COMBATIVE CREATIVITY: RESISTANCE TO COGNITIVE FIXATION EFFECTS IN AN IDEA GENERATION TASK

A Dissertation

by

ROBERT STEVEN WOODWARD, JR.

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2004

Major Subject: Educational Psychology

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William Nash (Co-Chair of Committee)	Joyce Juntune (Co-Chair of Committee)
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ABSTRACT

Combative Creativity: Resistance to Cognitive Fixation

Effects in an Idea Generation Task. (August 2004)

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This study investigated whether individuals identified as highly creative can resist a cognitive fixation tendency brought upon by the introduction of examples prior to an idea generation task. Ninety-eight subjects, ranging in age from twelve to seventeen and participating in Texas A&M University's Youth Adventure Program for gifted students, comprised the sample. All took the *Thinking Creatively with Sounds and Words* test and were divided into three creativity groups (high, middle, and low) based on originality scores. A proportional stratified random sampling procedure was implemented to ensure equal representation for experimental and control groups. The subjects were then presented an experimenter-designed idea generation task, patterned after Smith, Ward, & Schumacher (1993), that called for them to generate ideas for a chair of the future. The experimental group viewed examples prior to task onset that all included three specific features relevant to the design of a chair (adjustable lever, four legs, drink holder). The control group did not view any examples prior to task onset. Conformity effects were measured in relation to the proportion of the features in the examples that were included in the ideas generated by the subjects. Chi-square and a model generated analysis of

variance procedure were used to determine if there were any significant direct or interaction effects for both the creativity and treatment groupings on the construct of conformity.

The results demonstrated that subjects in the control group conformed at a significantly lesser rate than the experimental one, across all creativity groupings. A significant difference was also found between the high and low creativity groups for conformity. The ANOVA data additionally discovered a significant interaction effect between the variables of treatment condition and creativity grouping, indicating that the interplay of these two variables influenced results. Finally, the conformity rate of those individuals with the highest level of creativity, true to the linear nature of the initial polynomial trend contrast, were, on average, the lowest observed scores.

DEDICATION

To my Lord – for guiding me in everything and being my strength.

To my parents – an unending source of emotional, physical, and financial support through all of my endeavors. Thank you for all you have done and all you continue to do.

To my mentors – thank you for taking a chance on an ambitious and eager student and allowing me to freely express and fulfill my creative potential in whatever pursuit or dream I chased.

To my friends – who almost ensured that I would never graduate with this degree. However, the diversions were much appreciated and needed. I will remember you all.

To Texas A&M – for allowing me to bleed maroon at a school I think so grand.

To the Manor – your walls have surrounded me throughout this pursuit. Thank you for never falling down as I huffed and puffed on this paper.

To YAP camp – a source of pride, a source of passion, and the source of my data.

And finally,

To Catherine – the love of my life.

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CHAPTER I

INTRODUCTION

"Monkey see, monkey do."

Though only a simple phrase used primarily to describe the tendency of individuals to mimic the ideas, products, or behaviors that they have deemed successful within a particular environmental or social context, this adage carries great empirical meaning when applied to the construct of creativity. Specifically, are there situations in which an individual's ability to generate novel and creative solutions to problems can be inhibited? This is a key question to answer when determining the value of examples and other such cognitive prompts in an idea generation setting. Novelty is an essential component in relation to defining creativity. Although there is no clear consensus in academia on how to operationalize this term in a universally accepted manner, Morgan (1953) was able to conclude through a meta-analysis of creativity definitions in the field that the prevailing element common to all was novelty. This was echoed by Hausman (1964), who stated, "each appearance of genuine novelty is a sign of creative activity" (p. 20). However, from this statement, pertinent questions arise: "what is genuine novelty, how can it be attained, and what factors can hinder its existence?"

There is a series of experiments that demonstrate that the production of novel ideas may be hindered by a variety of cognitive factors such as recently activated

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This dissertation follows the style and format of the *Gifted Child Quarterly*.

knowledge and/or the presentation of examples. Within the field of creative cognition, several studies have been conducted that have analyzed the effects of related examples on an individuals' ability to produce creative products in an idea generation task. The most eminent of these studies was conducted by Smith, Ward, & Schumacher (1993). They studied the effects of examples in an idea generation task under the specifically stated theory that "although prior experiences can provide the expertise needed to fully explore and develop ideas into creative products, it may be that such experiences limit creative thinking when ideas are originally being generated" (p. 837). The results of the experiment bore this out. In all three experiments, they found significant conformity effects for individuals who were presented with examples prior to task onset. The subjects who had viewed examples of what they were to generate were statistically more likely to include features contained within those examples in their designs. These effects persisted even with the inclusion of time delays and specific instructions informing the students that they were *not* to include any of the features they had previously viewed. This is an indication of functional fixation, identified by Jansson and Smith (1991) as "restricting one's use of an object to previously encountered functions" (p. 4) as tested in their experiment on design generation with engineering students. They tested whether the introduction of examples of previous solutions to the experimental group would reduce the fluency of their responses to a design problem. The results substantiated this hypothesis, even in conditions where the examples demonstrated faulty characteristics that would not be desirable in an end product.

The results of the prior experiments clearly demonstrate the effects that examples have on individuals in an idea generation task. Finke (1990) foreshadowed these findings

with his assertion that creative imagination is often structured by recently activated knowledge cognitively induced by examples. This conception is also discussed in an article by Runco and Chand (1995) in which they state, "… Individuals who rely on details from past experience – even persons who have been innovative in the past – preclude original behavior. It is another kind of functional fixedness, whereby someone is stuck with one perspective and has difficulty finding new alternatives." (p. 248).

But is this truly the case? Can individuals who score high on traditional measures of creativity overcome the traditional cognitive fixation effects that examples can produce on an idea generation task? In essence, do these individuals have a high level of transformational power to transcend the given properties of the examples? The notion of transformation power was stated by Feldman, Marrinan, & Hartfeldt (1972) and relates to "… the extent to which a given response represents the production of new form rather than improves upon the existing forms, the extent to which the apparent constraints of the stimulus are overcome, but overcome in a highly appropriate fashion." (p. 336).

This definition of transformational power not only encompasses the two principal fundamentals of a creative product – that it is novel and appropriate – but directly addresses the focus of this research. Can those individuals identified as creative by standard psychometric means resist the cognitive fixation tendency brought upon by the introduction of examples prior to an idea generation task?

Statement of the Problem

It is the purpose of this study to examine whether those individuals identified as creative by the *Thinking Creatively with Sounds and Words* (TCSW) test (Khatena &

Torrance, 1973) can resist the cognitive fixation tendency brought upon by the introduction of examples prior to an idea generation task. The results of this study will provide a better understanding of the cognitive abilities of highly creative individuals and whether they have the ability to resist functional fixedness and the rigidity that pervades commonplace thinking when presented with salient examples of potential solutions. Additionally, knowledge gleaned from this study can be applied to educational and professional settings for the purpose of fostering creativity and in turn creative production among those participants in these specific environments.

Research Questions

The research questions to be answered are:

1. Will the presentation of examples prior to the onset of an idea generation task produce a significantly higher tendency among subjects to include features of those examples in their design? The null hypothesis related to this question is that there will be no significant statistical differences found with relation to conformity between the group that is presented with examples (experimental group) and the group that does not receive such exposure (control group).

2. Will there be a significant difference in the overall conformity scores of those identified as possessing either: high, middle, or low creativity levels regardless of experimental grouping? The null hypothesis related to this specific question is that there will be no significant statistical differences found between any of the creativity groupings on the dependant variable of conformity.

3. Will there be any significant interaction effects between the independent variables of treatment condition and creativity grouping on the dependant variable of conformity? The null hypothesis related to this question is that there will be no significant interactions found between these two variables with respect to conformity.

Definition of Terms

Creativity. For the purpose of this study, E. Paul Torrance's (1974) complete definition for creativity was employed. Using this definition, creativity will be considered to be … "a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" (p. 8).

Originality. For the purpose of this study, originality was operationally defined as statistical infrequency of occurrence of a given response in relation to a specific stimulus on the *Thinking Creatively with Sounds and Words* test.

Fluency. Fluency, for this study, was defined as the total number of drawings produced by subjects on the experimenter designed idea generation task of designing a "chair of the future."

Conformity. Conformity was assessed as an indication of how frequently one of the three design features common to the chairs in the example appears in the students' drawings of "chairs of the future."

CHAPTER II

REVIEW OF THE LITERATURE

Since being thrust into the limelight in 1950 as a result of J.P. Guilford's presidential address at the annual American Psychological Association conference, the construct of creativity has enjoyed a substantial growth in empirical investigation and focus. With this new vigor came a litany of experiments designed to operationally define and quantify this unique concept. As Helson (1996) observed in her analysis of the research conducted a decade after Guilford's address, the creative personality became the "hot topic" of investigation; a trend which has continued through today. Feist and Runco (1993) provide evidence of this transformation in their findings that "the percentage of articles dealing with creativity in the *Psychological Abstracts* has grown from 0.002% in the 1920's to approximately .01% in the 1980's" (p. 272). While this is still a small percentage of overall research, this represents a substantial increase from previous levels and there is additional evidence that this percentage is still climbing. However, despite the fact that the amount of research was relatively small before the middle of the twentieth century, the subsequent theorems derived from this research were theoretically rich and helped form the cornerstone of creativity research today. However, it would be negligent to dismiss the foundations of creativity research upon which this theoretically rich cornerstone was laid. What these early scholars found shaped the course of what is

debated among contemporary scholars. Therefore, to harvest an exact picture of where the research of the future is headed, it's important to examine from where it came.

Creativity Research: A History

The earliest explanation of creativity can trace its lineage to one of the oldest recorded books in history – *The Bible*. Boorstin (1992) asserts that the earliest Western conception of creativity was the biblical story of creation found in Genesis. He writes:

> For man's awareness of his capacity to create, the Covenant was a landmark. It declared that a people become a community through their belief in a Creator and His Creation. They confirmed their creative powers through their kindship, their sharing qualities of God, their intimate and voluntary relationship to a Creator – God (p. 42).

Further examination of inferences found in specific passages of *The Bible* and from the writings of the poet Homer led psychologist Julian Jaynes (1976) to develop a term that he felt encapsulated the belief of the time; that of a "bicameral mind." Simply stated, and separate from current research on the hemispheric nature of the human brain, the bicameral mind can be described as the belief that the human mind was composed of two entirely separate chambers. Jaynes forwarded the notion that people uniformly believed that the gods controlled the chamber of the mind in which new thoughts occur – with the other chamber being reserved for the lower level processes necessary for the communication of these ideas (via written or spoken word, physical action, or other means) to which the creative inspiration could flow through. It was believed that all creative ideas come from the gods, usually through the mediation of a muse, a divine

intermediary for the gods. A person who felt a creative impulse would invoke the appropriate muse for assistance. A major function of the mind, then, was to serve as a receptacle for supernaturally inspired interventions. These supernatural influences were considered to be the source of creative thought and inspiration. Dacey and Lennon (1999) observed that many early thinkers, including Plato and Aristotle, believed that this "creativity chamber" also housed madness when the muse's spirit was present (p. 17). But careful distinction should be made between the madness of this early time and our current view of madness – or insanity – today. As Eysenck (1995) points out, "In Latin there is no linguistic distinction between madness and inspiration. Mania and furor are terms that cover many different non-rational states like anger, passion, inspiration, and insanity" (p. 130). There are still some contemporary scholars who continue to support the association between madness and creativity – however, their distinctions are based on far different terminology, scientific findings, and prevailing attitudes than early philosophers faced.

One of the first theoretical challenges to the concept of what Jaynes termed "the bicameral mind" can found in the writings of Aristotle, noted philosopher of early fourth century B.C. Dacey and Lennon (1998), in examining these manuscripts, have concluded that although Aristotle agreed that inspiration involved madness, he suspected that great insights begin as the result of an individual's own thought (p. 17). This free-thinking paradigm that Aristotle described was the first recorded theorem related to the principle of associationism – one that guides contemporary cognitive and creativity research today. The principle behind associationism is simple – the mind contains a varied assortment of knowledge broken down to its basic roots (images, letters, words, etc.). The mind makes

loose associations between pairs and chains of these constructs as ideas and objects come to be related through the experiences of the individual. In this theoretical notion then, the process of thinking simply involves moving from one set of principles to another via the conductivity of this association chain and learning how they specifically pertain to one another. For ideas to be linked together, temporality, saliency, and proximity of occurrence are key factors with ideas that occur close together and at the same time with an obvious direct or indirect relationship being the most likely to be linked.

Aristotle was not alone in his contributions - there were many other important advances in the study and examination of creativity by the Greeks – who flourished in what many historians will cite as "the golden age" of Western civilization's history. Looking back at the foundation of knowledge that has allowed us such technological, architectural, scientific, and cultural advances, it becomes obvious that the Greeks provided the basis for a lot of what is found in the modern world today – especially if one closely examines their mathematical, political, medical, artistic, literary, and philosophical forms, theorems, and discoveries. In examining the creative achievements that flourished during this time, historian Moses Hadas (1965) offers his opinion on how the Greeks were able to procure as many societal, philosophical, artistic, and creative advances in a myriad of different disciplines and fields. It was his conclusion that the Greeks were prolifically creative because they were free of many of the cognitive restraints that effected other major civilizations. They were economically secure and had ample assistance in their daily lives as a result of their slave system. However, according to Hadas, their main asset was not having the religious beliefs that fettered most other societies. In essence, the Greeks did not think that their self-expression would upset the

deities. In breaking free of this traditional religious view and making significant achievements, the Greeks demonstrated the powerful impact that the cultural environment can have on shaping creativity and innovation, and ultimately the acceptance of these two ideals. This element will be discussed in more detail later, but is an important ingredient of the overall picture when looking at creativity and the creative culture: society plays an important role not only in the quantity, quality, and type of advances made but also in the acceptance of these advances in whatever medium they are expressed.

The Romans did not embrace this Greek ideology that was so fruitful to the development of creativity and as their rule ended and their empire crumbled under hordes of foreign invaders, so did the advancement of creativity. In fact, scholars are largely in agreement that the next several centuries in history were marked by a great decline in creative accomplishment as Western society was plunged a period that culminated with one of the worst plagues in human history – the Black Death. However, despite killing nearly a third of the world's population, this plague served as an impetus for a paradigm shift regarding the position of the individual within society. Now that workers were at a premium, they were able to better assert their rights against the traditional religious, clerical, and governmental hierarchies that had largely suppressed their rights. This fundamental shift brought the Renaissance and the dawning of the modern era. Berdyaev (1962) writes:

> In the creative upsurge of the Renaissance there occurred such a powerful clash between pagan and Christian elements in human nature as had never occurred before. In this lies the significance of the Renaissance for the

> world and for eternity. It revealed the activity of the pagan nature of man in creativeness, and at the same time the activity of his Christian nature. (p. 213)

From this grew the belief that the individual was responsible for much of what happens, and under this greater humanistic impulse, the rigid social structure that dominated society began to schism, allowing the individual a freedom that had been long suppressed – the freedom to think, act, and create. Wilson-Given (1996) depicted these salient sociological and philosophical shifts as being marked by "the decline of serfdom, the triumph of the English language, the rise of the judicial and medical professions, and the growth of religious nonconformity" (p. 3). This led to profound cultural and intellectual advances that ushered in the "Age of Enlightenment," to which many of the modern theories of creativity can trace their empirical inspirations, roots, and lineage. Though the general notions pertaining to creativity remained dormant with respect to any alterations of its ideational conceptualization during this period, Albert and Runco (1999) noted that "the other changes taking place were exceptionally fertile grounds for the idea of research," as it was "… around this time that science and scientific thinking took form as the preeminent instruments of discovery and models for thinking about the physical world" (p. 19).

One of the first major inquiries that arose out of this specified focus on scientific and empirical thinking came from William Duff (1767) and his investigation into the quantifiable difference between genius and talent. It was his assertion that genius was the root of creative potential grounded in the creative process. In contrast, talent was simply the ability to be productive in an area, but not have this production contain any

traditionally defined features of novelty. Unique to Duff and his investigation was the assertion that creativity possessed a biophysical nature. He also examined the influences of society and the unique attributes of the individual themselves – with special devotion towards determining the cognitive traits that caused the variance he observed in people's accomplishments. He was concerned with not only hereditary influences, but also with the eras in which his subjects lived. All of these initial investigative elements of Duff's study have been adopted and adapted for modern research on creativity and will be discussed in greater detail on an individual basis later in this literature review as they comprise several of the major schools of thought pertaining to creativity. Dacey et al. (1999) noted that the publication of Duff's work was one of several events that set the stage for scientific research on human thought, which would later prove essential to the demystification of the creative act (p. 26). Ultimately, once the mystery of the term was removed, the specific, scaled, and scientific examination of the construction of creativity could commence. With this gradual shift in thought came a sweeping theoretical movement toward the belief that creativity could be considered a heritable trait. As advances in medicine began to show that many traits were passed down from generation to generation, creativity began to be looked at in the same light. This opened the door to the great debate in contemporary psychology – that of nature vs. nurture; and creativity was not immune to this theoretical implication.

