great deal of enthusiasm to these subjects. What would be the difference in creativity scores between these two groups? Perhaps this research would reveal a very positive effect on creativty when different methods are used to introduce the brainstorming technique.

How much does the personality of the creative individual influence the environment used to enhance creativity? More attention may need to be given to the personality traits associated with the creative individual when planning the most effective environment. The personality trait of autonomy which is often included in the description of a creative person may need to be more thoroughly considered when planning the most effective environment. In this study the subjects were randomly assigned to the treatment and control groups. Research could be done using teams with a particular type of individual. Would the make up of the group change the results? Would the association with a highly creative individual increase the creativity of the less creative person? Would creative individuals profit more from group interaction than less creative individuals? Would the

personality type of the individual have a meaningful effect on the environment needed to enhance creativity?

Preferences of designers and design students for interactive social environments in different stages of the creative process could be compared to their scores on individual creativity measures in order to ascertain differences in preferences related to individual creativity levels. Are there differences in environmental preferences associated with one's individual level of creativity?

People who found the idea generation task more difficult felt less positive about a change in the environment helping to make that task easier. When the search for a better environment for enhancing creativity is explored, personality traits and individual creativity traits should be considered. The environment should be a fit with the characteristics of the user.

Studies designed to test for the amount of influence each factor has on the creative product may shed light on how to rank the factors influencing creativity. Motivation, interest, confidence, satisfaction, difficulty, preferences and more factors could all be measured and tested to find out how much influence they have on the creativity in the product. Finding a model of factors in the social and physical environment that influence creativity and to what degree they influence creativity still needs exploration. These factors should be considered when testing for a better environment for creativity. They may be more important to the quality of the creative product than the process of social interaction.

In this study the treatment was an interactive brainstorming team of two. Research could be done varying the size of the interactive team. Increasing or decreasing the the number of verbally interactive brainstormers may increase or decrease the level of creativity assessed in the design project. Perhaps the size of the group would differently effect creativity in the product. More than half of the published studies show that interactive groups of four or more produced significantly fewer ideas than nominal groups (Gallupe et. al., 1991). Perhaps as the group size increases, the creativity as measured in the final product will change.

Electronic and nominal and interactive groups could be compared and measured by assessing the creativity in the final product. Using computer brainstorming versus individual

brainstorming and or verbally interactive brainstorming as a focus could be studied to determine if generating ideas by interacting with other subjects' ideas on a computer would improve the creativity assessed in the final project. Electronic groups have been found to be more productive (Gallupe et. al., 1991), when the measurement used is the number of ideas generated; however, the measurement of creativity in the final product may yield different results.

In addition to the hypothesis, subjects' perceptions, preferences, attitudes, and motivation were examined in a post session questionnaire. Responses to these questions may identify areas for future research. Attitudes and perceptions of those subjects who participate in the creative process are important in further defining the construct of creativity, the personality traits of creative individuals, and the creative process itself. Moreover, attitudes and perceptions about the creative process which correlate with creativity in the final project may help to define predictors and methods for enhancing creativity in the future.

Throughout this study one question has continued to surface. Why does industry continue to use interactive brainstorming when research continues to show that it does not enhance creativity and may even constrain it? What exactly are the methodologies and technologies used in industry and how do they differ from those used in research? Surveys could be done to discover how and why industry still uses verbally interactive brainstorming. Reasons for the continued use of group interactive brainstorming in industry may include success because they apply the technique differently from researchers. Do they introduce it in a different stage of the creative process? Do they allow for incubation of ideas generated? Do they use purposeful decision making when selecting members for the interactive groups? What techniques differ from research techniques? Testing the technologies and methodologies of industry may bring different results from past research.

If creativity is a reason for man's survival, a catalyst for cultural change, a competitive edge for corporations, and a major contributor to profit in industry, we should seriously investigate the strategies involved in designing an effective environment for creativity. Discovering the environmental factors that will enhance creativity will not only affect our economy in the future but the well being of our society and the future quality of life. Reasons to pursue research in the area of creativity are abundant.

At least one reason exists to pursue research about brainstorming. This particular study raises a question that should continue to be asked until there is an answer. If this type of brainstorming does not enhance creativity why is it still being used? Research has indicated the inadequacy of this process but it has not offered an alternative which has been accepted by society. Further studies need to define a better process and or social environment for the enhancement of creativity or brainstorming will continue to be used. This study suggests that verbally interactive brainstorming has no impact on the creative product, and other research indicates that it has a negative impact on the number of ideas generated. However, until there is an alternative process that society recognizes as better our culture will continue to use this technique. That is the contention of Csikszentmihalyi (1996) when he states that cultural evolution of memes is an analogy to the biological evolution of genes. Values are some of the memes that continue in a culture until a creative person offers a change; if enough of the right people see the change as an improvement, it will then become a part of the culture (Csikszentmihalyi, 1996). Therefore, the evolution of techniques for enhancing creativity depends in part, on the creativity of the researcher. The catalyst for cultural change will be a new technique that society accepts as being an improvement. Research has not identified such a technique at this time so cultural change has not yet occurred. This underscores the need for further research in this area. Moreover, creative applications devised from this research for alternative techniques to enhance creativity should be tested and publicized in an effort to disseminate the possibilities which could be accepted by society as a better alternative.

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APPENDICES

APPENDIX A
DEFINITIONS OF VARIABLES

Definition of Variables

Creativity, a Conceptual Definition: "A product or response will be judged as creative to the extent that (a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and (b) the task is heuristic rather than algorithmic" (Amabile, 1996, p. 35).