One of the earliest contemporary pioneers in the field of creativity research was Sir Francis Galton, who developed one of the first laboratories specifically for the purpose of measuring individual differences on specific abilities and sensory functions related to intelligence. In pursuit of this goal, he is largely credited with conducting the

first scientific research on the nature of genius. Crovitz (1970) depicts this process in his literary description of Galton's pioneer study of attempting to accurately measure and record the workings of his own mind and subsequent thoughts. Directly from his publication of this study, Galton (1879) recorded: "The actors on my mental stage were indeed very numerous, but by no means as numerous as I had imagined. They now seemed to be something like the actors in theaters where large processions are represented, who march off one side of the stage, and going round by the back, come again at the other" (p. 162). In attempting to measure the workings of his own mind, Galton discovered two principles that have had an enormous impact on the science of metacognition. The first principle and subsequent terminology that Galton introduced was that of *recurrence* – which holds that our mind is like a *plenum*, a space that is completely filled with objects. According to this notion, the mind is constantly filled to capacity and thoughts can only follow each other around. Galton believed this discovery to be a positive one because without this natural flow, conscious thought would have no order and would, in essence therefore, be random. It seems a basic enough principle that orderliness is essential to logical thought. But, under this guidance, how can the mind produce and make room for creative thought? This was explored in Galton's second principle in which he stated that new input could come into the plenum from another part of the mind. The source of this input is the unconscious. The unconscious can be made conscious through association of thoughts. Thus, he advanced the notion of free association, which holds that ideas in the conscious mind are linked to those in the unconscious mind by threads of similarity. This definition was adopted by many as a prominent and lasting feature towards and understanding of creativity, and, more

specifically, how it could be tested. His publications of *Hereditary Genius* (1870) and *Inquiries into Human Faculty* (1883) inspired others to continue his work in the field. Terman carried this mantra domestically in America in the early 1900's. His five-volume publication, *Genetic Studies of Genius*, completed over a span of 30 years, correlated intelligence with evidence of eminence and sought to scale people along a dimension that could be quantifiably validated (Guilford, 1970). Carolyn Cox (1926), continuing in this line of research, conducted her own investigations into those factors that led to distinction. Her findings revealed that, "those who achieved eminence are characterized not only by high intellectual traits, but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character" (p. 218). These results were among the first to assert that eminence, genius, and/or creativity were not a result of a single factor, but rather a synthesis of multiple factors interacting together. This finding provided the rationale and theoretical basis that has guided the myriad of contemporary investigations into this concept as researchers try to pinpoint the exact features and contributing factors that define creativity.

Creativity: Defying Definition

As individual research in creativity progressed, it became clear that there was no clear consensus on how to operationalize this term in a universally accepted manner. As early as 1960, Repucci counted between 50 and 60 definitions extant in the literature on creativity (Parkhurst, 1999). Twenty years later, Welsch (1981), in a comprehensive literature review stated, "the literature contains such a variance of definitional statements that the task of defining the concept of creativity is a challenging one" (p. 3). Therefore,

as we look towards identifying many of the prominent definitions that exist in published literature today, it is important that the salient and unifying aspects of these seemingly diverse statements be emphasized. From this exact analysis, we are likely to find agreement among the discord.

As noted, Guilford's 1950 address sparked a renewed interest in creativity research. It is only fitting then, in reviewing the relevant literature that resulted from his inspiration, that we examine his definition as a starting point: Guilford (1950) stated:

> In its most narrow sense, creativity refers to the abilities that are most characteristic of creative people. Creative abilities determine whether the individual has the power to exhibit creative behavior to a noteworthy degree. Whether or not the individual who has the requisite abilities will produce results of a creative nature will depend upon his motivational and temperamental traits. (p. 444)

Guilford, through this definition, opened the door to a myriad of investigations that could focus on different aspects of the term. For some theorists, creative abilities became their area of study. For others, personal characteristics of the individual provided the angle for their investigation. It is of no surprise, then, that several markedly different schools of thought developed, and this diversity provided a comprehensive and thorough analysis that resulted in many variant definitions of its properties.

Psychoanalytic View

Sigmund Freud was the chief proponent of this early view that creative ability is a personality trait that tends to become fixed by experiences in the first five years of life. He thought that creativity resulted from overcoming some traumatic experience, usually

one in childhood, as often such an experience is buried in the unconscious. Freud's explanation of the creative process was most famously laid out in his publication *On Creativity and Unconscious* (1959). Freud's creativity theory depended heavily on his ideas about defense mechanisms, which he explained as being unconscious attempts on the part of the individual to block out unpleasant, incongruent, or morally unacceptable ideas or stimuli. To Freud, creativity was indirectly linked to the ability to satisfy sexual desires. Therefore, the presence of defense mechanisms seemingly inhibited creativity and creative thought as they filtered out that which could be sexually pleasurable to the individual. Freud believed that only when individuals channeled displaced sexual frustration into another talent, ability, or thought process could they truly be creative. He called this defense mechanism sublimation and proclaimed it the root of creative thought. Many of Freud's contemporaries were outraged by this theory – especially the assertion that infants and young children were capable of sexual thoughts and desires. However, despite these attacks, Freud's theory stimulated the research on creativity and the creative persona.

Building upon Freud's theory was Ernst Kris. He supported Freud's notion of the presence and utility of defense mechanisms in the human psyche. Relating this to a personality based theory of creativity, Kris (1952) believed that when a person is able to regress to a childlike frame of mind (via the regression defense mechanism), the barriers between the unconscious and conscious mind are broken down, allowing the unconscious material to rise to a more accessable level of awareness. According to Kris, the seeds of creative thought lie in the unconscious mind and through regression an individual is able to bring these thoughts to a working level of consciousness. Therefore, a person who is

creative is adept at retrieving information from this unconscious store. When there is a free interchange between the conscious and unconscious mind, creative people are able to retrieve material more readily and to look at problems in a fresh, innovative way**.**

Humanistic View

In contrast to Freud and other psychoanalytic theorists, the humanistic theorists downplayed the role of the unconscious in their definition of creativity and creative thought. To the humanist, creativity was something that individuals achieved once they had met a systematic hierarchy of needs that allowed them to become physically, mentally, and emotionally fulfilled: in other words – self-actualized. Once they were functioning at this level, creative thought could occur.

Abraham Maslow (1954), one of the pioneers of humanistic psychology, described self actualization as "the desire for self-fulfillment, namely, to the tendency for a person to become actualized in what he or she is potentially … what one can be, one must be" (p. 92). According to Maslow (1954), self-actualized people are independent, autonomous, and self-directed. Because they are not distracted by lower-level needs (such as food, shelter, clothing, etc.), they are free to strive for optimal health and well-being. Once at this higher level, they have the potential to discover what Maslow termed a "peak experience," i.e., an internal flash of insight that brings joy and happiness to the individual. Linking the concepts of self-actualization and peak experiences to that of creativity was humanistic theorist Carl Rogers. In a 1961 publication, Rogers stated that "the mainspring of creativity appears to be the same tendency which we discover so deeply as the curative force in psychotherapy – one's tendency to actualize oneself, to become one's potentialities" (p. 350). In the same theoretical vein, Maslow (1971)

followed Rogers' empirical assertion by stating that "the concept of creativeness and the concept of the healthy, self-actualizing, fully human person seem to be coming closer and closer together, and may turn out to be the same thing" (p. 57).

Behavioristic View

Sharply disagreeing with both the psychoanalytic view and the humanistic view was that of the behaviorists, most notably B.F. Skinner. To behaviorists, learning was simply a result of stimulus-stimulus and stimulus-response associations that when reinforced grew stronger in nature. To the behaviorists, the state and psyche of the unconscious was largely irrelevant as all learning took place at the conscious level. They also rejected the humanistic notion that individual needs, states, and balances shape the creative potential of an individual. To Skinner (1971), the explanation was simple – creativity was nothing more than the product of genetic and environmental influences. In that assertion, it would be sufficed to say that an apt summary of Skinner's position would be that an individual's level of creativity will depend directly upon his/her prior conditioning in such ways that these experiences will either increase or decrease the likelihood of a given behavior (original or creative thought) depending upon the reinforcements given (positive or negative) to the output manifested through a response that was initially triggered by a stimulus in the environment. Maltzman (1960), another behaviorist psychologist, took a similar stance in his assertion that simply the rewarding of its occurrence could increase creative behavior. And, Sarnoff Mednick, under the theoretical umbrella of behaviorist notions, coined the term *mental associations* in addressing cognitive thought and the construct of creativity. These mental associations represent two stimuli (words, images, etc.) that have been considered contiguously

related due to repeated stimulus-stimulus pairings. To Mednick (1963), a highly creative person is "one who possesses a large number of verbal and non-verbal mental associations which are available for recombination into creative ideas. A less creative person is one who is only able to respond with just a few, highly dominant mental associations" (p. 587). One of the first specifically designed tests for creativity came out of this research when Mednick published his *Remote Associates Test* in 1967 that purported to measure an individual's creativity through his or her ability to make verbal associations with specific words in a set. Critics have since demonstrated that this instrument was more of a verbal intelligence test than a creativity test, but nonetheless, it started the trend toward empirical research on the construct of creativity.

There were many other theories of creativity that did not fall into one of the main prevailing schools of thought at the time. No less valid than their counterparts, their diversity seemed to unify them under a single explanatory term – contemporary.

Contemporary Theories of Creativity

E. Paul Torrance may sum up the state of contemporary creative thought better than anyone in his assertion that "creativity defies precise definition" (Parkhurst, 1999, p. 13). But, defying definition doesn't mean that theorists haven't tried to pin down its aspects. Guilford (1967), in harmony with his own concurrence for increased study on creativity, proposed a three parameter model of creativity he termed "structure of the intellect." In this theory, the dynamic interaction of the operations needed for mental synthesis combined with the content of the problem itself with respect to the output that was desired could yield over 120 different factors that could be used to predict creative

thought. Robert Sternberg advocated a three-facet model of creativity that, in contrast to Guilford's model, focused on aspects related to the creative individual. Summarizing his own work, Sternberg (1988) states that "creativity is … a peculiar intersection between three psychological attributes: intelligence, cognitive style, and personality / motivation" (p. 128). Teresa Amabile (1983) also had a three-part model of creativity, but her dimensions differed from both those of Sternberg and Guilford. In her model, she recognized the existence of *domain-relevant skills*, *creativity relevant skills,* and *task motivation.* In essence, these three separate areas must all work in harmony to produce creativity; with a deficiency in one, the core breaks down. These three theories and theorists, with their tertiary view of the creative process, spawned a litany of investigations from the concepts they derived.

Taking a somewhat different path to arrive at his definition of creativity is Howard Gardner. By studying the lives of eminent creative geniuses in several different fields of studying (ranging from dance to politics), Gardner was able to ascertain what he felt was the true essence of creativity. To Gardner (1993), "… the creative individual is a person who regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular cultural setting" (p. 35). A closer examination of this definition and those discussed as contemporary reveals an interesting pattern. In their explanation of creativity, they have resorted to a multi-faceted model that involves several nodes of influence and the inclusion of several distinct areas pertaining to the fulfillment of creativity. But, despite this seemingly murky appearance, some clarity can be gleaned

from an analysis of those features that tie these definitions together rather than separate them apart.

Morgan (1953) was one of the first to attempt such a task and his findings led him to conclude that the prevailing element common to *all* definitions of creativity was novelty. This was echoed by Hausman (1964), who stated, "each appearance of genuine novelty is a sign of creative activity" (p. 20). Chand and Runco (1992) echo this with their assertion that "thinking is creative if it leads to original and adaptive ideas, solutions, or insights" (p. 244). However, is novelty by itself enough to substantiate the presence of creativity? It seems too simplistic a definition to encompass such an intricate construct. In reference to this notion, Charles and Runco (1993) argue that creative behaviors and products are typically defined in terms of originality and adaptiveness. The viability and inclusion of adaptiveness as an integral component of creativity can be seen throughout the theoretical development of the term. It can be traced as far back as the Darwinian theory of natural selection in which creative adaptations relevant to environmental demands led to the continuation of a given species. Along the same continuum, Poincare (1913) noted, "to create consists of making new combinations of associative elements which are useful" (p. 286). Stein (1967) suggests that creativity must be novel or new to the culture to be creative, and most recently, Martindale (1999) defines a creative idea as "one that is both original and appropriate for the situation in which it occurs" (p. 137).

Examining all of these definitions both in content and in context and keying in on the areas of originality and adaptiveness, it becomes obvious that there are several different arenas in which creativity can be discussed, depicted, and defined. For this

reason, is it important to examine creativity in the separate sectors in which it is purported to be manifested. Through this very analysis, Rhodes (1961) theorized that definitions of creativity can fall into one of four main strands: the individual involved in the creative act itself (person), the mental process at work in creation (process), the influence of the social context that the creative act is occurring in (press), and the resulting product that the creative act produces (product). Using these four categories as a precursor for investigation, it is easy to dissect their different components and analyze not only the key components separately, but the unifying features that overlap to ultimately produce the phenomenon known as creative thought.

The Four "P's" of Creativity

The Creative Person

What better way to start than at the individual level? And, judging by the number of creative theories specifically devoted to the creative person, this is where many theorists chose to start as well. Creativity scholars have not been able to discern whether personal qualities can be direct causes of creativity. But, Winner (1996) states, "For those who do make it into the roster of creators, a certain set of personality traits proves far more important than having a high general IQ, or a high domain-specific ability, even one at the level of prodigy" (p. 292). Here, Winner lays out the case for a variety of terms that can be used to encapsulate the essence of what it is to be creative – and she certainly was correct based on the volume of literature devoted to this area. What follows can only be described as a brief categorical listing of the most often cited and researched

depictions of traits related to the creative persona and the evidentiary support behind the term.

The first such term is *tolerance of ambiguity*. The ability to remain open-minded in the face of ambiguity is a hallmark of the creative personality (Barron, 1968). In an ambiguous situation, no framework exists to help direct one's actions while at the same time decision making is hampered as relevant facts are missing, the rules are ill-defined, and the right procedures to complete the task are unavailable (MacKinnon, 1978). Through all this, the truly creative person has been demonstrated to be open-minded and decisive even when facing these tough and uncertain circumstances. The second pertinent particular with regards to the creative personality is *stimulus freedom*. To best describe what this term entails, it is easier to look at what it does not. For the stimulus bound person, the rules are rigid and are strictly adhered to. And, for these individuals, when they encounter an ambiguous situation that has no explicitly stated rules for action, they are likely to infer their presence and acquiesce to the implicit demands to guide their behavior in order to reduce any anxiety about being incorrect or "out of bounds." In contrast, when the stated rules of a situation interfere with the creative ideas of people who have stimulus freedom, they are likely to bend the rules to meet their needs. Second, and most important, they do not assume that rules exist when the situation is ambiguous (Getzels & Csikszentmihalyi, 1975). Closely related to stimulus freedom is *functional freedom*, another characteristic of the creative personality. This term is especially important as it is one of aspects of the creative personality that is under investigation in this study. Defined, functional freedom involves imagining items being used for other than their usual purposes. Several experiments have demonstrated this phenomenon and

will be discussed later in more elaborate detail. Torrance (1979) adapted the use of the term *flexibility* from Guilford (1959) and used it in reference to the characteristics of the creative individual. As described by Torrance, flexibility is the capacity to see the whole of a situation, rather than just a group of uncoordinated details. This can manifest itself into multiple shifts in thinking along many different categories of response as the individual is able to concentrate on several aspects of a stimulus or problem set and not just fix his or her self on one detail. Smith and Amner (1997) believe that the creative person is flexible in being open to the world, open to change, and prepared to bring about such a change. This holistic view of flexibility has garnered its commonplace acceptance among most creativity theorists as being one of the most frequently descriptive traits of a creative individual. Another term that is similarly considered to be a basic concomitant of creativity is *originality*. There is little debate on the contribution of originality to the creative personality, and some would argue that it is a core essence for creativity itself. Tardiff and Sternberg (1988) assert that originality "… is commonly said to be associated with creative individuals" (p. 434) and few would disagree. In its basic sense, originality refers to the individuals' ability to generate unique responses to stimuli or problem sets that the average person wouldn't have been able to generate or see the potential relevance to. It's the ability to notice and note the unusual, infrequent, and concealed aspects and relate these to real working solutions that is the basis of original thinking, and creative individuals excel at this practice.

In describing the creative tendency of *preference for disorder*, Montuori (1996) states that "creative individuals favor disorder and complexity, but only because they wish to integrate it into a higher order – yet simple – synthesis … Creative persons create

order in disorder and disorder in order" (p. 151). In explaining why this is the case, MacKinnon (1978) states "… creative persons are especially disposed to admit complexity and even disorder into their perceptions without being made anxious by the resulting chaos" (p. 62). Simply related, creative individuals prefer that which is complex and mentally rich to that which is standard, boring, and intellectually bland or commonplace. The next two characteristics of creative individuals seem to go together. Creative individuals have been shown to be willing to *delay gratification*, or endure prolonged effort for the purpose of garnering higher rewards and satisfactions in the long run while largely ignoring the temptation to submit to short-term pleasures and abandon the pursuit of what one was trying to achieve. The roots of this can be found in Thomas Edison's famous statement that "genius is one percent motivation and ninety-nine percent perspiration." It is of no surprise that the rewards of creative work are often minimal, especially in the beginning (Sternberg & Lubart, 1995). But, when one combines the willingness to delay gratification with the creative tendency to *persevere*, great things can happen. Researchers have found that successful creators are very perseverant in the face of frustration and against obstacles that might ordinarily be thought overwhelming. This ability to march on in the face of imminent, notable, and frustrating failure is what sets the creative individual apart from the ambitious achiever. With regard to creatively eminent individuals, Simonton (1997) states "even after notable achievers establish their reputation … failures will accompany successes throughout their lives" (p. 340). Creative individuals are *risk takers* in the fact that they go against convention, dare to stand out and be different, challenge conformity, and defy authority. Though this sets them up for potential embarrassments, pitfalls, or criticism, it is because of these last two

characteristics that they are able to endure. Torrance (1995) stated that he found courage to be the most essential quality for a creator's success. The love of one's work is defined by Torrance (1993) as "having a passionate love for something" (p. 73). Amabile (1986) echoed this sentiment when she stated that "Extraordinary talent, personality, and cognitive ability do not seem to be enough – it's the labor of love aspect that determines creativity" (p. 13). In summing up this position, Torrance (1995) himself said that, "one of the most powerful wellsprings of creativity seems to be falling in love with something" (p. 131). This love, zeal, and passion for creative thought combined in dynamic with the personality traits and cognitive abilities unique to the creative personality yields itself perfectly to the examination of the creative process. How does the individual harness all these separate strengths and utilize his/her potential towards the production and creation of something novel, adaptable, and meaningful? An investigation into the creative process should provide help in answering this question.