Algorithmic task: "algorithmic tasks are those for which the path to the solution is clear and straightforward -tasks for which an algorithm exists" (Amabile, 1996 p.35).

Heuristics: "A general rule that can be of aid in approaching problems or tasks" (Amabile, 1996 p.89).

Heuristic task: The heuristic task does not have clearly defined solutions or goals a part of the problem solver's task is to identify them. "Heuristic tasks are those not having a clear and readily identifiable path to solution -tasks for which algorithms may still be be developed" (Amabile, 1996, p. 35).

Path to solution: "should be taken in its most general sense, referring to that set of cognitive and motor operations that will lead to an acceptable response or product in the domain of endeavor" (Amabile, 1996, p.35).

Creativity a Consensual Definition: "A product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated. Thus, creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers, and it can also be regarded as the process by which something so judged is produced" (Amabile, 1996, p. 33).

For the purpose of this study the following definitions of the independent variable, group or team verbally interactive brainstorming were used:

Brainstorm: a brainstorm group devotes itself solely to creative thinking...organized ideation..."brainstorm" means using the *brain* to *storm* a creative problem-and to do so in *commando* fashion, with each stormer audaciously attacking the objective (Osborn, 1957). Brainstorming is a group process of generating ideas in which there is no criticism (Aiken & Riggs, 1993).

Verbally interactive brainstorming: face to face group in which individual members of the group verbally interact with one another to generate ideas in a common fashion.

Nominal groups: individuals generating ideas on their own, which are then combined with the ideas of other individuals also working on their own (Gallupe, Bastianutti, & Cooper, 1991; Taylor, Berry, & Block, 1958). Combining the ideas is in order to compare nominal groups with verbally interactive groups. The number of individuals must equal the number of members of a verbally interactive group.

Group or team: more than one person and less than six engaged in a task under collective task responsibility, working coactively (in the presence of others working on the same task).

Collective task responsibility: "group member efforts are pooled to produce a single group product, and the contributions of each individual group member may not be easily identifiable" (Price, 1993, p. 329).

Individuals: one person engaged in a task under the condition of sole task responsibility.

Sole task responsibility: individual efforts are used to produce a single product.

Working coactively: one person engaged in a task under the condition of sole task responsibility, in the presence of others working on the same task.

Work Environment: the social-psychological environment in which the task is accomplished or product is produced.

APPENDIX B

MULTIDIMENSIONAL STIMULUS FLUENCY MEASURE

Name_____

The researcher is interested in problem solving and there are no wrong answers.

The object is to generate as many ideas as possible! Be creative!

List interpretations for the patterns or shapes shown.

List all the things that this pattern could be.

List all the things that this pattern could be.

List all the things that you can think of that are round.

List all the things that you can think of that are red.

List all the things that you could use a box for.

List all the things that you could use paper for.

APPENDIX C

INTERJUDGE RELIABILITY FOR AMABILE STUDIES AND BARNARD'S STUDY

Table 7 Reliability Coefficients from Amabile's Studies

Interjudge Reliability of Creativity Ratings: Summary of Amabile Study Results in The Artistic Domain.

Product	Subjects	Judges	Reliability*	
collage	22 girls	12 psychologists	.73	(.18)
		21 art teachers	.88	(.26)
		7 artists	.77	(.32)
collage	95 women	15 artists	.79	(.20)
collage	111 children	6 artists	.77	(.36)
collage	47 children	7 artists	.72	(.27)
		7 non artists	.80	(.36)
collage	79 children	7 artists	.78	(.34)
collage	28 children	8 artists	.79	(.32)
collage	20 adults	14 non artists	.93	(.49)
collage	40 women	10 artists	.93	(.57)
collage	50 women	10 artists	.92	(.53)
collage	60 women	14 artists	.75	(.18)
collage	120 women	12 artists	.80	(.25)
collage	52 men	15 artists	.79	(.20)
collage	48 adults	10 artists	.77	(.25)
collage	80 children	11 artists	.80	(.27)

From Amabile (1983a, pp. 40-50) and Amabile, Hennessey, & Grossman (1986). Studies conducted at Stanford and Brandeis over a ten year period by Amabile and students/colleagues: S. Berglas, M. Handel, M.L. Stubbs, J. Gitomer, S.C. Brackfield, P. Goldfarb, N. Goldberg, D. Capotosto, L.M. Berman. B. Hennessey, and B. S. Grossman.

Note: The reliability coefficients reported by Amabile are estimates of the average reliability for all judges. Based upon these figures and Winer's (1971) procedures, the researcher also calculated reliability estimates for a hypothetical single judge within the sample* (shown in parentheses) for comparing studies with varying sample sizes.

Reproduced from Barnard's Study to test CAIDC (Barnard, 1992).

Table 8 Reliability Coefficients from Barnard's Study

Interjudge Reliabilities for Mean Scale Ratings on Dimensions of Judgement: Judges and Sub-categories of Judges.

Dimension of Judgement	Educators n=13	Designers n=31	All Judge n=44
Aesthetic Appeal*	.80	.93	.94
Appropriateness	.46	.90	.89
Artistic Merit	.85	.94	.95
Complexity	.83	.96	.96
Craftsmanship	.88	.93	.95
Creativity*	.85	.93	.95
Functionality	.54	.77	.84
Liking	.73	.93	.93
Novelty	.79	.95	.95
Originality	.77	.92	.92
Technical Merit*	.84	.90	.93
Thematic Expression	.73	.92	.93

Global-Dimension Variable

Note: These overall interjudge reliability estimates were calculated by procedures outlined by Winer (1971, pp. 286-287), and based upon mean squares within and between judges given by ANOVA table

Reproduced from Barnard's Study to test CAIDC (Barnard, 1992).

APPENDIX D
PROJECT STATEMENT

PROJECT STATEMENT

Project Description:

The slide is of a space used for reflection and contemplation. The challenge of this exercise is to use the slide as a source of inspiration and reinterpret this space to create a 3 dimensional design. The concept for your new design will also be reflection and contemplation. Be creative.

Project requirements:

Using the materials supplied and the elements and principles of design you have learned in this class and others, develop a creative design solution to the problem stated above. Use the color present in the materials supplied as a tool to further define and enhance (maximize) your design. Your design solution should be both novel and appropriate. Be creative!

Include a brief description of how your design concept was used in the development of your project on the 81/2 x 11 sheet provided. Write your name on the back of your brief description of how your design concept was used. Attach your name to your project in a discrete fashion using masking tape supplied by the project monitor.

Project schedule :

Time allocated for the project creation session is 2 1/2 hours. Plan to be in studio during the entire session. Each person will work independently, without benefit of discussion or collaboration for the development of the project solution.

Materials required:

Colored mat board will be provided for each student. It can be manipulated in any fashion necessary to maximize your design solution. Don't add other color to this project.

Thank you for your interest and participation.

RELAX AND ENJOY DEVELOPING YOUR DESIGN SOLUTION.

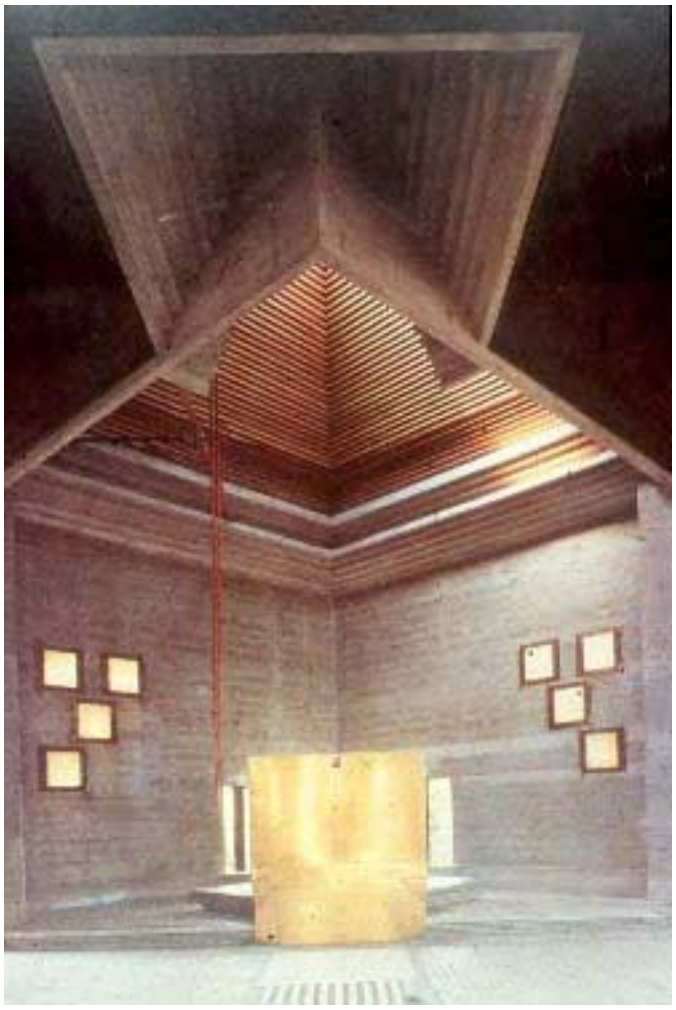
BE CREATIVE!

Turn your completed project into the project monitor and fill out the brief questionnaire before leaving.

*Please do not discuss this project with other students until tomorrow *

Figure 5.

Slide used as a source of inspiration for the design project



APPENDIX E

DIMENSIONS OF JUDGMENT FOR INTERIOR DESIGN PROJECTS

DIMENSIONS OF JUDGMENT

Dimensions of Judgment for Interior Design Project

DIMENSION	DESCRIPTIVE DEFINITION
Aesthetic appeal	The degree to which the project, overall, is aesthetically pleasing.
Appropriateness	The degree to which the design is an appropriate solution to the problem.
Artistic Merit	The degree to which the presentation is good artistically.
Complexity	The level of complexity displayed in the design solution.
Craftsmanship	The level of craftsmanship skills displayed in the design solution.
Creativity	The degree to which the design is creative, using your own subjective definition of creativity.
Functionality	The degree to which the designed space is functional.
Liking	The degree to which you like the design, based upon your own subjective reaction to it.
Novelty	The degree to which the use of materials and /or design elements is novel.
Originality	The degree to which the design solution is original or unique.
Technical Merit	The degree to which the project, overall, is good technically.
Thematic expression	The degree to which the design conveys the theme identified in the statement.

APPENDIX F

CAIDC JUDGES RATING SHEETS

Please rate (x) each project from VERY LOW to VERY HIGH on the dimension described below. Rate projects RELATIVE TO ONE ANOTHER, not according to some absolute standard for excellence. Consider the projects in ANY RANDOM ORDER, and indicate the project number being rated (1-37) in the bracket at the left.

NOVELTY : The degree to which the use of materials and /or design elements is novel.

Prj. #	Very Low	Very High
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	
( )	1 2 3 4 5 6 7 8 9	

You may use these numbers to cross off projects as they are rated.