The Creative Process

For Rhodes (1961), the ultimate criterion towards determining the success of the creative process is the psychological frame of mind which best serves the creator in handling himself productively during the process of creating. With this in mind, let us turn our attention to some of the prominent process-driven theories in relation to creativity.

All discussion of the creative process can only be justly started by again examining the work of one of the preeminent scholars on creativity – E. Paul Torrance. According to Torrance (1974), creativity is … "a process of becoming sensitive to

problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" (p. 8). Going back to what Rhodes (1961) identified as the ultimate criterion in relation to a process driven explanation, Torrance (1974) delineated several unique features of the creative psyche that need to be present in order for the steps in this process to flow and fully reach their creative potential. With relation to the first part of his process, Torrance believed that an individual needed to possess curiosity and general exploration strategies with an attraction for complex situations complemented by the ability to pose unusual questions in relation to those situations. Additionally, he felt it was important for the individual to defer judgment on any brainstormed ideas or potentialities and be willing to rigorously test and retest such notions until confident in the result. Obviously, there are a lot of parallels between Torrance's process-driven explanation of creativity and many of the identified features of the creative individual. This is a strength of this particular theory and the reason why it has been chosen to operationalize and define creativity for the empirical purpose of this study. However, this endorsement aside, there are several other vital and valid process-driven theories that also aptly depict the creative process. Of those, the one by Wallas (1926) has been a standard by which all others have been judged. It has stood the test of time and has held up for three quarters of a century under intense scrutiny, investigation, and debate. To Wallas, the process of creativity involved four distinct stages: preparation; incubation; illumination; and verification. Looking at each individually, preparation can best be described as the stage in which the problem is

investigated from all angles and directions. Deciding upon what is the "real" problem is key, as is thinking about the requirements for a good solution to that specific problem. Incubation is the most often discussed and researched portion of Wallas' process theory. In that incubation involves the individual not consciously thinking about the problem state, investigators have sought to examine *what* exactly the individual is doing during this stage. Cognitive theorists maintain that a catalog of mental associations are being run in the below conscious awareness for potential relevancy or matches. Other theorists argue that the unconscious is at work during this stage. Guilford (1979) argues that incubation takes place during reflection – or a pause in the mental action. While the exact nature of this stage is not known, it culminates with the onset of stage three – illumination. Illumination is the "I've got it" feeling, or as Torrance would phrase as the "Eureka" or "Aha!" experience. This is when a working solution enters conscious awareness and the individual has the cognitive resources available to act on this solution. This can take the form of a new pair of mental associations that provide a different idea combination, a slight transformation that alters the way that the solution is viewed and provides a unique insight into a workable solution, or a myriad of other possibilities. Incubation and illumination very much depend on the person, as no two people will have the exact same experiences, mental sets, cognitive ability, or history to view the problem and its potential solution in the same way. To round out this process is the final step of verification in which the validity of the idea is tested and reduced to an exact form. In this stage, the ultimate value of the generated creative solution is tested. Many times, the first generated idea does not address or effectively solve all aspects of the problem state to be considered an effective and applicable solution. In the face of this, the individual

must proceed in determining a solution. As previously identified, persistence is one of the hallmark aptitudes of the creative individual and pressing on in the face of failure is what sets a creative genius apart from an ambitious one. Once a solution is ultimately derived, then it is up to the individual to make his/her results known and act upon what they have discovered. To Csikszemtmihaly, this is a key element of his process-driven theory of creativity. According to Csikszemntmihaly's theory of creativity (1988, 1990), the creative process consists of three essential elements and the act of creativity itself is an interactive process by which each of these elements participates in conjunction with each other. The first of these nodes is the individual person. Already discussed, this is a commonality this theory shares with the others. However, Csikszemnthmihaly identifies two other key elements essential to creativity that will carry into the next domain of discussion. The first of these elements is the domain in which the individual is working. Whether it is an artistic based problem or a scientific one will have a substantial affect not only in the type of problem selected and solution generated, but also in the conventional parameters in which the creative solution must be structured. But who or what defines conventional? This is the third part of Csikszemnthmihaly's theory. The creative solution must be judged by the surrounding field that ultimately renders the final "say" in what is accepted related to the quality of the final product. The surrounding field and domain specific constraints discussed in this theory ultimately make up part of what is considered to be a very salient, yet separate strand of creativity – the creative environment.

The Creative Press

When relating creativity to the environment, Carl Rogers (1962) believed the ultimate criterion by which environmental factors should be judged is the pattern of circumstances necessary for releasing creative production. To this end, there are several theories that speak to the very nature of the elements required to have a conducive creative environment, or more dramatically, those that can inhibit the presence of such an environment.

With specific relation to the individual within the environment, Rogers (1962) identifies three important issues that must be present for an individual to thrive creatively. The first is psychological safety in the pursuit of the creative task. If there are social stigmas, threats, or violent repercussions for the creative thinker, creative thought is not likely to occur except in the most rare and isolated cases. In essence, Rogers asserts that the "creative climate" of the time must mirror and embrace what the individual is trying to create and/or innovate. In addition, according to Rogers, society must be willing to suspend, or defer, judgment on the creative task until its full implications or realizations are able to take shape. Harsh and preemptive criticism on the part of society can stifle the creative process. This is especially why creative individuals, according to Rogers, must possess two key traits. The first of those identifiable traits is an openness to experience that prevents rigidity. This is the opposite of the defensiveness that occurs when people unconsciously protect themselves from potential criticism. Furthermore, this openness involves what Rogers considers as the second important trait – tolerance for ambiguity, as well as the ability to receive conflicting information without closing one's mind to the situation. This is important because the value of one's creative work is established not by

others' feedback but ultimately by one's own opinion. In the analysis of Roger's theory, Isaksen (1987) summarizes these traits as being necessary for the healthy functioning of the preconscious mental processes that result in creativity. However, what of the characteristics of the environment and its relation to the individual? In tackling this tough question, Rhodes (1987) specifically isolated two elements of the environment which he believed were vital for the creativity to occur. First, he mentions that, "… the social needs of the time must be met through previous intervention or invention itself. Society will not pay attention to developments outside what is pertinent and that which must be immediately satiated" (p. 220). Above and beyond this, he states that the environment must offer "a sufficiently advanced state of culture and a proper technical heritage" (p. 220). Beyond this basic element of society, there are hierarchal structures, governmental regulations, and individual barriers that seemingly have a bureaucratic stranglehold on the creative environment that ultimately chokes creative thought. Van Gundy (1987) lists some of these institutional barriers that the individual must break free of in the environment to pursue true creative thinking. The first is status hierarchy. Those who are in an inferior position to one of authority are less likely to offer, brainstorm, or create suggestions for improvement due to insecurities about compromising the authority of those in charge and the fear of being criticized or even terminated. In an analysis of this, Khaleefa, Erdos, & Ashria (1996) state that "conformity to the socio-cultural institutions and to the expectations of others involves a substantial limitation of one's individuality … there is small scope for individuals to be creative" (p. 270). In addition to status hierarchy, Van Gundy (1987) describes the formalization of society as an inhibitor to creative thought. To lend support to this

assertion, he states, “It is thought that formalization is detrimental to initiation of innovations … If organizational members are expected to behave in prescribed ways, and innovation is not prescribed, fewer idea proposals will be generated” (p. 361). Taking this one step further, as organization is derived from the cultural climate of the time, there are several salient cultural blocks to creativity as well. In addressing this, Davis (1999) states that, “the greatest cultural barrier to creativity probably is the culture itself” (p. 25). But what in the culture could stifle such a seemingly important tool for advancement? Specifically, cultural blocks take the form of social influence, expectations, conformity pressures, rules, traditions, and any other established pattern of thinking or behavior that leads the individual to fear being different. Acting together, these features form a destructive sphere of influence that can have a national, regional, or global effect on creativity, innovation, and ideation depending on the severity of circumstances, time, and place. How can this be combated? Humanistic theorist Rogers (1962) advises that individuals embrace openness to experience that prevents rigidity. This is the opposite of the defensiveness that occurs when people unconsciously protect themselves from potential criticism. To further shield from this criticism, the creative individual should have the ability to evaluate situations according to his/her own personal standards. This is important because the value of one’s creative work is established not by others’ feedback but ultimately by one’s own opinion. And finally, Rogers identifies the ability to experiment with and engage in unstable situations as being key to overcoming environmental, social, or cultural barriers. Creative people are able to explore possibilities and to toy with concepts, which allow them to generate hypotheses, express the ridiculous, translate from one form to another, and transform concepts. From these

explorations arise hunches that often lead to creative ways to seeing life. Life is creation to the creative individual and ultimately that creation manifests itself through the creative product.

The Creative Product

In addition to addressing the environment, Rogers (1962) moves to examine the end result of creation – the creative product. He states,

> One of the first criteria related to creativity is the fact that there must be something observable – some product of creation. These products in turn must be novel constructions, which grow out of the unique qualities of the individual in their interaction with the materials of experience. Creativity always has the stamp of the individual upon its product, but the product is not the individual, nor his materials, but partakes of the relationship between the two. (p. 71)

MacKinnon (1978), states his opinion on the value of this area of investigation, that "the starting point, indeed the bedrock of all studies of creativity, is an analysis of creative products, a determination of what it is that makes them different from more mundane products" (p. 187). But what can objectively and systematically separate mundane from creative, or novel? Stein (1967), in addressing the features of the creative product, asserts that the creative work is novel in the sense that it is accepted as tenable or useful or satisfying by a significant group of others. He later clarifies this by asserting (1974) that

> … by *novel*, it is meant that the creative product did not exist previously in precisely the same form. Rather, it stems from a reintegration of already

> existing materials or knowledge, but when it is completed, it contains elements that are new … the novelty of the work depends on the degree to which it deviates from that which exists already. It is a measure of what has been achieved and what existed previously. (p. 34)

Other statements regarding the nature of the creative product include that of May (1959), in which he holds that the process of creativity can be seen as bringing something new to life and fruition. But, again, one must ask, is novelty by itself enough to consider a product creative? Briskman (1980) states that, "the novelty of a creative product clearly is only a necessary condition of its creativity, not a sufficient condition" (p. 95). Several theorists have added additional conditions to their definition of a creative product to include appropriateness and/or perceived value as part of the distinction. Evidence of this trend can be found in Perkins (1988), where he extends the definition of the creative product past originality, as the lone determining factor, to fully encompass and account for appropriateness. Hennessey & Amabile (1988) concur, as they believe that to be considered creative, a product or response must be novel and appropriate. This new theoretical appendage attached to the creative product has its roots in an earlier study as Barron (1988) writes that "creativity is an ability to respond adaptively to the needs for new approaches and new products … it is essentially the ability to bring something new into existence purposefully" (p. 80).

Thus, with these descriptions, we have completed a look at the four pillars of creativity – person, process, press, and product. If one were to place these notions into four separate corners and connect them together in a grid-like fashion, a very valid conceptual continuum could be produced that could relate exactly where a given theory

or explanation stood with relation to the four "p"s previously discussed. However, as is so often the case with creativity and creative inspiration, we need to look "outside the box" to discover what lies beyond the realm of the theory and the definition. What follows, then, is an examination of the principles that guide the myriad of different conceptual approaches to how creativity should be studied and thus defined.

Approaches to Studying Creativity

To say that there are a variety of different methodologies used would be an understatement as there are many diverse theoretical assumptions related to the measurement of creativity currently being proposed and practiced. However, there are two salient and identifiable methods that warrant discussion with relation to this specific study: psychometric and cognitive-experimental. In a comparison of the properties of these approaches, it is important to identify the key features that delineate and differentiate them along theoretical and empirical lines, and, more importantly, how these varied approaches can be fused together to synthesize a new approach for examining creativity – that of creative cognition.

The first approach to be discussed is psychometrics. Psychometrics, at its core, attempts to directly measure human characteristics. This is done through the design of specific testing instruments that are valid and reliable assessments of the construct that the researcher is attempting to gauge. For creativity, many psychometric instruments have been developed to assess different aspects of the term. These include, but are not limited to, tests that examine the creative person, the creative product, the creative process, the creative environment, and other similar features of creativity. And, as would

be expected by such a wide range of research interests, there is no prevailing theoretical basis for the construction of these measurement tools. In light of this, psychometricians in creativity research are interested in how well their instrument succeeds at measuring the feature of creativity that it was intended to measure and how their results compare with other related instruments that are designed to assess the same, or related, characteristics of the individual.

The most commonly used tool to assess creativity under the psychometric approach has been the divergent thinking test. While convergent thinking involves using existing mental faculties to arrive at a specific, correct answer for a given problem, divergent thinking requires quite a different process. Divergent thinking tasks involve two varieties. In the first, the subjects are asked to provide as many responses as they can to a given question. In the second, the subject is asked to come up with unique and novel ideas and/or responses related to the posed question (Parkhurst, 1999). These responses can then be judged on a set of criterion related to the fluency (the number of items), flexibility (the number of leaps in thinking across categorical boundaries), originality (the statistical novelty of the response related to normative data), and elaboration (the amount of detail included in the response) of the answers. These terms, introduced by Guilford (1959), were adapted by Torrance (1966) for use on his *Torrance Test of Creative Thinking,* the most widely used divergent thinking test today. As is evident, a comparison of the features of the creative personality shows great overlap between the measurable traits on these divergent thinking tests and the features of the individuals themselves – hence the popularity and perceived content validity.

Experimentalists differ somewhat from psychometricians in their attempts to define and measure creativity. Although those who adhere to an experimentalist methodology frequently use many of the instruments employed in psychometric research, they apply them for a different purpose. The experimental approach in creativity is concerned with rigorous testing of scientific hypothesis related specifically to certain variables that the researcher is seeking to manipulate and isolate. This is often done in a controlled setting and often involves a strict and narrow definition of the variables being studied rather than relying on general principles. Within the experimental framework, there are a variety of approaches that address specific components of the creativity construct. One of the most prominent approaches within this framework is creative cognition.

Creative Cognition

The cognitive approach to creativity seeks to comprehend the mental representations and processes underlying creative thought (Sternberg & Lubbart, 1999). As cognition involves the way people obtain, organize, process, store, and use information (Cropley, 1999), creative cognition specifically looks at how these features relate to creative thinking. In an article by Ward, Saunders, & Dodd (1999), the goals of creative cognition as an empirical approach to study creativity are clearly stated.

> The first is to advance the scientific understanding of creativity by adapting the concepts, theories, methods, and frameworks of mainstream cognitive psychology to the rigorous study and precise characterization of the fundamental cognitive operations that produce creative and noncreative thought … The second goal is to extend the scientific

> understanding of cognition in general by conducting experimental observations of the cognitive processes that operate when people are engaged in plainly generative tasks. (p. 189)

A key point of this theory and of the creative cognition approach is the notion that each individual has the capacity for creative thought. It is not, as argued by others in the field, a talent or skill unique to a select few eminent or intellectually elite individuals. Nicholls (1972) asserts that creativity is a normally distributed trait. Support of this position is found in Ward, et al. (1999) in their statement that "creative cognition emphasizes the idea that creative capacity is an essential property of normal human cognition and that the relevant processes are open to investigation" (p. 190). One of the earliest theoretical models that sought to address these purposes was the Geneplore model proposed by Finke, Ward, & Smith (1992). The term *geneplore* is derived from the combination of the words "generation" and "explore" and represents the two processes within the model. Smith, et al. (1993) provide a concise listing of the basic features of this model:

> … in the generative phase, one uses processes such as retrieval, analogical transfer, or mental transformation to construct representations of ideas that may take various forms such as visual patterns, verbal combinations, or mental models. These initial ideas, referred to as preinventive forms, ideally have properties such as novelty, meaningfulness, and emergent qualities. Exploratory processes can then be used to develop the initially generated ideas for specific purposes. (p. 837)

Cropley (1999) related this model to the formulation of a creative product. Within the generative phase, an individual is forming novel cognitive structures from the mental operations directly activated by the problem set. The relevant stimuli from this problem, as identified by the subject, induce a spread of neural activation throughout memory store and pull into consciousness those ideas and/or representations relevant to solving the situation at hand. This is akin to the pattern of associational hierarchies theory of Mednick (1962), who stated that responses frequently linked with a given stimuli in the past have a greater statistical probability of being selected as appropriate when the stimuli is presented again. The combination, transformation, and synthesis of these activated responses into working preinventive forms are an indication of novelty. However, this novelty in and of itself is not sufficient for our definition of creativity related to the formulation of a creative product. Instead, through the exploration of the creative implications of the new structures in the exploratory phase, the subject can ensure the application of these ideas in an effective solution to solving the problem at hand. This portion of the process symbolizes the meaningfulness of appropriateness to the creative process and further to the development of a creative product.

But is it always the case that the generative process leads to novelty and ultimately creativity? There are a series of experiments that demonstrate the production of novel ideas can be hindered by a variety of factors related to cognitive production such as recently activated knowledge and/or the presentation of examples. This effect is termed functional fixation and the salience of its effects is well documented in the literature. As this is one of the key points of investigation for this particular study, an analysis of the features and prevalence of this term is certainly warranted.

Functional Fixation

Within the field of creative cognition, several studies have been conducted that have analyzed the effects of related examples on an individuals' ability to produce creative products in an idea generation task (Marsh, Landau, & Hicks, 1996; Ward and Sifonis, 1997). The most eminent pioneering study, as previously introduced, was conducted by Smith et al. (1993). They studied the effects of examples in a creative generation task under the specifically stated theory that "although prior experiences can provide the expertise needed to fully explore and develop ideas into creative products, it may be that such experience limits creative thinking when ideas are originally being generated" (p. 837). The results bore this out. In all three experiments they ran, they found significant conformity effects in those individuals who were presented with examples prior to task onset. The subjects who had viewed examples of what they were to generate were statistically more likely to include features contained within those examples in their designs. These effects persisted even in the face of time delays and the inclusion of specific instructions informing the students that they were not to include any of the features they had previously viewed. This is an indication of functional fixation, identified by Jansson and Smith (1991) as the tendency to restrict the use of an object to previously encountered functions as tested in their experiment on design generation with engineering design students. They tested whether the introduction of examples of previous solutions to the experimental group would reduce the fluency of their responses to a design problem. The results substantiated this hypothesis, even in conditions where

the examples demonstrated faulty characteristics that would not be desirable in an end product.

The results of the prior experiments clearly demonstrate the effects that examples have on individuals in an idea generation task. As Finke (1996) points out, "these studies imply that creative imagination is often structured by prior knowledge, typical features of familiar categories, or recently seen examples" (p. 389). This notion is paralleled by Runco and Chand (1995) who state "… individuals who rely on details from past experience – even persons who have been innovative in the past – preclude original behavior. It is another kind of functional fixedness, whereby someone is stuck with one perspective and has difficulty finding new alternatives" (p. 248).

But is this truly the case? Can individuals who score high on traditional measures of creativity overcome the traditional cognitive fixation effects that examples can produce on an idea generation task? In essence, do these individuals have a high enough level of transformational power to transcend the given properties of the examples? The notion of transformation power was stated by Feldman, et al. (1972) and relates to "… the extent to which a given response represents the production of new form rather than improves upon the existing forms, the extent to which the apparent constraints of the stimulus are overcome, but overcome in a highly appropriate fashion" (p. 336).

This definition of transformational power not only encompasses the two principal notions of a creative product – that it is novel and appropriate – but directly addresses the focus of this research. Can those individuals identified as creative by standard psychometric means resist the cognitive fixation tendency brought upon by the introduction of examples prior to an idea generation task? To determine the answer to

this question is one of the explicit purposes of this investigation. It is anticipated that those individuals with the highest level of assessed creativity will show significantly lower proportions of conformity, attributable to functional fixation, on an idea generation task than their cohorts. The null hypothesis for this postulation would be that there would be no significant differences between creativity groups on conformity. However, before specific information related to the experimental design is discussed with relation to this study and subjects are individually tested for these specific effects, it is important to examine a feature of the sample that will be used for this investigation. All subjects in this study will be attendees of a gifted and talented summer program. Though the implications of using such a group will be addressed in the discussion section and more details about the scope of the camp itself will be address in the methodology section, it is important to examine the link between creativity and giftedness in *this* section as there is a lot of information in the literature today that has examined the duality of and relationship between these two constructs. Therefore, it is important that a review of the literature relating giftedness to creativity be discussed.

Giftedness and Creativity

The constructs of giftedness and creativity have quite a substantial empirical and theoretical relationship. They also have the similar distinction of having a litany of definitions from which consensus among conceptions is hard to discern. Contemporary researchers have studied the construct from a myriad of conceptual angles, which has resulted in many varying theories, and consequent definitions of the term “gifted.”

Treffinger (1980) stated that none of these theories has been widely enough accepted to serve as a unifying basis for developing assessments.

With this in mind and before a relationship can be established between giftedness and creativity, a working definition to frame the construct of giftedness must be built. For this study, the U.S. Office of Education definition, penned by Marland (1971), will be adopted. This definition is still in use today and reads as follows:

> Gifted and talented children are those identified by professionally qualified persons who, by virtue of outstanding abilities, are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school program in order to realize their contribution to self and society. Children capable of high performance include those with demonstrated achievement and/or potential ability in any of these following areas: (1) General intellectual aptitude; (2) Specific academic aptitude; (3) Creative or productive thinking; (4) Leadership ability; (5) Visual and performing arts. (p. IX)

With this definition providing the foundation for the definition giftedness, the ability to construct an empirical foundation around this term pertaining to its relationship to the construct of creativity can commence.

There are three prevailing schools of thought on the relationship between these two constructs. In the first view, giftedness and creativity are seen as separate intellectual abilities, with little or no area of overlap. Giftedness is seen as synonymous with high intelligence, and creativity is defined as novel or divergent thinking (Getzels & Jackson,

1961). However, in their analysis of this particular view, Hunsaker and Callahan (1995), observed that "even those taking this position do not necessarily align their views precisely" (p. 110). Disagreement and discord as to what factors should be included, what factors should be accounted for, and what factors should be ignored in any model pertaining to giftedness and creativity have dominated the landscape of this particular theoretical assertion leading many theorists to abandon this stringent conceptual division.

The next predominant viewpoint takes an entirely different stance with regards to creativity and giftedness. Instead of viewing the independence of the two terms, this view embraces the symbiotic duality seen as inherent between these constructs. It holds that creativity is a fundamental, driving concept of giftedness. This theoretical sentiment is forwarded by Piirto (1992) in her belief that creativity is "the underpinning, the basement, and the foundation which permits giftedness to be realized" (p. 24). And, one of the most salient endorsements of this particular view comes from Renzulli (1978), who states that "giftedness consists of an interaction among three basic clusters of human traits – these cluster being above-average general abilities, high levels of task commitment, and high levels of creativity" (p. 261).

The last viewpoint with regard to these two constructs holds that creativity is a separate category of giftedness. This view is mirrored in Cropley's (1993) belief that creativity is a distinct style of giftedness. Relating this notion to a predominant theory in the literature today, this would be akin to what Howard Gardner (1993) asserted in his multiple intelligence theory: that giftedness knows no specific limitation, domain, or boundary by which its manifestation can be observed and identified. He holds that there are several identifiable outlets by which giftedness can be demonstrated. These include,

but are not limited to the areas of verbal-linguistic, bodily-kinesthetic, logical-mathematical, visual-spatial, inter- and intrapersonal relation, and musical-rhythmic. Under this theoretical vein, one could postulate that creativity would warrant inclusion in this list so that the fruits of the creative labor (i.e., products, innovations, thoughts, etc.) could be considered a special, separate, yet salient type of giftedness.

Whatever the view that is adopted, it is clear that the relationship between these two terms will have to be included in any discussion pertaining to any derived significant effects found for the study. With this in mind, an in-depth analysis of the methodology specific to this experimental design follows in the next chapter.

CHAPTER III

METHODOLOGY

The purposes of this study were as follows: (1) To discover if the presentation of examples prior to the onset of an idea generation task produces a significantly higher tendency among subjects to include features of those examples in their design, and the null hypothesis for this research question is that there will be no significant statistical difference between the control and experimental treatment groups on their mean levels of conformity; (2) to determine the nature of the relationship between creativity and conformity, and the null hypothesis for this research question is that there will be no discerned statistical correlation significant enough between these two constructs to imply a relationship outside what is due to error, and; (3) to assess whether individuals with higher levels of measured creativity show significantly lower proportions of conformity, attributable to design fixation, on an idea generation task than their respective cohorts, and the null hypothesis for this last research question states that there will be no significant statistical differences between creativity groupings (high, middle, and low), on the dependent measure of conformity. These null hypotheses will guide the experimenter in the discussion section as the different statistical procedures are applied and explained and will serve as the basis for framing the results of the study.

Subjects

The subjects for this study were 98 middle school and high school students (grades seven through eleven) who enrolled in sessions III and IV of the 2002 Youth Adventure Program, a residential career exploration program for gifted and talented adolescents sponsored by Texas A&M University's Institute for the Gifted and Talented. No official school placement verification or test scores demonstrating the level of giftedness of the student were required for admittance into the camp, so it can not be assumed that all individuals taking part in the investigation were gifted and talented as federally defined by Marland (1971) and the U.S. Office of Education (definition listed in Chapter II).

As only program attendees would be able to participate in the study (forming a sample of convenience), measures were taken to assure as random and as representative a sample pertaining to the cohorts as possible. This was addressed through recruitment and registration procedures. Specific to recruitment of individuals, access to the program could be obtained via brochure mail-out, website access, email correspondence, or telephone call and no one was denied information or access to enrollment materials. For registration purposes, the camp adhered to a first come first served basis of enrollment, and every individual, regardless of race, gender, age, or geographic location, had an equal chance of procuring a spot in the program. To achieve as diverse a group as possible in relation to socioeconomic background, scholarships were offered and awarded to students who otherwise would not have been able to afford the camp. Through all of these efforts, the subjects who attended the program represented a good sample mix along the lines of age and gender. For age, the sample ranged from 11 to 17 years of age, with a mean of

13.50 and a standard deviation of 1.45. Diversity in the sample was sparsely reflected along the lines of race and socioeconomic background and subjects were not required to provide any information related to these two qualifiers. Limitations of the study with regards to sampling will be discussed in detail in a later section.

All testing took place during the course of the camp and subjects were recruited for the study during the check-in period at the beginning of camp. All subjects, prior to their participation, were asked to sign a student assent form stating that they understand the nature of the investigation and agreed to be a part of the study. Participation in this study was strictly solicited on a volunteer basis and students informed of this during recruitment. To ensure informed consent, it was explained to every individual that there would be no adverse or punitive effects if they did not wish to participate and alternate activities for those students in the camp who chose not to participate for any reason in the study were set up. In addition, because all of these subjects were not of legal majority age, the parents and/or guardians of these students were asked to give their permission for their students' participation and were asked to sign an experimenter prepared consent form. Both signatures (student and parents) were necessary for a subject to be included in the study. When both signatures had been collected, the experimenter assigned the subject an experimental number. The assignment of experimental numbers followed an ordinal pattern (i.e., the first student who turned in his/her paperwork was assigned "1," the second student was assigned "2," etc.). The experimenter kept a master record of subjects' names and their corresponding experimental number for the purpose of randomly assigning subjects into experimental and control groups in the second part of

the investigation. Copies of both the student assent and parental consent forms can be found in Appendix A.

Instruments

Subjects were first administered the Sounds and Images portion of the *Thinking Creatively with Sounds and Words* (TCWSW) instrument, developed by Joe Khatena and Paul Torrance in 1973. This instrument was chosen for its high levels of validity and reliability in assessing creativity. Evidence for this is found in the updated normative manual for the test in which Khatena and Torrance (1988) cite considerable evidence for the content and construct validity of the instrument and the indicators used in the scoring scales. For the purpose of this study, subjects' level of creativity was determined by their overall performance on the Sounds and Words portion and an originality score was then derived for each individual. For the purpose of this study, originality is operationally defined as statistical infrequency of occurrence of a given response in relation to a specific stimulus and served as the operational judgment for creativity according to the criterion laid out in the scoring manual for this test. This statistical delineation will be explained in greater detail in the procedure section.

The "Sounds and Words" activity is a divergent-thinking idea generation task in which the subject is called upon to think of many descriptors for sounds that are presented. These sounds are ambiguous in nature and call for the subject to make judgments on their origin and description based upon their own perceptions. Each sound is played four times, and for each presentation, the subject is encouraged to break down all thought barriers and to generate as original and creative of an explanation as possible for what they are hearing.

The second instrument used in the investigation was an experimenter generated idea- generation task that called for the subjects to engage in a divergent production activity related to the design of a "chair of the future." A detailed description of this instrument and its features is provided in the procedure section below.

Procedure

To begin the study, all subjects who elected to participate gathered in a conference room in the place of residence for the Youth Adventure Program. The counselors of the program distributed the first instrument prior to the experimenter entering the room based on the experimental number assignments. As previously discussed, for the purpose of assessing a normalized level of creativity for each individual, subjects were administered the Sounds and Words portion of the *Thinking Creatively with Sounds and Words* instrument. This was administered in a group setting with all participants taking the test at the same time. Approximate presentation time for this instrument is 15 minutes. When all subjects were finished, the booklets were collected and the subjects were allowed to leave.

After completion of this first activity, the experimenter scored all the tests looking solely at the prevalence of originality. Originality was scored according to the criterion set out in the Norms-Technical manual provided with the test. For each response, subjects could obtain a score that ranged (on a Likert-style continuum) from "0" (no originality) to "4" (highest originality). To obtain an originality score, all points were added together to form a composite total. This total represented the subjects' overall score on the divergent thinking creativity test. From the computed originality scores of

the sample as a whole, a descriptive statistic analysis was run resulting in a mean, median, and mode score for the data set. Relative to the median, the distribution was divided into thirds for the purpose of placing subjects into either the high-creative, middle creative, or low-creative group. This judgment was based on how the subject scored relative to the sample as a whole on this subscale of the *Thinking Creatively with Sounds and Words* test. Those subjects who scored in the top third of the distribution were placed in the high creative group. Those who scored in the bottom third of the distribution value were placed in the lower creative group. Those who scored in the middle third were placed in the middle creativity group. The assignment of individuals was done strictly off experimental numbers without knowledge of participants names for the purpose of maintaining confidentiality and anonymity. Once these assignments were made, a stratified random sampling procedure was conducted to select subjects for the experimental and control groups of the second part of the study. This procedure was implemented so that equal numbers from all creativity groups would be chosen for each of the two experimental conditions. To fulfill the random assignment condition of this procedure, the basis of this assignment was done off random and impartial selection of the experimental numbers via a random number drawn until equal numbers of all three of the creativity groups were represented equally in both conditions based off their assigned experimental number. Once this assignment had taken place, the second phase of the study was begun.

To test for conformity, the experimenter generated idea generation task was presented to the subjects. To divide participants into their respective experimental and control groups, the counselors of the program were given a list of the experimental

number assignments. From this list, the subjects were assembled correspondingly into either the control group room or the experimental group room located in separate areas of the residence hall. These areas, though different in location, were identical in size and set-up, thus reducing the effect of any potential confounding variables with relation to the room in which subjects were tested.

Prior to the onset of testing in this second phase, the counselors passed out the testing instrument specific to each subject related to the recorded number on the provided answer sheet. To eliminate any potential experimenter errors, all counselors were thoroughly trained and debriefed on the nature of the investigation and the procedures related to testing and material dissemination on this task.

As previously introduced, the second instrument subjects were presented with was an idea generation task to complete that called for them to engage in a divergent production activity related to the design of a chair of the future. Both the experimental and control groups received these same set of instructions prior to the onset of the idea generation task. However, to determine if the presentation of examples can induce design fixation, the experimental group received a handout depicting examples of chairs of the future constructed by the experimenter (Appendix B). They were allowed to view these examples for a time period of two minutes and then the examples were re-collected. This two minute time period was measured by a stopwatch to ensure accuracy. After the examples were collected, subjects were given the instruction to start. The control group did not receive any such examples and were instructed to sit in their seat for the two-minute period prior to being told to begin. This two-minute period was also measured via a stopwatch to ensure accuracy. Subjects in both groups were provided with twenty

minutes to complete the idea generation task. At the conclusion of this time, all answer sheets were collected. A copy of the instructions pertaining to this task can be found in Appendix C for both the experimental and control group.

The examples the experimental group was presented with were unified with respect to three features. These features that were common to all design examples were: (1) having four legs at the base; (2) having drink holder in an armrest; and, (3) having an extendable footrest. These three design features were chosen due to their prevalence in contemporary furniture/chair design and can be used to determine fixation effects according to their frequency in subjects' designs. These features were labeled for each example in the provided packet to ensure uniformity of exposure.

During the twenty minutes, students were instructed to draw as many chairs as they could. If they finished one chair, they were to move on to another. In this respect, the fluency (or number of chairs generated) could differ greatly from subject to subject depending on a myriad of factors not limited to elaboration of the design and other intricate details. For this reason, fluency of designs generated was included as part of the statistical analysis. Also calculated were indications of conformity with respect to each design that the subject generated. Conformity was assessed as an indication of how frequently one of the three design features common to the chairs in the example appears in the students' drawings of "chairs of the future." Therefore, it was possible for an individual who designed multiple chairs to have varying scores of conformity on each of the separate designs. However, for the purpose of tabulation, conformity was treated as an aggregate total with each instance being totaled and contributing to the overall score of

the individual. At the conclusion of twenty minutes, all packets were collected and the testing portion of the experiment was over.

After the examination packets were collected, they were scored by the experimenter using the aforementioned criteria to determine a conformity score. Each subjects' conformity score was entered alongside their creativity score using experimental numbers for the purpose of data entry. Once all data was entered, it was analyzed according to the parameters set out below.