1	21
2	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	
19	
20	

Please rate (x) each project from VERY LOW to VERY HIGH on the dimension described below. Rate projects RELATIVE TO ONE ANOTHER, not according to some absolute standard for excellence. Consider the projects in ANY RANDOM ORDER, and indicate the project number being rated (1-37) in the bracket at the left.

APPROPRIATENESS: The degree to which the design is an appropriate solution to the problem.

Prj. #	Very Low								Very High
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9

You may use these numbers to cross off projects as they are rated.

1	21
2	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	
19	
20	

Please rate (x) each project from VERY LOW to VERY HIGH on the dimension described below. Rate projects RELATIVE TO ONE ANOTHER, not according to some absolute standard for excellence. Consider the projects in ANY RANDOM ORDER, and indicate the project number being rated (1-37) in the bracket at the left.

CREATIVITY: The degree to which the design is creative, using your own subjective definition of creativity.

Prj. #	Very Low								Very High
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9
( )	1	2	3	4	5	6	7	8	9

You may use these numbers to cross off projects as they are rated.

1	21
2	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	
19	
20	

APPENDIX G

POST SESSION QUESTIONNAIRES

Name _____

We would like for you to answer the following twelve questions

We would like to know about your preferences for working in groups.
Please circle the number that is appropriate for your situation.

A. 1. I would rather generate ideas alone.

2. I would rather generate ideas in a group.

B. 1. I would rather develop design projects as a group.

2. I would rather develop design projects alone.

We would like to know about your perception of the project assigned.
Please circle the number that is appropriate for your situation.

1. How motivated were you to produce a quality solution to the project assigned?

1	2	3	4	5	6	7
Definitely Not Motivated						Very Motivated

2. How interested were you in the project assignment?

1	2	3	4	5	6	7
Definitely Not Interested						Very Interested

3. How confident are you in the quality of the project you generated?

1	2	3	4	5	6	7
Not Confident At All						Very Confident

4. How difficult was the project?

1	2	3	4	5	6	7
Not Difficult At All						Very Difficult

PLEASE ANSWER THE QUESTIONS ON THE BACK OF THIS PAGE TOO.

*Back page for group interactive brainstormers

We would like to know about your perception of the brainstorming session.
Please circle the number that is appropriate for your situation.

1. How satisfied are you with the idea generation process your group used?

1	2	3	4	5	6	7
Definitely Dissatisfied						Very Satisfied

2. How confident are you in the quality of ideas your group generated?

1	2	3	4	5	6	7
Not Confident At All						Very Confident

3. How difficult was the idea generation task?

1	2	3	4	5	6	7
Not Difficult At All						Very Difficult

4. How motivated were you to generate ideas?

1	2	3	4	5	6	7
Definitely Not Motivated						Very Motivated

5. Did you feel you had sufficient opportunity to express your ideas?

1	2	3	4	5	6	7
Very Little Opportunity						Ample Opportunity

6. I feel I would have generated more ideas alone.

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

Adapted from a questionnaire used in a previous study on brainstorming (Gallupe, et al, 1991).

*Back of page for individual brainstormers

We would like to know about your perception of your own idea generation for this project.

Please circle the number that is appropriate for your situation.

1. How satisfied are you with the idea generation process you used?

1	2	3	4	5	6	7
Definitely Dissatisfied						Very Satisfied

2. How confident are you in the quality of ideas you generated?

1	2	3	4	5	6	7
Not Confident At All						Very Confident

3. How difficult was it for you to generate ideas?

1	2	3	4	5	6	7
Not Difficult At All						Very Difficult

4. How motivated were you to generate ideas?

1	2	3	4	5	6	7
Definitely Not At All						Very Motivated

5. Did you feel you had sufficient opportunity to generate ideas?

1	2	3	4	5	6	7
Very Little Opportunity						Ample Opportunity

6. I feel I would have generated more ideas in a group.

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

Adapted from a questionnaire used in a previous study on brainstorming (Gallupe, et al, 1991).

APPENDIX H

INSTRUCTIONS FOR BRAINSTORMING

1) group brainstorming

2) individual brainstorming

INSTRUCTIONS FOR BRAINSTORMING

Objective: When you participate in a brainstorm session, you will be driving for ideas. All we ask is: " Please don't drive with your brakes on!" (Osborn, 1957).

I. Criticism is ruled out - Adverse judgment of ideas must be withheld until later. Do not be critical of any ideas at this stage just generate many different ideas.

2. "Free Wheeling " is welcomed. The wilder the ideas the better: It is easier to tame down than think up.

3. Quantity is wanted. The greater number of ideas the more likelihood of winners.

4. Combination and improvement are sought. In addition to contributing ideas of their own participants should suggest how ideas of others can be turned into better ideas or how two or more ideas can be joined into still another idea.

We are not striving for finished solutions at the idea generation stage.

Thoughts do not have to be complete.

Messy is ok. We want you to generate as many ideas as you can in the time limit.

Keep a written record of all ideas suggested.

Self encouragement is needed as much as mutual encouragement.

Play and have fun with the ideas.

Warm up problem: Reflection & Contemplation - Generate as many ideas as you can about the aesthetic qualities you would associate with a reflective or contemplative environment. .....**Time limit: 5 minutes**

Problem: Project Statement Generate as many ideas as you can about the project.

.....Time limit : 20 minutes

Osborn, A. F. (1957). Applied Imagination. New York: Charles Scribner's Sons.