Analysis of Data

For the purpose of analysis, five separate factorial analysis of variance (ANOVA) statistical procedures were conducted to test the conformity differences between both the experimental and control groups as well as among the high-creativity, middle-creativity, and low-creativity groups. These three divisions serve as the independent variables for factor analysis, creating a 3x2 matrix. An alpha level of .05 was set for all determinations of statistical significance to avoid the occurrence of Type I and Type II statistical errors. The dependent measures for this procedure were as follows: (1) the fluency of responses in the idea generation task; (2) the proportion of designs that included four legs; (3) the proportion of designs that included a drink holder; (4) the proportion of designs that included a footrest, and; (5) the overall level of conformity across all three features. These interaction effects were the key to understanding if those identified as highly creative and resistant to interference were able to overcome the fixation tendencies induced by the presentation of examples, as theorized in the hypothesis of this study.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to determine the relationship between an individual's assessed level of creativity and his or her ability to overcome cognitive fixation effects on an idea generation task. Additionally, the design of the study purported to examine what effects, if any, the presentation of pertinent examples prior to task onset had on an individual's tendency to conform to features depicted by the examples themselves. Last, it sought to determine if a significant correlation existed between measured originality on a standardized creativity test and observed fluency on the idea generation task. Instruments used to achieve these purposes included the *Thinking Creatively with Sounds and Words* (Torrance & Khatena, 1983) test and an experimenter derived idea generation task and corresponding example packet. A 3x2 cross factorial analysis of variance was run on the data to determine whether there were any significant main and/or interaction effects on the dependant variable of conformity with respect to the two fixed variables of creativity group placement (high, middle, low) and treatment condition (control, experimental) that were determined by the experimenter. The variables of creativity (as measured by originality scores on the TCWSW) and fluency (on the idea generation task) were also correlated to determine the relationship between these two variables. If a strong, direct relationship can be found, the experimenter can achieve greater confidence that the measure of creativity used for

assessment, originality scores via the TCSW, is both valid and reliable for the purposes of creativity group assignment and data analysis.

Results

The results of this study are organized in the following order for the purpose of addressing all of the identified research questions: (1) analysis of the correlational relationship between measured originality and assessed fluency level, (2) analysis of the descriptive statistics gathered on the *Thinking Creatively with Sounds and Words* test for the variable of creativity so as to divide the sample into creativity and treatment groups, (3) analysis of the main effects of assessed creativity level and treatment group on conformity to determine if the null hypothesis of no statistical difference can be rejected, (4) analysis of nonparametric Kruskal-Wallis test to determine the effect of assessed creativity level and treatment group on conformity, (5) analysis of the interactions of creativity and treatment across groups to determine if the null hypothesis of no difference can be rejected, and, (6) analysis of the descriptive statistics pertaining to conformity on each of the three components presented in the example packet (drink holder, four legs, and adjustable lever).

Sample Statistics

The subjects for this study consisted of ninety-eight students grades seven through eleven who were attendees of a residential gifted and talented summer camp program. This subject sample was first asked to complete the Sounds Activity 1A from the *Thinking Creatively with Sounds and Words* test. Subjects were scored on the level of originality related to their responses, with statistically infrequent responses receiving

points while commonplace responses were not scored. All of these determinations were made with respect to the scoring manual provided with the test to prevent any experimenter bias or subjective scoring errors. This manual can be found in Appendix E. Scores for the sample as a whole can be found in Table 4.1 below.

Table 4.1 *Descriptive statistics for the variable of creativity*

Descriptive Statistics

		Creativity Scores	Valid N (listwise)
Statistic	N	98	98
	Range	36	
	Minimum	6	
	Maximum	42	
	Mean	26.46	
	Std. Deviation	7.400	
	Variance	54.766	
	Skewness	-.379	
	Kurtosis	-.113	

In analyzing these results, the conclusion can be drawn that the subject sample for this study is representative of the population as a whole with respect to the obtained mean (26.46) and dispersion of the scores measured by the range (36) and standard deviation (7.4). This is done by relating this data to the normative data for the instrument itself, and through this comparison it is evident that these sample scores are relatively consistent with what is found in the population as a whole. For the instrument, the maximum creativity score achievable is 64 with the respective minimum being zero. For the population, the normative manual depicts a mean of ($\mu = 23.84$) with a standard deviation

of (s = 6.74) for students aged 8-18. Further analysis of the data for the variable of creativity shows negative scores for both the tendency variables of skewness and kurtosis. A negative score on skewness represents a centering of the distribution towards the top end of the scoring curve. A negative score on kurtosis indicates a degree of peakedness to the distribution. However, as these values do not come too close to a value of -1, one can be confident that the observed scores do not vary from what one would normally find in the population.

Once the creativity scores were tabulated, an analysis of the scores with respect to percentiles was necessary to divide the distribution into three equal groups for the purpose of treatment group placement and creativity group identification. To properly achieve this division, relative scores pertaining to the thirty-third and sixty-seventh percentile were computed to generate the breaks in the data by which the sample could be evenly divided. This analysis is presented below in Table 4.2:

Table 4.2 *Percentile breakdown for creativity scores*

Creativity Score Distribution

Percentiles	33.33	23.00
	66.67	31.00

In accordance with this statistical finding, all subjects who scored “23” or below on the TCSW instrument were placed in the “lower” creativity group. All subjects who scored between “24” and “30” were placed in the “middle” creativity group. Finally, all subjects who scored above “31” were placed in the “high” creativity group. Once this sorting procedure was completed, the resulting groups are broken down in Table 4.3:

Table 4.3 *Frequency for creativity group divisions based upon percentile distribution of the data set on the dependent variable of creativity*

Creativity Group Breakdown

Creativity Groups		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	33	33.7	33.7	33.7
	Middle	31	31.6	31.6	65.3
	Low	34	34.7	34.7	100.0
	Total	98	100.0	100.0	

With a sample size of 98, it was not possible to have three equal groups of subjects with respect to number of included subjects. As evident in Table 4.3, size for each of the creativity groups was not exactly equal, with small variances in numbers between the three. The "middle" creativity group (n=31) had two fewer members than the "high" creativity group (n=33), which had one less member than the "low" creativity group (n=34), which had the most subjects. The reason for this small discrepancy can be found in the nature of this data set, as several subjects had scores that fell right on the grouping cut line. Instead of assigning individuals with identical scores to two different creativity groups for the purpose of obtaining exact equality in numbers among groups, the experimenter ignored this slight number discrepancy in favor of maintaining consistency in grouping with respect to assessed creativity. This final division of the sample yielded the following treatment group sizes, with respect to creativity grouping, as depicted in Table 4.4.

Table 4.4 *Statistics for data set grouping based on the independent variable of condition*

Treament Grouping Analysis
Condition by Group

Count

		Group			
		High	Middle	Low	Total
Condition	Control	16	16	17	49
	Experimental	17	15	17	49
Total		33	31	34	98

Once this group was finalized, the second part of the study commenced. For the purpose of obtaining an indication of whether the presentation of examples can hinder creative production through cognitive fixation on the salient and identifiable features of presented examples, the experimenter developed an idea generation task that served to test this notion. All subjects were presented with a task that called for them to design and draw a chair of the future. The subjects who were in the experimental group received an example packet prior to onset of testing which contained several drawings that all contained common aspects found in chairs today: (1) a drink holder; (2) four legs; and (3) an adjustment lever. The control group did not receive anything prior to testing. All subjects were instructed to be as creative and original as they could be in their design and not to rely on features of chairs today in developing their chair. With regard to the dependent variables of this, fluency was operationally defined as the number of total chair drawings each subject produced. Conformity for this particular task was operationally defined as the number of times a subject included one of the features (identified above) in their chair drawings. Individual statistics were kept for each of the features separately and will be discussed later in the results section, but for the purpose of operational definition for this dependant variable, conformity was considered to be a total

of all instances of the identified features in a single drawing. For subjects who drew multiple chairs, their conformity score was determined by adding all instances of conformity across the drawings divided by the number of drawings each completed. All instances of conformity found in any of the drawings were included in determining an aggregate total for conformity. With these distinctions and clarifications satisfied, the experimenter conducted a statistical analysis of the data with regard to all of the variables discussed. First, an analysis of the correlation between creativity and fluency was conducted. This particular finding sought to discover the magnitude and direction of the relationship between these two variables so that the experimenter could feel confident in the predictive validity of scores on the TCWSW test with regard to derived scores, creativity groupings, and subsequent data analysis.

Data on Correlation

While many creativity instruments yield multiple scores for different aspects of the construct of creativity, the *Thinking Creatively with Sounds and Words* test only produces a single score; that of originality. As previously established, originality is considered one of the integral components of creativity. For this reason, the TCWSW test could certainly be defended in using this construct as a sole basis for determining a base, or standardized, level of creativity. However, as this study yields a fluency score for each subject via the idea generation task, an analysis of the relationship between these two variables would seem pertinent so as to increase the confidence related to the construct validity of the derived creativity scores, as construct validity deals specifically with whether the test accurately measures the construct/s it purports to measure.

Torrance (1973) included fluency as a subscale of his *Torrance Test of Creative Thinking* and the link between the two constructs is well established. To determine the relationship between these two scores, a correlation analysis was run.

The correlation score (r) reflects the relationship of rank orders that correspond to scores on two different variables that are measured on a continual scale. This type of analysis yields two important pieces of information: the magnitude of the relationship between the two variables (strong or weak), and the direction of the relationship between the two variables (positive or negative). Table 4.5 shows the results for this test:

Table 4.5 *Correlation between the variables of creativity and fluency*

Correlation

		fluency	creative
Pearson Correlation	fluency	1.000	.324**
	creative	.324**	1.000
Sig. (1-tailed)	fluency	.	.001
	creative	.001	.

**Correlation is significant at the 0.01 level (2-tailed).

Scores on this test can range from -1.00 to 1.00, with scores closet to each end demonstrating a stronger relationship. Our derived score (.324) would indicate a moderately strong correlation between our two variables as this value is significant at the alpha = .01 level, a very stringent value by which to judge significance. Further analysis shows a direct relationship between these variables, which the experimenter hoped to find. If the derived value is positive, it means that the two variables are positively correlated and monotonically increase with each other. That is, as one value goes up, the other correspondingly rises. This finding indicates that as scores on the TCWSW test

rose (pertaining to originality), fluency also increased. Due to this positive, direct relationship between these two scores, the experimenter can feel more comfortable that the derived score from the TCWSW test does indeed measure what it purports to measure; the construct of creativity, taking into account all of its intricacies and variability. If a statistically insignificant, indirect, or weak relationship was found, the basis for using TCWSW test with regard to a general level of creativity could have come under serious question. As it stands, however, this was not the case and the experimenter felt confident in proceeding with the rest of the data analysis with the application of an analysis of variance (ANOVA) on the data set.

Data on Analysis of Variance

The analysis of variance statistical technique allows the researcher to determine the impact of multiple treatment effects on an isolated dependent variable, allowing for the analysis for both main (direct) and interaction (interplay of the variables together) effects of the treatment conditions both in isolation and in combination. The advantage of this factorial design is that it allows pairing every level of the creativity grouping independent variable with every subsequent level of the treatment condition independent variable to determine if these effects are present. To summarize, our creativity grouping variable has three levels (high, middle, and low), while the treatment condition variable has two levels (control and experimental). Since one factor has three levels and the other two, a 3x2 factorial design was created, and because all possible combinations of the two factors will be considered in this design, it is considered to be a fully crossed design. The null hypothesis for this statistical application is that there will be no significant

differences in the means across both creativity and treatment groupings with respect to scores on the dependant variable of conformity. Additionally, the interaction of these two independent variables will be found to be not significant with respect to the conformity variable.

Before the ANOVA was run, a preliminary statistical procedure was performed that gave an indication of what trend the data might show with respect to shape and dispersion. As the independent variable of creativity grouping has three levels, a trend contrast was run for this variable. If the null hypothesis is correct that there is no effect across creativity groupings for the dependent variable of conformity, then the experimenter would expect to find no significant linear or quadratic trends for this data. Table 4.6 displays the findings for this procedure:

Table 4.6 *Polynomial trend contrast for the independent variable of creativity group on the dependant factor of conformity*

Contrast Matrix (K Estimates)

Polynomial Contrast GROUP			Dependent Variable Conformity
Linear	Contrast Estimate		.291
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		.291
	Std. Error		.109
	Sig.		.009
	95% Confidence Interval for Difference	Lower Bound	.074
		Upper Bound	.508
Quadratic	Contrast Estimate		-.074
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-.074
	Std. Error		.112
	Sig.		.510
	95% Confidence Interval for Difference	Lower Bound	-.297
		Upper Bound	.149

The results of the trend contrast show that for the independent variable of creativity grouping there is not a significant quadratic (.510) shape to the data as this value lies way outside the area of acceptance with regards to significance at the .05 level. In contrast, the observed value for the linearity test (.009) can be considered significant. Though the experimenter cannot speculate on the direction of this linearity, it would lend credence to the notion that the low, middle, and high creativity groups were staggered relative to each other with regards to the dependent variable of creativity. This would provide preliminary evidence towards rejecting the null hypothesis that the creativity groupings are all equal on the dependent variable of conformity. However, a closer look at the descriptive statistics and the variance is warranted to reliably determine whether the null hypothesis of no difference can be rejected. Table 4.7 graphically displays the descriptive statistics for this data:

Table 4.7 *Descriptive statistics for the dependent variable of conformity by creativity grouping and treatment condition factors*

Descriptive Statistics

Dependent Variable: Conformity

Group	Condition	Mean	Std. Deviation	N
High	control	.2500	.34960	16
	experimental	.4608	.60245	17
	Total	.3586	.50021	33
Middle	control	.1875	.40311	16
	experimental	1.1167	.84386	15
	Total	.6371	.79772	31
Low	control	.3088	.56960	17
	experimental	1.2255	.84767	17
	Total	.7672	.84978	34
Total	control	.2500	.44683	49
	experimental	.9269	.82944	49
	Total	.5884	.74495	98

The descriptives provide several interesting insights into the data. First, as a whole, the mean for average conformity across all factors is .5884. Using this as a guide, it appears that there is a great deal of difference between the condition groups on the dependant variable of conformity. The experimental group (.9269) was observed to conform at a rate that was almost four times greater than that of the respective control group (.2500). With respect to the creativity groups, the linearity discovered in the trend contrast test shows up in the results. As a whole, the high creativity group (.359) conformed the least, the low creativity group conformed the most (.7672), and the middle creativity group conformed in the middle of these two groups (.6371). This result is consistent with one of the hypotheses of the study, that creativity and conformity would have a significant indirect relationship, with higher scores on creativity leading to lower conformity scores. However, before the experimenter could perform the analysis of variance off this mean and standard deviation data, the assumptions related to this test needed to be satisfied.

The analysis of variance statistical procedure has three key assumptions that need to be satisfied by the data set for this particular statistical procedure to be considered valid with regards to statistical significance of results and subsequent analyses of the findings. The first of these assumptions is that independent random samples have been taken from each population. The data set fits this assumption as each individual was randomly assigned a particular cell in our 3x2 matrix by which his/her scores will be analyzed in separate comparison to individuals in other treatment and creativity groups. The second assumption is that the populations are normal and the third assumption is that their populations have equality of variance across all factor groups. These last two

assumptions are of particular importance as the study has a small sample size with unequal numbers across both creativity grouping and treatment conditions. Though the grouping differences across factors is slight, statistical tests for these two assumptions are warranted so that it can be shown that they meet the necessary criterion for running an ANOVA. First, the normality or data was analyzed through the application of the Kolmogorv-Smirnov test, which tests the null hypothesis that the normality of the dependent variable is equal across groups. The findings of this test are summarized in Table 4.8:

Table 4.8 *Test for equality of normality across factor groups of group and condition*

Tests of Normality

	GROUP	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Conformity	High	.278	33	.000	.749	33	.000
	Middle	.239	31	.000	.801	31	.000
	Low	.258	34	.000	.832	34	.000

	CONDITION	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Conformity	Control	.406	49	.000	.619	49	.000
	Experimental	.186	49	.000	.895	49	.000

a Lilliefors Significance Correction

Results of this statistical test overwhelmingly indicate the necessity to reject the null hypothesis that the population is equal with respect to normality across groups based upon the fact that significant differences were found for each independent variable across all categories of that variable. The Shaprio-Wilk test was run as there were fewer than fifty members in the categorical cells, but the results were still the same. The normality

assumption has failed to be satisfied for the ANOVA. Next, to test for equality of variance, a Levene's test was run on the data. This statistical procedure tests the null hypothesis that the error variance of the dependant variable (conformity) is equal across all groups. The results for this test are summarized in Table 4.9 below:

Table 4.9 *Test for equality of variance across conformity groups*

Levene's Test of Equality of Error Variances

Dependent Variable: Conformity

F	df1	df2	Sig.
4.489	5	92	.001

As with the normality data, the Levene's test is also significant with regard to equality of variance across groups. This means that the null hypothesis that error variance is equal across all factors in our study has to be rejected.

Due to these two findings, the data set, as is, cannot be analyzed using an analysis of variance procedure as two of the three assumptions are violated. This gives two options from which to choose to continue with data analysis. The first calls for a transformation of the dependant variable of conformity to adjust normality and reduce error variance across groups. The type of transformation necessary would be determined by a power estimate of the data set. The second option is to conduct a nonparametric test on the data, such as chi-square. The chief downside to this type would be the inability to examine any interaction effects between the dependant variables of creativity grouping and treatment condition. Because of the desire to determine the presence of these effects, both options were completed, first looking at the nonparametrical analysis and then

transforming the data in the hope that an analysis of variance with regard to main and interaction effects would be possible.

Nonparametric Test Summary

While nonparametric tests are less stringent on the requirements of the data set necessary to run an analysis, this leniency comes at a price. The price of this leniency can be summed up in a word: power. More specifically, nonparametric tests ignore some of the available information that a parametric test would factor into account. For this reason, results derived from a nonparametric test sometimes miss finding a true difference when it there is a true difference in the population.

The statistical test employed to analyze the data set nonparametrically was the several independent samples test. It compared the distribution of our conformity variable against the creativity and treatment groupings. The results will be displayed in the form of a Kruskal-Wallis test, which will demonstrate whether the distribution of our conformity variable is the same in all our groups by comparing the sum of the ranks within the groups themselves. The results of this test are displayed in table 4.10:

Table 4.10 *Nonparametric test on dependant variable of conformity by creativity group and treatment condition*

Ranks

	Conformity	N	Mean Rank
Group	.00	67	45.32
	1.00	21	55.31
	2.00	8	65.31
	3.00	2	65.25
	Total	98	
Condition	.00	67	44.01
	1.00	21	57.67
	2.00	8	67.88
	3.00	2	74.00
	Total	98	

Test Statistics(a,b)

	Group	conditio
Chi-Square	6.091	12.067
Df	3	3
Asymp. Sig.	.107	.007

a Kruskal Wallis Test
b Grouping Variable: Conformity

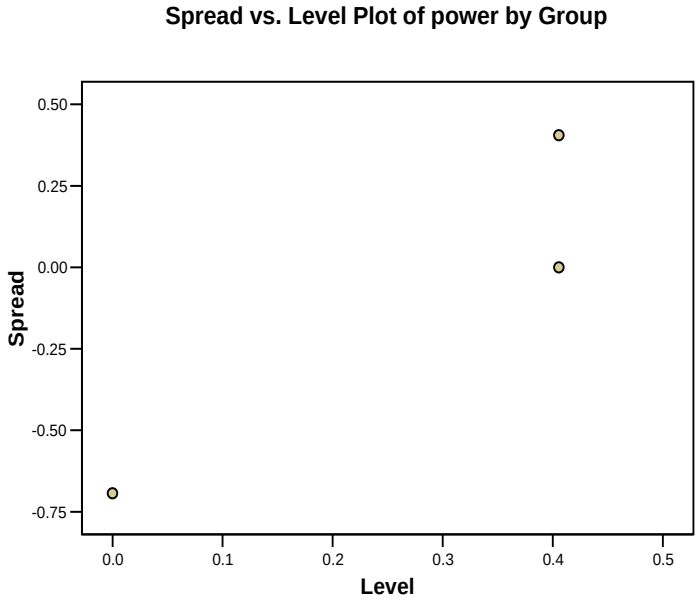
Through the analysis of this table, it appears that a significant finding (.007) was found for the dependent variable of treatment condition. This can be interpreted as an indication that the distribution of the conformity results differed significantly between the control and experimental conditions, and the null hypothesis that there is no difference between the two groups on this variable can be rejected. In contrast, the derived value of the creativity groups (.107) was not found to be significant, meaning that the experimenter cannot reject the null hypothesis that conformity scores were equal across groupings with this particular test. However, due to the limitations of the nonparametric test, it's uncertain as to whether actual magnitude of the differences between specific groups (high vs. low, high vs. middle, middle vs. low) and whether a true difference for

this variable as a whole were missed due to the lack of power behind the statistical analysis. Additionally, it can't be determined if there were any significant differences due to the interaction of these two independent variables. For this reason, it seems in order to revisit the analysis of variance procedure, and attempt to transform the data to meet the assumptions for the ANOVA.

Analysis of Variance - Revisited

When homogeneity of variance cannot be assumed, an exploratory procedure can be run on the data to determine the power of the data set. In turn, this power statistic can be used to help figure out the necessary transformation that needs to be applied to the independent variable so as to meet the assumption of equality of variance across the two groups in question.

From the original data set, a power estimation was performed for the homogeneity of variance. As a result, a spread vs. level plot was generated for each of the two variables with a suggestion for a data transformation power so as to meet the assumption of equality of variance. Figure 4.1 shows the plots for the variables of creativity group and treatment condition:



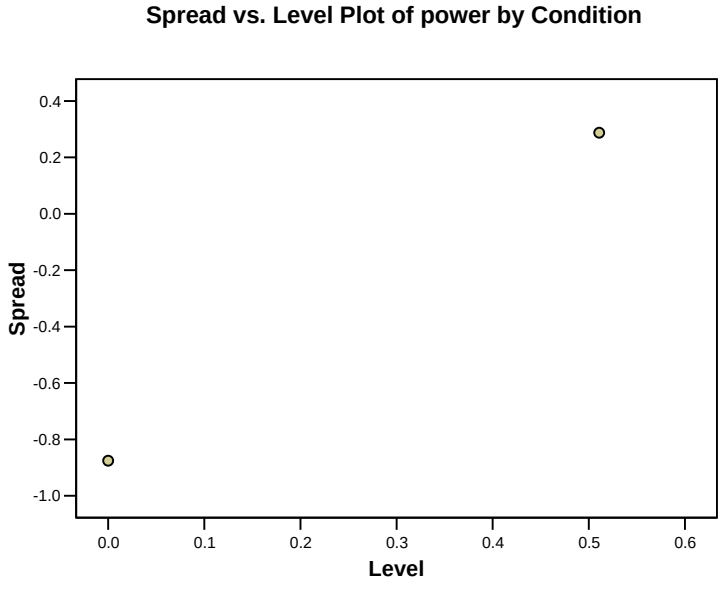


Figure 4.1 *Spread vs. level plots for observed power for the independent variables of creativity group and treatment condition*

A close examination of Figure 4.1 shows nearly identical powers of transformation for our two independent variables. The transformation recommendation for the creativity group variable (-1.210) only differs from that of the recommendation for the treatment group variable (-1.277) by .067. For the purpose of transformation then, the experimenter averaged these two recommendations and arrived at a final transformation quotient of -1.243. This value was the power to which the values in the dependant variable of conformity were raised. Once this transformation was applied to the data set, the Levene's test for equality of variance was run to see if the experimenter had met this assumption, thus allowing an analysis of variance on the transformed data set. The result of this test is found in Table 4.11:

Table 4.11 *Test for equality of variance across treatment groups for transformed data on variable of conformity*

Dependent Variable: Conformity / Transformed

F	df1	df2	Sig.
1.728	5	92	.136

It appears from a cursory glance at the above table that the transformation worked. The experimenter satisfied the elusive assumption of equality of variance and was thus able to proceed with the analysis of variance related to the factors of creativity grouping and treatment condition on conformity.

The analysis of variance procedure allowed for a determination of whether there were any significant main effects in either of our factors and if there was a significant interaction effect between the two. Results of the ANOVA can be found in Table 4.12

Table 4.12 *Data for the 3x2 cross factorial ANOVA design (creative group x treatment condition) for the dependent variable of conformity*

Tests of Between-Subjects Effects

Dependent Variable: Conformity / Transformed

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	18.406(b)	5	3.681	10.455	.000
Intercept	48.056	1	48.056	136.484	.000
Group	1.264	2	.632	1.795	.172
Condition	12.924	1	12.924	36.705	.000
Group * Condition	4.684	2	2.342	6.651	.002
Error	32.393	92	.352		
Total	98.000	98			
Corrected Total	50.800	97			

a Computed using alpha = .05
b R Squared = .362 (Adjusted R Squared = .328)

The results from the ANOVA painted an interesting picture. With a calculated F-value of 1.795, the factor for creativity group was found to be not significant (.172) at the alpha level of .05. This is in line with what the nonparametric test found (.107) with regards to this variable. In a similar vein, the calculated F-value for the factor of treatment condition was 12.924, which was significant (.000) at the alpha level of .05. This is very similar to the derived nonparametric value (.007). Of most interest, however, is the F-value of the interaction between the factors of group and condition. This interaction effect was found to be significant (.002) at the alpha level of .05. From this data there appears to be significant main effect on conformity for the factor of treatment condition and a significant interaction effect for the combined factors of creativity grouping and treatment condition. The null hypothesis of no difference for both of these effects can be rejected.

A post-hoc test was run on the data set, but because through the analysis of variance the experimenter was able to dismiss the factor of creativity groupings as significant, an analysis of this test is not warranted as this is the only factorial variable with more than two levels, a requirement needed for the test to be effectively calculated.

ANOVA: Conformity Components

Before jumping straight to a discussion pertaining to the results described above, it would be prudent to examine each of the components separately that led up to the conformity score and findings. The three components (specific to a chair) that were featured in the all of the examples presented to the experimental group were as follows: four legs, drink holder, and adjustable lever. While the determination overall was that condition assignment significantly affected conformity as a whole, an examination of the conformity effects specific to each feature would be pertinent to determine if this finding was consistent across all features, or rather present in a large amount in one or more features but devoid of significance in others. It would be helpful to garner whether this conformity effect was uniform across all features or, rather, specific to a particular feature (or two) enough to tip the significance balance towards rejection of the null when unilaterally this was not the case. Tables 4.13, 4.14, and 4.15 shows the results for each of the conformity features. Profile plots for these three features can be found in Appendix D.

Table 4.13 *Data for the 3X2 cross factorial ANOVA design (creative group x treatment condition) for the dependent variable of four legs*

Descriptive Statistics

Dependent Variable: Conformity Factor - Four Legs

Group	Condition	Mean	Std. Deviation	N
High	Control	.38	.500	16
	experimental	.35	.606	17
	Total	.36	.549	33
Middle	Control	.00	.000	16
	experimental	.73	.704	15
	Total	.35	.608	31
Low	control	.24	.752	17
	experimental	.71	.772	17
	Total	.47	.788	34
Total	control	.20	.539	49
	experimental	.59	.705	49
	Total	.40	.654	98

Tests of Between-Subjects Effects

Dependent Variable: Conformity Factor - Four Legs

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6.326(b)	5	1.265	3.311	.009
Intercept	15.678	1	15.678	41.031	.000
Group	.246	2	.123	.322	.725
Condition	3.794	1	3.794	9.930	.002
Group * Condition	2.367	2	1.184	3.098	.050
Error	35.154	92	.382		
Total	57.000	98			
Corrected Total	41.480	97			

a Computed using alpha = .05
b R Squared = .153 (Adjusted R Squared = .106)

Table 4.14 *Data for the 3X2 cross factorial ANOVA design (creative group x treatment condition) for the dependent variable of drink holder*

Descriptive Statistics

Dependent Variable: Conformity factor - Drink Holder

Group	Condition	Mean	Std. Deviation	N
High	Control	.13	.342	16
	Experimental	.24	.437	17
	Total	.18	.392	33
Middle	Control	.19	.403	16
	Experimental	1.27	1.223	15
	Total	.71	1.039	31
Low	Control	.24	.437	17
	Experimental	.88	.600	17
	Total	.56	.613	34
Total	Control	.18	.391	49
	Experimental	.78	.896	49
	Total	.48	.749	98

Tests of Between-Subjects Effects

Dependent Variable: Conformity Factor - Drink Holder

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	17.456(b)	5	3.491	8.680	.000
Intercept	23.353	1	23.353	58.063	.000
Group	5.064	2	2.532	6.295	.003
Condition	9.162	1	9.162	22.779	.000
Group * Condition	3.773	2	1.886	4.690	.011
Error	37.003	92	.402		
Total	77.000	98			
Corrected Total	54.459	97			

a Computed using alpha = .05
b R Squared = .321 (Adjusted R Squared = .284)

Multiple Comparisons

Dependent Variable: Conformity Factor – Drink Holder

	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	High	Middle	-.53(*)	.199	.030	-1.01	-.04
		Low	-.38(*)	.125	.011	-.68	-.08
	Middle	High	.53(*)	.199	.030	.04	1.01
		Low	.15	.214	.762	-.37	.67
	Low	High	.38(*)	.125	.011	.08	.68
		Middle	-.15	.214	.762	-.67	.37

* The mean difference is significant at the .05 level.

Table 4.15 *Data for the 3X2 cross factorial ANOVA design (creative group x treatment condition) for the dependent variable of lever*

Descriptive Statistics

Dependent Variable: Conformity Factor - Lever

Group	Condition	Mean	Std. Deviation	N
High	Control	.06	.250	16
	Experimental	.18	.393	17
	Total	.12	.331	33
Middle	Control	.00	.000	16
	Experimental	.47	.743	15
	Total	.23	.560	31
Low	Control	.00	.000	17
	Experimental	.12	.332	17
	Total	.06	.239	34
Total	Control	.02	.143	49
	Experimental	.24	.522	49
	Total	.13	.397	98

Tests of Between-Subjects Effects

Dependent Variable: Conformity Factor - Lever

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.369(b)	5	.474	3.378	.008
Intercept	1.841	1	1.841	13.124	.000
Group	.505	2	.252	1.799	.171
Condition	1.325	1	1.325	9.442	.003
Group * Condition	.652	2	.326	2.323	.104
Error	12.906	92	.140		
Total	17.000	98			
Corrected Total	15.276	97			

a Computed using alpha = .05
b R Squared = .155 (Adjusted R Squared = .109)

Close inspection of these statistical results, combined with analysis of the profile plots found in Appendix G, paint an interesting picture. The most salient conclusion that can be drawn from these results is the tendency for the experimental groups to conform at a significantly larger frequency across all the components that made up the factor of

conformity (four legs, drink holder, lever) and across all creativity groupings (high, middle, low). This conclusion is borne out through analyzing the significance values for each of the conditions across conformity components. These compute to be .002, .000, and .003 for the components of "four legs," "drink holder," and "lever" respectfully. All of these values are way below the significance cut off of alpha = .05. This is in line with what the statistical analysis for overall conformity found.

However, contrary to the initial analysis for conformity as a whole, one particular conformity component displayed a significant difference between the creativity groups. This is particularly intriguing in light of the fact that the general analysis for conformity was not able to detect such a difference. A result such as this is somewhat akin to a post-hoc test for the factorial variable of conformity in which individual differences among its components are analyzed. The conformity component that flagged a significant difference for the factor of group was "drink holder." Table 4.14 shows that the computed significance value (.003) is well below the alpha value necessary to determine a statistical significance. A post-hoc multiple comparison test was run to determine the true difference between the groups with respect to the variable of conformity with respect to the presence of a drink holder in subjects' drawings. The results show that the high creativity group demonstrated a mean difference of -.53 compared to the middle creativity group. This difference was significant (.03) at the .05 level. Additionally, the high creativity group demonstrated a mean difference of -.38 compared to the low creativity group. This value was also found to be significant (.011) at the .05 level. So, from these results alone, our high creativity group was able to resist the tendency to conform at a level that was significantly different than the lower two creativity cohort

groups. As this was a key research question of the study; that higher creativity students would be able to resist the tendency to conform at a higher rate than their lower creativity cohorts, this result is a key finding. Although broad generalization from this result would certainly not be warranted, as this effect was not found across any of the other conformity comparisons or for the variable of conformity as a whole, it at least demonstrates that on one small level, our null hypothesis of null difference would have cause to be rejected.