INSTRUCTIONS FOR IDEA GENERATION

Objective: When you participate in an idea generation exercise, you will be driving for ideas. All we ask is: " Please don't drive with your brakes on!" (Osborn, 1957).

I. Criticism is ruled out - Adverse judgment of ideas must be withheld until later. Do not be critical of your ideas at this stage just generate many different ideas.

2. "Free Wheeling " is welcomed. The wilder the ideas the better: It is easier to tame down than think up.

3. Quantity is wanted. The greater number of ideas the more likelihood of winners.

4. Combination and improvement are sought. In addition to generating ideas you can explore how the first idea can be turned into a better idea or how two or more ideas can be joined into still another idea.

We are not striving for finished solutions at the idea generation stage.

Thoughts do not have to be complete.

Messy is ok. We want you to generate as many ideas as you can in the time limit.

Keep a written record of all ideas.

Self encouragement is needed.

Play and have fun with the ideas.

Warm up problem: Reflection & Contemplation - Generate as many ideas as you can about the aesthetic qualities you would associate with a reflective or contemplative environment. .....**Time limit: 5 minutes**

Problem: Project Statement Generate as many ideas as you can about the project.

.....Time limit : 20 minutes

Osborn, A. F. (1957). Applied Imagination. New York: Charles Scribner's Sons.

APPENDIX I
CONSENT FORMS AND AWARDS

You are invited to participate in a study about creativity. The study involves interior design students in the College of Human Resources and Education at Virginia Tech.

The procedure to be used in this research is a Design Charette, an Idea Generation Exercise and a brief questionnaire. To participate you must be a student in design.

Your participation in this project will provide information to interior design researchers, interior designers, and other professionals regarding importance of the facilitation of creativity.

The individual results of this study will be kept strictly confidential. At no time will the researchers release the individual results of this study to anyone, other than those working on the project without your consent.

_____

I know of no reason I cannot participate in this study. I understand I am to complete and return the Idea Generation Exercise, Design Charette, and Brief questionnaire.

_____ _____
Signature Date

In order for us to send the awards to the proper address. Please print your summer address below.

_____
Name

_____
Street

_____
City State Zip Code

Thank you for your interest and participation

PROJECT AWARDS

Thank you for your participation in the charette

Awards:

First Place award for most creative $100.00

Second place award for second most creative $75.00

Third place award for third most creative $50.00

* Distributed after the project creation session

APPENDIX J

PROJECT JUDGING INSTRUCTIONS

Thank you for your participation in this rating session!

PROJECT DESCRIPTION

The projects you are asked to evaluate are student generated, non-literal, three-dimensional design solutions to a problem presented in a class session. The problem presented was as follows:

Project Statement:

The slide is of a space used for reflection and contemplation. The challenge of this exercise is to use the slide as a source of inspiration and reinterpret this space to create a 3 dimensional design. The concept for your new design will also be reflection and contemplation. Be creative.

Project requirements:

Using the materials supplied and the elements and principles of design you have learned in this class and others, develop a creative design solution to the problem stated above. Use the color present in the materials supplied as a tool to further define and enhance (maximize) your design. Your design solution should be both novel and appropriate. Be creative! Include a brief description of how your design concept was used in the development of your project on the 81/2 x 11 sheet provided.

Materials: Colored mat board was provided for each student. It could be manipulated in any fashion necessary to maximize their design solution. They could not add other color to the project.

RATING SESSION

The 12 dimensions of judgment used for rating interior design projects using the CAIDC instrument are:
Aesthetic appeal
Appropriateness
Artistic merit
Complexity
Craftsmanship
Creativity
Functionality
Liking
Novelty
Originality
Technical merit
Thematic expression.

For this research project you are asked to evaluate the design projects based on only 3 of those dimensions:

Creativity
Originality
Appropriateness

One dimension is described on each rating sheet. Please complete these subjective ratings independently and without discussion or collaboration with other raters. Please proceed at your own pace.

1. Before beginning the rating process, Please browse through the display to familiarize yourself with the projects and establish your own impression of the overall range of project merit represented.

2. It is important that you rate the projects relative to one another, not according to some absolute standard for excellence.

3. Rate all projects according to the dimension described on one sheet before moving to the next rating sheet.

4. The projects may be selected for rating in any random order and the order may be different for each sheet as you go through the rating process.

5. When you have completed the ratings, please make sure that all project numbers and ratings are complete and return the forms.