Discussion

The first point that needs to be addressed with regard to this study is the inability to run an analysis of variance statistical procedure on the data set without first having to transform the data to meet the parameters of the test. Our sample size (n=98) simply did not yield enough power to allow the assumptions of equality of variance and normality to be met. With the knowledge that the results derived from such an analysis could not be used for generalization or data summary, it still would be interesting to note what such an ANOVA test on the data set, untransformed, would have yielded. To revisit, Figure 4.2 shows the profile plots for conformity with respect to creativity group and condition:

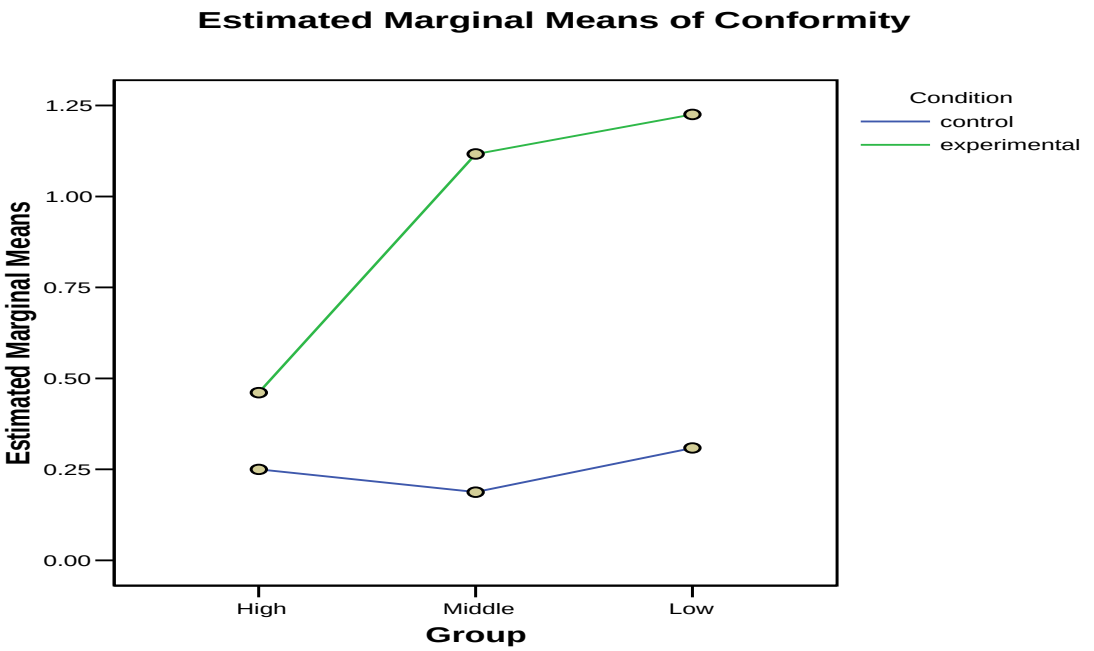


Figure 4.2 *Profile plots for dependent variable of conformity for creativity groups and treatment conditions.*

Looking carefully at these plots, it becomes obvious that the lines related to conformity across treatment conditions never cross and do, in fact, have a linear shape; which our polynomial trend contrast (Table 4.6) first indicated. Taking all of this information into account, it would seem to support the initial finding of significance of between treatment conditions on the variable of conformity. This would not only confirm what was found previously in this particular experiment, but what has been demonstrated for conformity and functional fixidity as a whole in the literature today. The presentation of examples does tend to increase conformity among subjects and this study was able to replicate these findings. A closer analysis of this plot, though, also shows that there is no discernable overlap between creativity groupings with respect to conformity. Although both of the high creativity groups only differ by approximately .25, this is the closest

observed value. There is quite a visible and measured discrepancy between the middle and low creativity groups. To determine if any significant differences are present based on our observations, an ANOVA was run. Table 4.16 summarizes the results of this test:

Table 4.16 *Data for the 3x2 cross factorial ANOVA design (creative group x treatment condition) for the transformed data on the dependent variable of conformity*

Tests of Between-Subjects Effects

Dependant Variable: Conformity

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17.095(a)	5	3.419	8.563	.000
Intercept	34.219	1	34.219	85.698	.000
Group	3.001	2	1.500	3.757	.027
Condition	11.489	1	11.489	28.774	.000
Group * Condition	2.771	2	1.386	3.470	.035
Error	36.735	92	.399		
Total	87.764	98			
Corrected Total	53.831	97			

This data reveals what the transformed data could not; a significant difference (.027) between the creativity groups with regard to conformity. In our prior ANOVA analysis with the transformed data, our significance value was found to be .172, disguising the presence of a true effect when one truly existed. If these results had met the necessary assumptions allowing them to be submitted for analysis, we would have the ability to confidently reject all the null hypotheses related to the study: that there were no significant differences between groups on conformity (significance = .027); that there were no significant differences between treatment groups on conformity (significance = .000); and, that there were no significant interaction effects between the factorial variables of creativity grouping and treatment condition on conformity (significance =

.035). Because a significant difference was found for the variable of creativity grouping, a post-hoc test was run on the data to yield specific information on the significance of the difference between each of the groups in relation to each other, shown in Table 4.17.

Table 4.17 *Post-hoc comparison for creativity grouping on the dependent variable of conformity.*

Dependent Variable: Conformity

	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower	Upper
Sidak	High	Middle	-.2785	.15805	.225	-.6629	.1059
		Low	-.4086(*)	.15441	.028	-.7841	-.0330
	Middle	High	.2785	.15805	.225	-.1059	.6629
		Low	-.1301	.15692	.794	-.5117	.2516
	Low	High	.4086(*)	.15441	.028	.0330	.7841
		Middle	.1301	.15692	.794	-.2516	.5117
Games-Howell	High	Middle	-.2785	.16766	.230	-.6835	.1265
		Low	-.4086(*)	.16977	.050	-.8178	.0006
	Middle	High	.2785	.16766	.230	-.1265	.6835
		Low	-.1301	.20437	.801	-.6206	.3605
	Low	High	.4086(*)	.16977	.050	-.0006	.8178
		Middle	.1301	.20437	.801	-.3605	.6206

From this post-hoc analysis, it is evident that the high creativity and low creativity groups significantly (.028 / .050) differed from one another. This result holds true through both statistical computations, though the Games-Howell fits this specific data better as it assumes inequality of variance and corrects the calculation accordingly. The middle and low grouping did not come close to meeting this level of significance. However, as one of the pertinent research questions dealt with the ability of high creativity subjects to conform significantly less than their lower creativity cohorts, we can not only feel confident in the ANOVA result that demonstrated significant differences (.027) overall, but the results above that show *how*, specifically, our high and low groups differ. Based on this data, we can reject the null hypothesis that a high level

of creativity would not produce any difference in conformity scores. This is not the case. Instead, it appears that those subjects who were measured to have a high level of creativity as operationally defined for our study were able to avoid the traditional fixation effects significantly better than those who were measured to be less creative across both treatment conditions. This finding would seem to support the notion that creativity can act as a buffer against the tendency to conform to functional fixidity. But, to validly and reliably determine if this was indeed the case with respect to our particular study, we would have to increase our sample size to accurately determine this effect. With that said, it is the contention of the experimenter that replication of this study with a larger number of subjects would lead to the same results and an across the board rejection of the null hypothesis with regard to all postulated research questions. Creativity would be shown to be a significantly effective buffer against functional fixidity and the tendency to conform to examples.

Error Variance

The discussion would not be complete without a reference to the observed error in our study, another potential pitfall of small sample size as this tends to increase the instances of variability with regard to error. Confounding variables always pose a potential threat to the generalizability of results and to the determination of a true effect. In our particular study, with reference to Table 4.16, our observed variation due to error was calculated to be 36.735 against a total variation of 87.764 (df=97). Quick calculation would reveal that, for this particular study, error accounted for approximately 42% of variation on the dependent variable of conformity with respect to creativity groupings and

treatment condition. This is quite a high amount of error enable one to truly feel confident in the results for the fear of incurring a Type I error, in which a true effect is implied when there is not one present in the data. In examination of the features of the study, it seems clear that several variables could have confounded our results. Several of the most salient among the possible explanations can be derived from the features of the sample itself and the testing situation.

First, the subjects in this study were all attendees of a gifted and talented summer enrichment program. Though no IQ scores, placement verification, or other data were used to accept students into the summer program, all advertisements and solicitations had been made to this population, so the assumption of a degree of gifted and talented ability would have to be considered as a general feature of the subject sample. With this knowledge, and based on the relationship in the literature between giftedness and creativity (a key component of the experimental design), our divisions of high, middle, and low creativity could have been confounded based on this grouping variable.

Additionally, all subjects agreed to participate voluntarily. For this reason, a desire to please the researcher could have entered into effect and confounded their efforts on the TCWSW test and/or the idea generation task. If expectations of performance were assumed by the participants on behalf of their admittance into an academic-based program, this could have affected the observed scores on both instruments. As for the instruments themselves, they were both administered in a group setting. Although all subjects were separated and were instructed to complete the task by themselves, the group atmosphere related to testing could have played into some of the responses – especially on the TCWSW test as the sounds were played aloud for the entire group and

some discussion, via whispering, giggling, body language, could have been communicated from subject to subject, thus confounding the validity of their individual scores on the instrument. Finally, all of the scoring on both instruments was done solely by the experimenter. Although experimental numbers were used to protect anonymity, and reduce the chance for personal bias and halo effects on the part of the experimenter, there were no counterbalances in place to account for observer reliability. Although the standardized scoring manual was used for the TCWSW, the possibility for observer error with regards to scoring was not balanced by having a separate observer rate the tests to determine concurrence. All of these factors combined could have influenced the observed scores and reduced the reliability and validity of the study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purposes of this study were to determine if the presentation of examples prior to the onset of an idea generation task could result in an individual to conforming to and depicting the features of the examples in their manifestations and, additionally, whether individuals who are assessed to be highly creative are able to successfully resist these tendencies at a rate that is significantly below the conformity rates of their lower creativity cohorts. Cognitive processes, to a large extent, are essential roots in the entemological stem of creative blossoms (i.e., creative thought and products), and the establishment of the direction and magnitude of any relationship of one of these constructs on the other certainly warrants investigation.

In recent years, the prevalence of the cognitive tendency to fixate on the features of examples in an idea generation task has been well documented in the literature (e.g., Smith, Ward, & Schumacher, 1993; Marsh, Landau, & Hicks, 1997). The results of these have led to the formulation and acceptance of the terms “design fixation” and “functional fixidity” to help explain the debilitating nature of examples on an individual’s cognitive inability to break free of the cognitive and ideational constraints that examples can induce in an idea generation task. This study was an attempt to determine if the effects that the presentation of examples can induce in an idea generation task can be offset by the mechanisms that are activated during the creative thinking process. Is there a combative

nature found within the construct of creativity that would allow an individual, through the application of his/her creative potential, to overcome the traditional cognitive blocks and barriers typically associated with the presentation of examples in an idea generation task?

Summary

In this experiment, the hypothesis that creative individuals (as defined by originality) could overcome design fixation effects related to the presentation of examples was tested in a traditional idea generation task. The subjects for this experiment were 98 seventh through eleventh graders who all attended of a gifted and talented summer camp program at Texas A&M University. Subjects were divided into high-, middle-, and lower-creativity groups based of their performance on the *Thinking Creatively with Sounds and Words* test. From this division a proportional stratified random sampling procedure was implemented to ensure equal representation among all groups across both the experimental and control treatment groups in the treatment cells of the design. The subjects were then presented an idea generation task patterned after Smith, et al. (1993) that called for them to generate ideas for a chair of the future. The experimental group viewed examples prior to task onset that all included three specific features. The control group did not view any examples prior to task onset. Conformity effects were measured in relation to the proportion of the features in the examples: (1) four legs, (2) drink holder, (3) adjustable lever; that were included in the ideas generated by the subjects. From the tabulation of the frequencies related to the prevalence of these features in their drawing, an overall conformity score for each subject was computed by adding the total number of instances of conformity and dividing by the number of

drawings generated by the student. The number of drawings generated by the student was considered by the researcher to be a separate indication of creative potential (i.e., fluency) and a correlation was run between this value for each individual and his/her score on the creativity test. This value was used to help determine the validity of using a single feature, originality, as a basis for creativity grouping. A moderately strong, positive relationship was found between these two terms, leading the researcher to believe that the instrument used possessed a strong degree of construct validity and that the subsequent groupings based on the results that the instrument yielded were reliable and valid. Once this had been established, results were initially analyzed by a nonparametric chi-square test and then were transformed to allow for the application of an analysis of variance procedure by which the main and interaction effects of the two independent variables could be discerned.

The initial non-parametric chi-square results showed that there was a significant difference between the treatment conditions with regard to the dependant variable of conformity. The difference between the creativity groups was not found to be significant for the variable of conformity. With these non-parametric trends in mind, the researcher transformed the data to fit the requirements of the analysis of variance test so as to better discover the true nature of the main and interaction effects. Due to the small sample size, equality of variance could not be assumed, so according to the statistical recommendations yielded by the power estimation, the data was transformed to help meet this assumption. Once transformed, the analysis of variance procedure was run. The results for this test yielded a similar result to that of the chi-square. For the variable of treatment condition, a significant difference was found between the control and

experimental groups on the dependant variable of conformity. This difference was found to be significant at the .05 alpha level and was consistent across all creativity groupings. This finding established the presence of design fixation effects in the sample induced through the presentation of examples and replicates the findings of the earlier studies mentioned. Results for the independent variable of creativity grouping again failed to yield a significant difference, meaning that there were no salient differences found between the creativity groups on their tendency to conform to examples. Though overall, the conformity results showed that the high creativity group conformed less than both the middle and low creativity groups, this difference was not profound enough to be deemed significant at the stringent statistical level we applied to this study. Therefore, this finding directly contradicts the stated hypothesis that highly creative individuals would be able to reduce the tendency to conform and forces the experimenter to fail to reject the null hypothesis of no difference for the variable of creativity grouping.

A key feature of the ANOVA test was its ability to test for the interaction effect between creativity grouping and treatment condition. The test revealed that a significant interaction effect was detected, meaning that the interplay between these two variables had a significant impact on an individual's tendency to conform. This finding would certainly fuel the theoretical fire towards kindling future investigations on an investigation into this relationship so as to fully determine the nature of what was detected.

Conclusion

In conclusion, based on the data that was analyzed, the results, though confirming the presence of design fixation tendencies among the sample with regard to treatment condition, did not reveal that the presence of a high level of creativity was able to significantly reduce the tendency to conform among the subjects in the study. However, as these conclusions were based on non-parametric tests and analysis of variance from transformed data, the accuracy and generalizability of these results is seriously compromised. With this in mind, one of the most obvious conclusions that can be made from this study is that due to the small sample size, the investigator did not have the power to run the statistical tests needed to determine the true effect that was present in the study. The non-parametric test did not allow for any in-depth insight for analysis, and the transformed data somewhat masked the true variability among creativity groups with respect to conformity. For a true conclusion to be made regarding the null hypothesis postulated in the research design, a larger sample size would need to be used so as to fully meet all the assumptions necessary to run the proper statistical analyses.

Significance of Study

This study contributes significant knowledge to the field of cognition, creativity, and creative cognition research through its attempts to discern, specifically, if the elements related to creative thinking and creative potential can mask, or block, the standard cognitive effects that are observed when examples are presented prior to the onset of an idea generation task. Masking and overshadowing studies are common in the field of cognitive research. However, often, these studies use stimuli to test the presence

of these effects, with the frequent result being that the most salient of two is attended to, despite the simultaneous presence of the other. This study, in contrast, uses constructs to determine this very same principle. When the mental processes and mechanisms for cognition and creativity are simultaneously activated, which construct will see their features attended to in a specific task setting? This study sought to answer that question by testing whether the cognitive tendency of design fixation could be overcome by the nature and principles of creative thought. In this same vein, this study expands the theoretical horizons of the field of creative cognition by going beyond simple replication of design fixation studies and adding the component of combativeness. The tendency to conform has been established. Now, the focus should shift to how to eliminate this tendency. Akin to extinction in classical conditioning, what steps can be taken or methods discovered to reduce the tendency to respond in a certain way to examples? Is the cultivation of creativity, creative potential, and creative thinking strategies the answer? Only further investigation and testing will reveal this answer. Finally, with respect to the field of creativity research, this study highlights the importance for viewing creativity as a tool, not just an instrument. The field of creativity research, in certain sectors, is consumed with developing the perfect test (divergent thinking, or otherwise) to capture the essence of creativity. Other sectors are driven solely by a desire to capture in words the exact essence of the term. Though these are both valuable pursuits and certainly worthy of continued scholarly investigation, it would seem prudent to examine how best to harness the power of creativity and not try to encapsulate, define, or box in the term, but rather, think “outside the box” and determine how best creativity can be

applied to a variety of fields, phenomenon, and areas of inquiry. Only then will the true transcending power of creativity come to fruition.

Recommendations for Future Research and Practice

With respect to this specific study, there are several questions that have emerged from the results that were obtained. Most of these deal with the sample and the study itself. First, it would seem prudent that a replication of this study be performed. Based on the analysis of the original data, prior to transformation, it could be said that evidence does exist that highly creative individuals are able to overcome design fixation tendencies brought on by the introduction of examples in an idea generation task. Though this study failed to reject the null hypothesis of no difference related to this question, it is not certain that this would be the case if this study was conducted again. For this to be validly and reliably determined, several features of this study would need to be altered. First, the sample size should be increased to allow for enough power to run all statistical tests necessary, including the analysis of variance. Second, the generalizability of the results, should a significant difference be determined, needs to be addressed. A potential limitation for generalizability of this study can be derived from the characteristics of the sample itself. All of the subjects included for analysis are attendees of a summer camp for gifted and talented students. Though no official test scores or placement verification validate the application of the label “gifted” for any of the students, as they are not required for admission into the program, the proper assumption would be that the students included in this study sample do differ more significantly with respect to their level of giftedness than would be expected from a normal distribution of students their

same age and grade level. Whatever the stance or position used to define giftedness, evidence that gifted individuals are considered to be proficient at tasks involving creative thinking is provided by Sternberg and Lubbart (1993), who demonstrated that those identified as creatively gifted achieve above normalized levels in many processes related to divergent and generative thinking, including selective encoding and problem definition. With these notions and results in mind, the lower-creative individuals in this study might have statistically higher resistance to interference scores than what would be expected in the population due to their identification of being gifted. Therefore, any observed effects in the lower-creative sample might not be representative of the population as a whole. To determine if this is truly the case, any replication of this study would need to be conducted with a sample that featured a normal distribution with respect to the variables of giftedness, intelligence, and creativity.

Finally, the inclusion of a more comprehensive battery of creativity thinking, such as the *Torrance Tests for Creative Thinking* would be suggested. This study employed a single factor (originality) to make all determinations related to creativity groupings. Though this factor correlated moderately and positively with another commonly identified factor of creativity (fluency), and instrument that took these factors into account while also addressing other features of the term itself would be warranted. By the inclusion of this, the chance of a Type II error and detecting a significant effect when it is not present can be reduced by ensuring the reliability and construct validity of the creativity group divisions.

Despite these methodological limitations, all evidence points to the value of this study as one to guide future research in the field of creative cognition. The true effects of

creativity need to be explored, tested, and examined so that the true potential of the creative capabilities in human thought and production can be realized for the betterment of the individual and society as a whole.