If you have any questions, please ask

APPENDIX K

3 EXAMPLES OF DESIGN PROJECTS

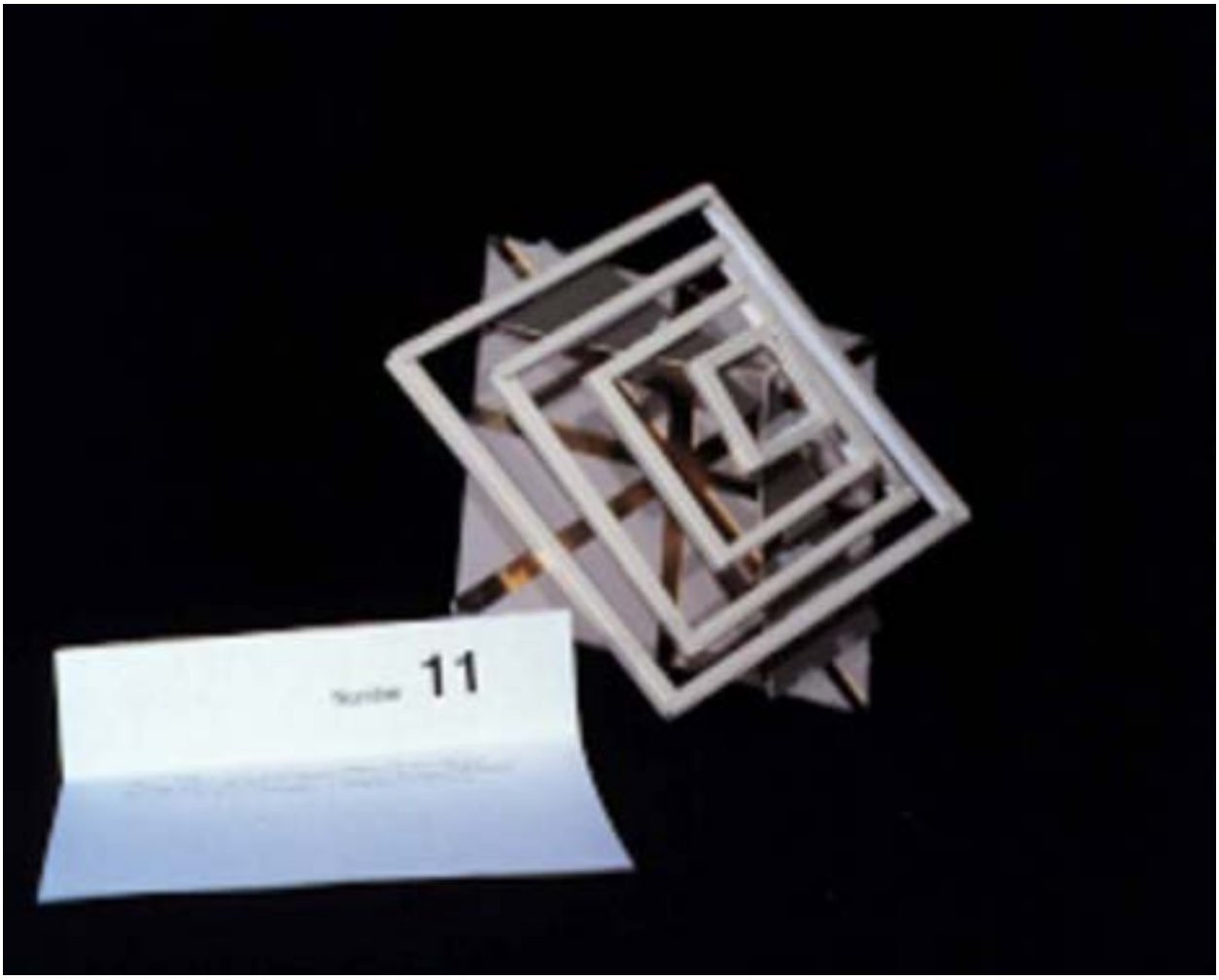


Figure 6

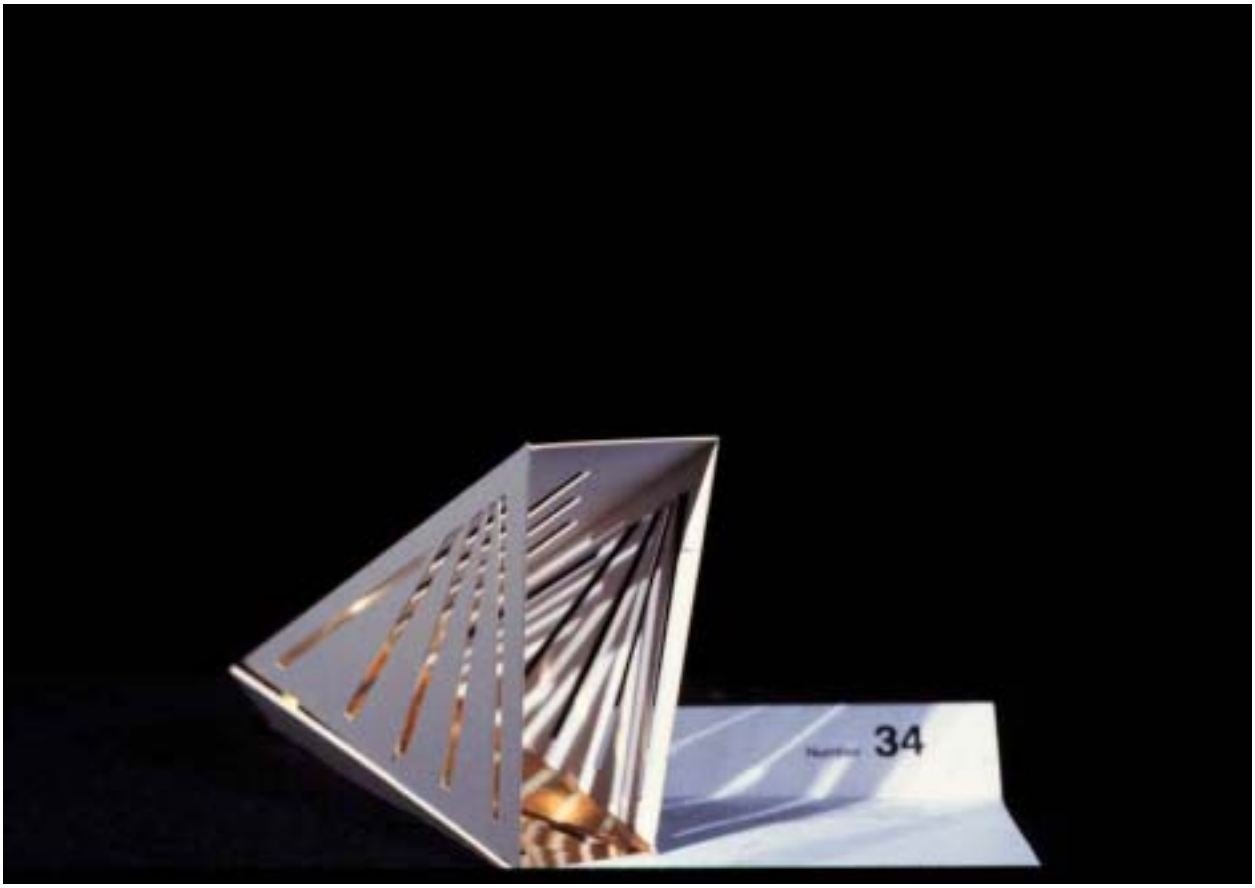


Figure 7.

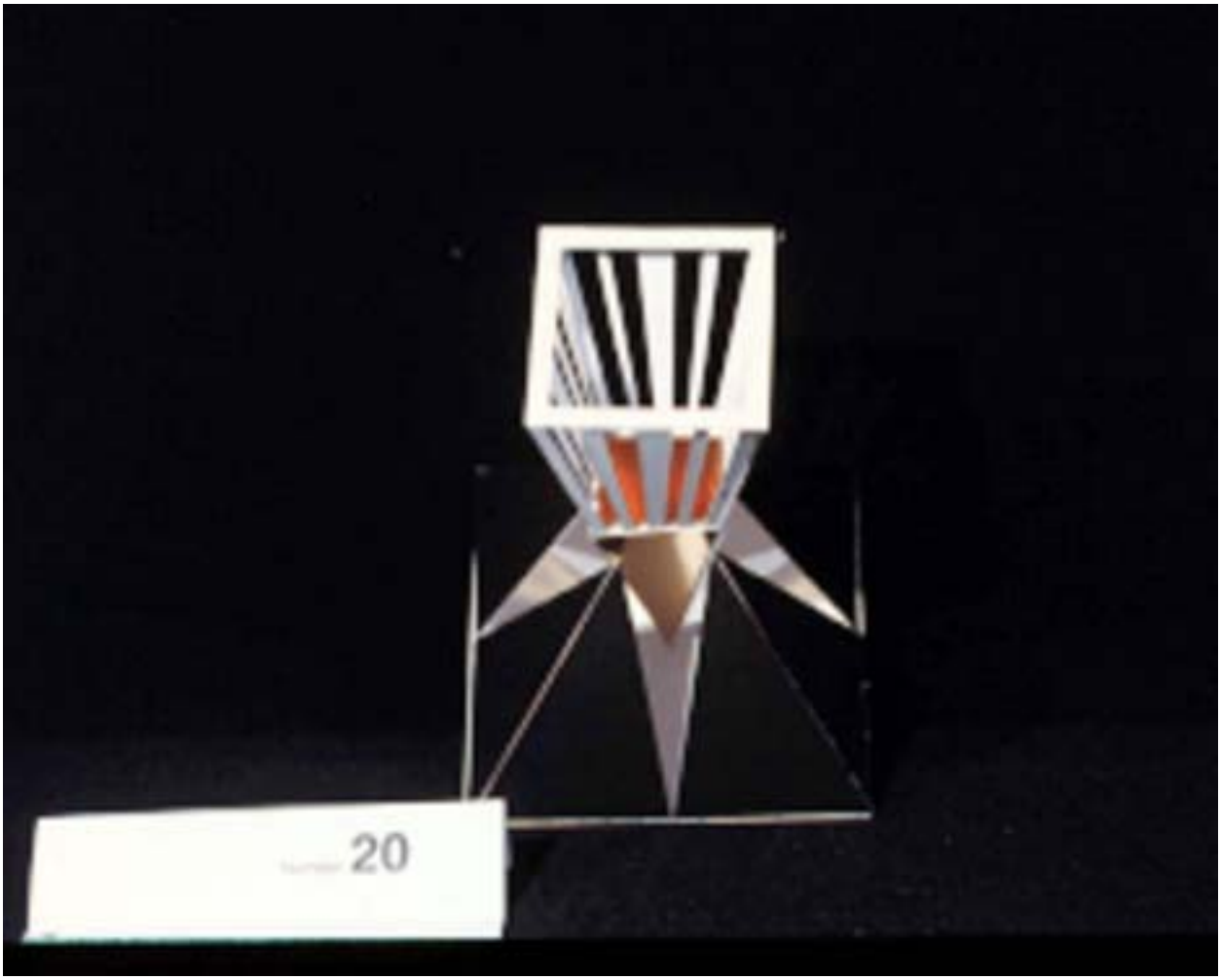


Figure 8.

APPENDIX L

DATA FROM CREATIVITY SCORES AND MSFM

Table 9 Creativity Scores

subject	judges 1 through 10, scores 1-9										treatment group
	1	2	3	4	5	6	7	8	9	10	
1	7	1	7	5	3	5	7	5	5	5	group
2	3	4	8	5	7	9	3	3	4	2	ind.
3	7	4	5	7	1	7	8	2	5	3	group
4	2	7	8	5	8	9	7	9	8	8	ind.
5	-	7	5	8	7	9	9	2	5	7	group
6	9	5	8	5	8	7	8	8	8	5	ind.
7	6	5	4	6	3	8	8	2	5	8	group
8	5	5	6	2	4	7	7	4	6	3	group
9	6	9	8	9	6	9	3	7	7	8	group
10	4	8	6	8	2	9	7	3	6	7	group
11	7	8	8	6	5	8	8	9	6	8	group
12	3	6	3	6	1	6	5	2	5	4	group
13	9	5	9	7	4	7	9	6	8	9	group
14	6	6	5	5	3	7	4	5	4	9	group
15	2	4	4	2	1	6	6	2	6	4	group
16	3	7	3	3	2	8	3	2	7	5	ind.
17	6	4	4	7	6	8	7	3	7	8	ind.
18	3	1	1	2	2	5	3	3	2	6	group
19	8	5	9	9	8	9	7	8	8	9	ind.
20	2	3	8	5	7	6	6	5	4	5	group
21	7	5	7	5	4	9	7	2	5	3	ind.
22	6	6	5	5	2	9	6	2	6	3	ind.
23	4	2	6	6	2	7	6	2	6	4	ind.
24	4	8	5	6	-	9	8	3	6	5	ind.
25	6	4	4	2	3	6	6	5	5	6	group
26	3	2	4	2	3	5	2	4	5	2	group
27	2	3	8	1	1	4	6	3	2	1	group
28	6	8	5	9	8	9	6	8	8	7	ind.
29	4	8	6	8	7	8	9	4	8	9	ind.
30	2	3	5	5	1	9	7	3	6	9	ind.
31	8	4	6	7	2	8	7	7	5	1	group
32	5	6	6	4	1.5	6	7	5	5	7	ind.
33	8	4	9	5	8	9	8	9	8	8	ind.
34	2	3	1	5	1	7	2	2	2	1	ind.
35	1	4	5	3	1	7	5	2	5	8	ind.
36	5	6	7	8	3	9	8	5	6	8	ind.

Table 10 MSFM Scores

subject	things		instances		uses		treatment group
	popular	original	popular	original	popular	original	
1	11	7	19	1	21	0	group
2	26	4	45	5	26	6	ind.
3	13	8	39	7	25	7	group
4	15	1	25	3	14	2	ind.
5	11	1	44	23	11	7	group
6	17	6	36	6	26	3	ind.
7	29	20	43	16	24	11	group
8	14	9	25	15	12	6	group
9	12	13	45	8	7	5	group
10	12	8	30	7	15	4	group
11	11	8	42	20	25	26	group
12	12	13	58	18	31	10	group
13	14	8	39	15	17	5	group
14	14	14	52	23	17	4	group
15	10	13	45	14	27	5	group
16	36	17	52	7	25	8	ind.
17	12	8	61	17	20	1	ind.
18	4	0	12	1	8	2	group
19	12	11	28	5	10	9	ind.
20	14	5	45	23	33	12	group
21	22	17	33	8	13	7	ind.
22	13	5	33	4	17	2	ind.
23	8	6	33	6	15	12	ind.
24	11	13	50	15	24	11	ind.
25	9	5	27	7	18	2	group
26	25	17	31	5	44	12	group
27	18	3	23	5	12	7	group
28	16	15	36	7	15	15	ind.
29	23	8	77	69	16	16	ind.
30	9	5	22	0	9	0	ind.
31	21	22	30	14	24	3	group
32	12	5	50	8	19	8	ind.
33	12	11	25	12	28	12	ind.
34	11	9	32	8	10	2	ind.
35	27	11	52	21	21	3	ind.
36	37	12	35	4	13	11	ind.

VITA

Shari Lane Park-Gates, after graduating from West Virginia University in 1969 with a Bachelor of Arts degree in psychology, accepted a position as a public relations representative with the State Department of Health. After marrying and having two children Shari decided to go back to school and seek a degree in interior design.

In 1979 she graduated with a Bachelors of Interior Design degree from Interior Design Institute in Denver Colorado. After graduation Shari accepted a position with an Architectural Interiors firm in Denver where she worked on large commercial and government projects.

In 1981 Shari and her family left Denver to return to West Virginia where she started her own commercial interior design firm called SPACE 3 Inc. An acronym for Systems Panning and Commercial Environments, SPACE 3 specialized in commercial interiors with an emphasis on the work environment. The company started with three employees and grew to include designers, outside sales and marketing staff, shipping, receiving and accounting employees, which numbered approximately 20 employees. Typical interiors designed by SPACE 3 employees included Banks, Corporate Offices, Medical Facilities, Retail Spaces and Government Projects.

Shari has practiced interior design for twenty years and has been NCIDQ certified since 1988. She has worked for Herman Miller and Steelcase dealerships besides owning her own business. She has also been a freelance consultant to Architectural and Design Construct firms.

She has taught as an adjunct faculty member at Interior Design Institute in Denver, Colorado and University of Charleston in Charleston, West Virginia. She was a graduate teaching assistant at Virginia Tech while working on her doctorate. An assistant professor at Georgia Southern University since 1998, she currently teaches the following courses: Commercial Design, Beginning Graphics, Design Appreciation, Professional Practices, and History of Interiors. She is also active in The Interior Design Educators Council (IDEC).

Shari completed a Masters of Business Administration in Business Administration at The University of Charleston in Charleston, West Virginia in 1991 and began working on a Ph.D. in Interior Design at Virginia Tech in 1995. While at Virginia Tech
She participated in the graduate advisory committee for HIDM as a graduate student representative, was selected for membership in Kappa Omicron Nu National Collegiate Honor Society, and was the recipient of the Jean Lane Scholarship Award in both 1995 and 1996.

With a research focus in creativity, Shari has presented papers at IDEC And AAFCS conferences. She hopes to continue making contributions to the profession of Interior Design in the classroom, with her research, and her consulting in the future.