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APPENDIX A

STUDENT AND PARENT CONSENT FORMS FOR PARTICIPATION

Student Assent Form

I have been asked by Jay Woodward from Texas A&M University to participate in a research study that investigates the relationship between middle school and high school gifted students' level of creativity and their ability to overcome cognitive fixation tendencies in an idea generation task. This study will take place during the 2002 Youth Adventure Program (YAP) summer camp for gifted and talented students. Approximately 140-150 seventh through twelfth graders will be asked to participate in this study. As a subject, I understand that I will be asked to complete the Sounds and Images (Form 1A) activity from the Thinking Creativity with Sounds and Words test. Additionally, I am aware that I will be asked to complete an idea generation task related to divergent thinking. The total administration time for these two instruments should not surpass 60 minutes.

For the experiment, I understand that I will not have to provide my name. I do understand that I will be given an experimental number and this will be on all of the assessment sheets. I understand that this number will serve as the basis for my assignment to different groups within the study. I am aware that my personal information about my identity will be kept confidential.

I understand that my participation in this experiment is voluntary and that my ability to participate in any Youth Adventure Program activities will not be affected by my choice to participate or not. Additionally, my right to attend future sessions of the Youth Adventure Program will not be compromised whether I choose to participate or not. I also understand that I will not be treated any differently by the camp counselors, staff, or director based on the decision I make regarding my participation. I also understand that it is my right to quit the experiment at any time by telling the researcher and I will not face any negative consequences as a result of this decision.

I have read and understand the project that I will be involved in. I have had all of my questions answered and agree to serve as a participant in this study.

Printed name of student: _____

Signature of student: _____ Date: _____

I agree to conduct this study as it is explicitly described above.

Signature of researcher: _____ Date: _____

This study has been reviewed and approved by the Institutional Review Board-Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' right, the Institutional Review Board may be contacted through Dr. Michael W. Buckley, Director of Support Services, Office of the Vice President for Research and Associate Provost for Graduate Studies at (979) 845-8585.

For information about this study, you may contact:

Researcher: Dr. William Nash
Dept. of Educational Psychology
4225 – TAMU
College Station, TX 77843-4225
(979) 845-1893

or

Jay Woodward
Dept. of Educational Psychology
4225 – TAMU
College Station, TX 77843-4225
(979) 845-1802

Parent / Guardian Consent Form

Researcher: Jay Woodward, Graduate Student
Institute for the Gifted and Talented
Dept. of Educational Psychology
Texas A&M University

My child has been asked to participate in a in a research study that investigates the relationship between middle school and high school gifted students' level of creativity and their cognitive processing ability. My child will be asked to complete the Sounds and Images (Form 1A) activity of the Thinking Creativity with Sounds and Words test. Additionally, I am aware that my child will be asked to complete an idea generation task related to divergent thinking. The total administration time for these two instruments should not surpass 60 minutes.

This study will take place during the 2002 Youth Adventure Program (YAP) summer camp for gifted and talented students. Approximately 140-150 seventh through twelfth graders will be asked to participate in this study. My child's participation in this experiment is voluntary their ability to participate in any Youth Adventure Program activities will not be affected by their choice to participate or not. Additionally, their right to attend future sessions of the Youth Adventure Program will not be compromised whether they choose to participate or not. I also understand that I will not be treated any differently by the camp counselors, staff, or director based on the decision they make regarding their participation. I also understand that they have the right to quit the experiment at any time by telling the researcher and will not face any negative consequences as a result of this decision. My child will not have to provide their name for this experiment. They will be given an experimental number and this will be on all of the assessment sheets. I understand that this number will serve as the basis for their assignment to different groups within the study. My child's personal information about their identity will be kept confidential

The information obtained from this study will be used to complete requirements for a dissertation and may be published in journal articles. The results of this research will provide a better understanding for parents, teachers, counselors, and administrators regarding how to best utilize the creative strengths of gifted and talented adolescents.

I have read and understand the project that I will be involved in. I have had all of my questions answered and agree to serve as a participant in this study. I have been given a copy of this form.

Signature of parent/guardian: _____ Date: _____

I agree to conduct this study as it is explicitly described above.

Signature of researcher: _____ Date: _____

This study has been reviewed and approved by the Institutional Review Board-Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' right, the Institutional Review Board may be contacted through Dr. Michael W. Buckley, Director of Support Services, Office of the Vice President for Research and Associate Provost for Graduate Studies at (979) 845-8585.

For information about this study, you may contact Dr. William Nash at (979) 845-1893

APPENDIX B

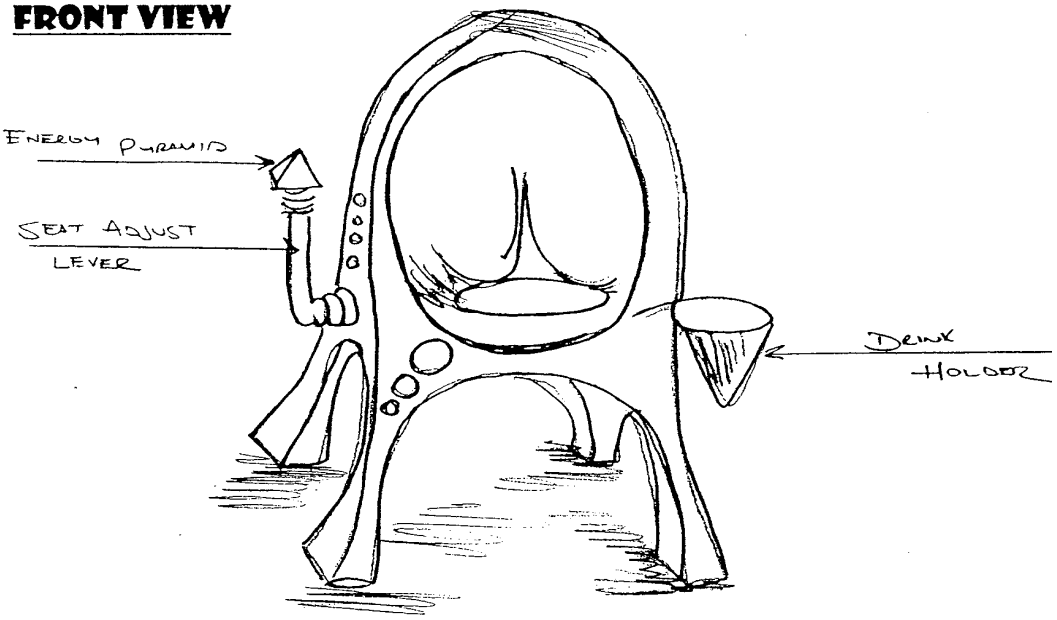
IDEA GENERATION TASK: DESIGNING CHAIRS OF THE FUTURE

EXAMPLE PACKET FOR EXPERIMENTAL GROUP

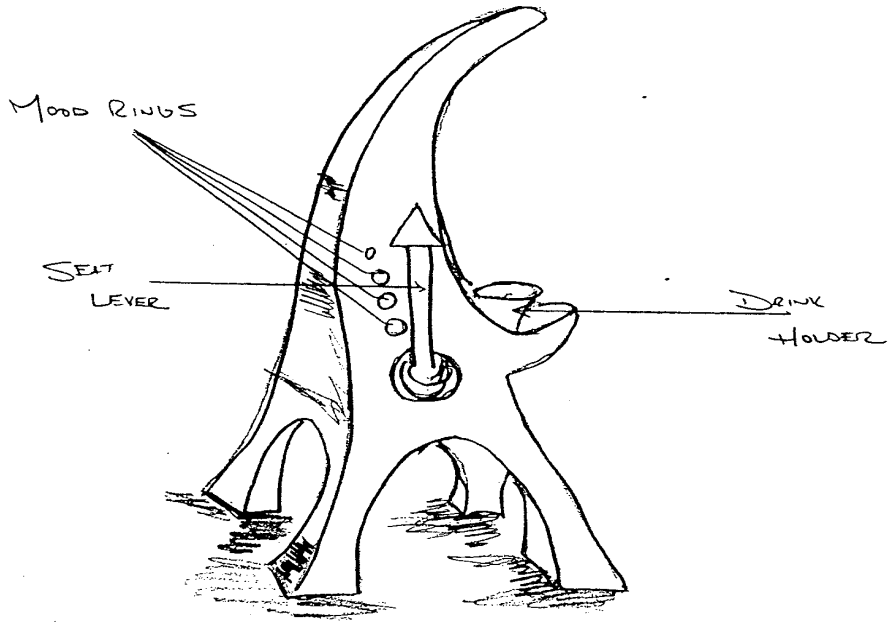
EXAMPLE PACKET

CHAIR OF THE FUTURE DESIGN

FRONT VIEW

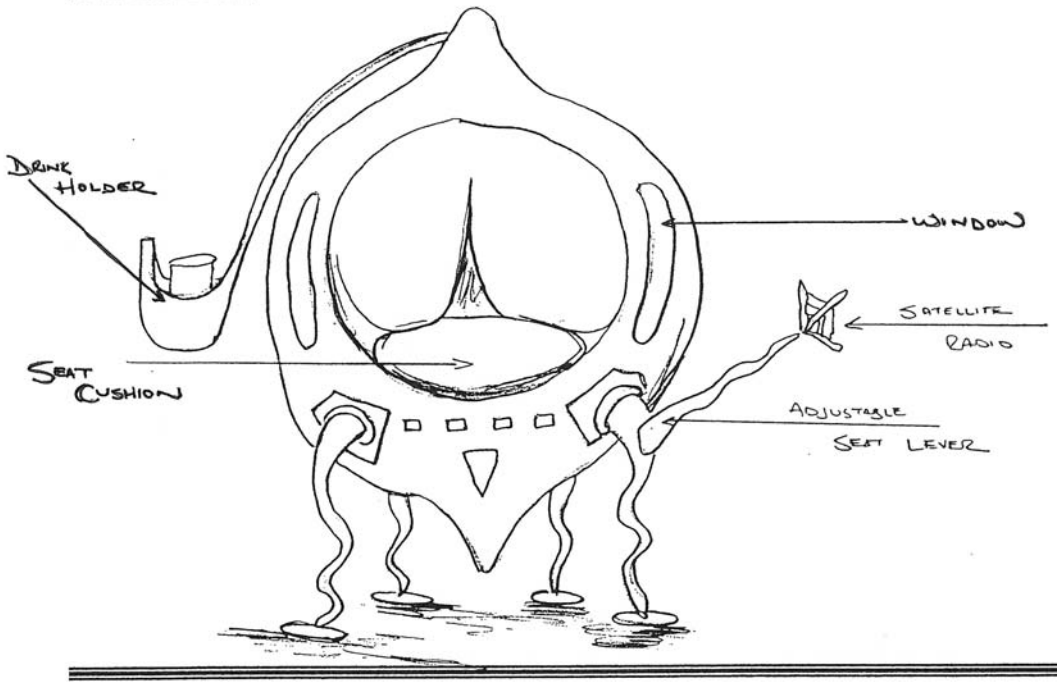


SIDE VIEW

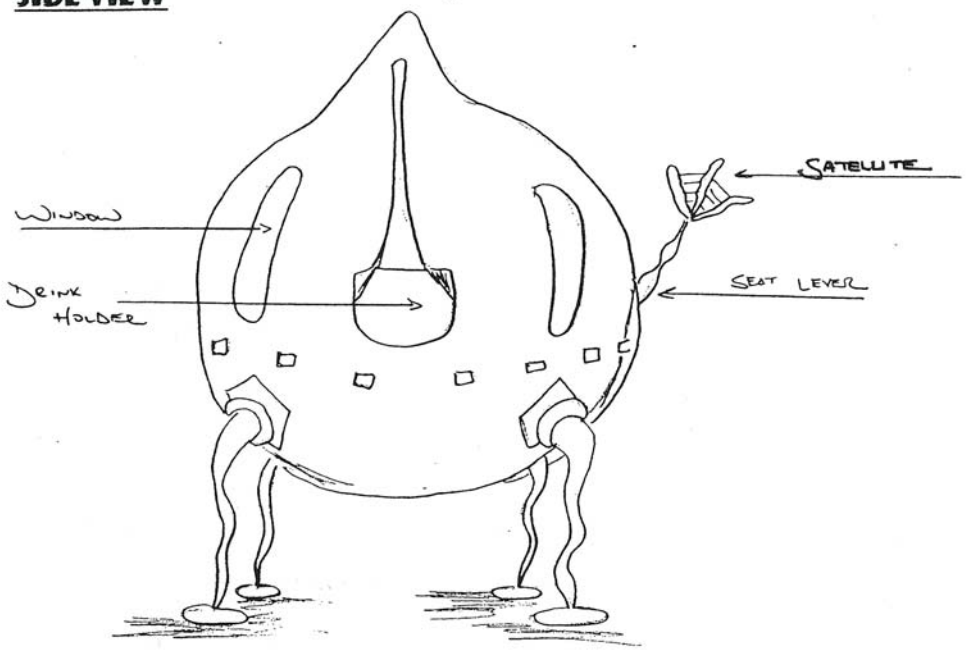


CHAIR OF THE FUTURE DESIGN

FRONT VIEW

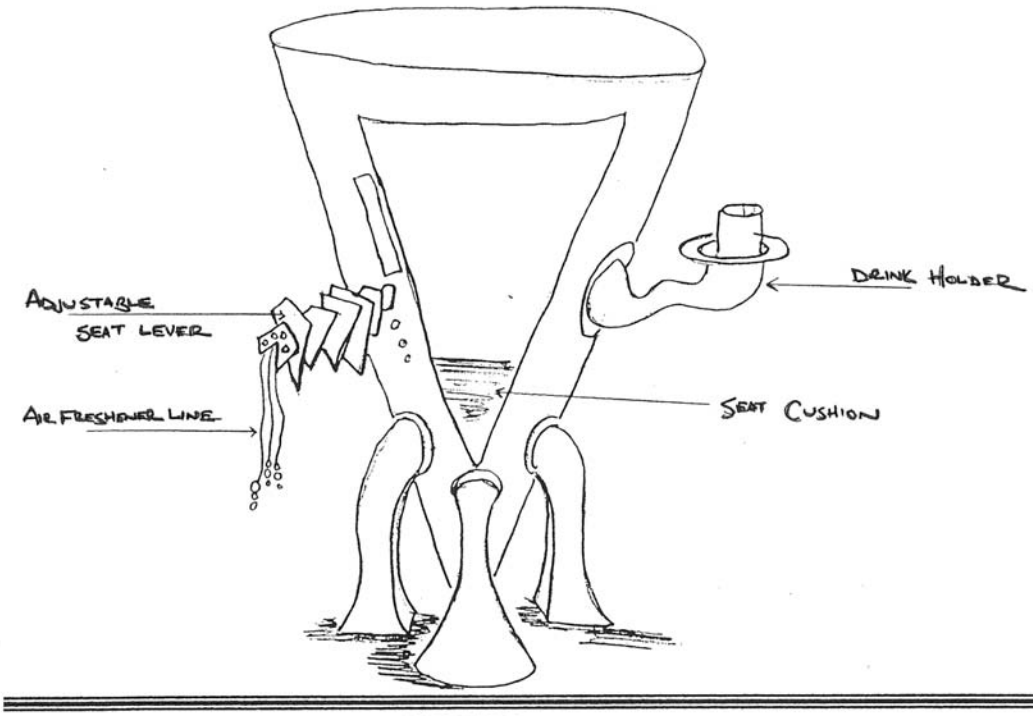


SIDE VIEW

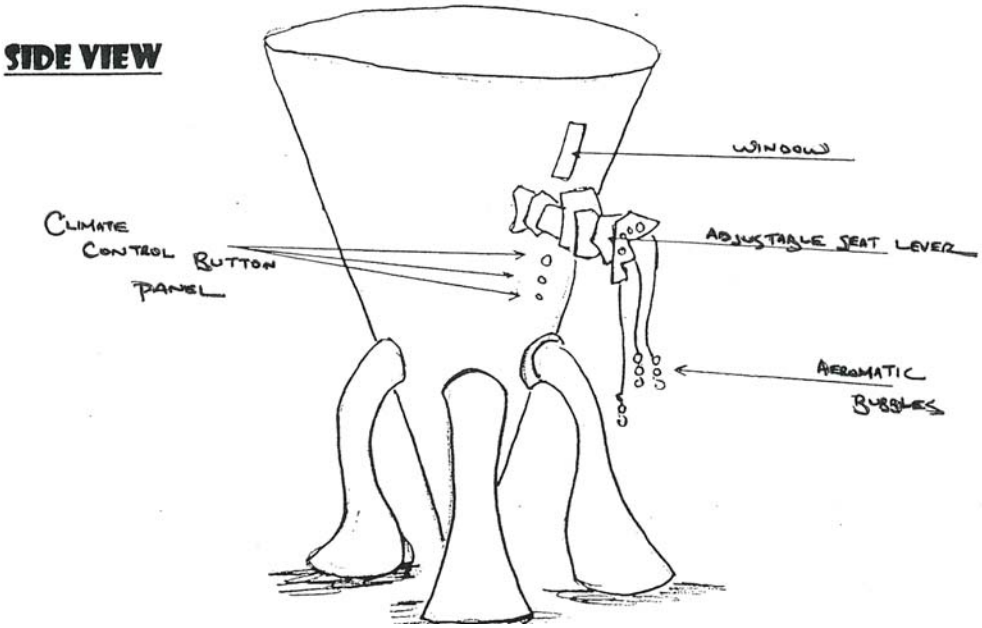


CHAIR OF THE FUTURE DESIGN

FRONT VIEW

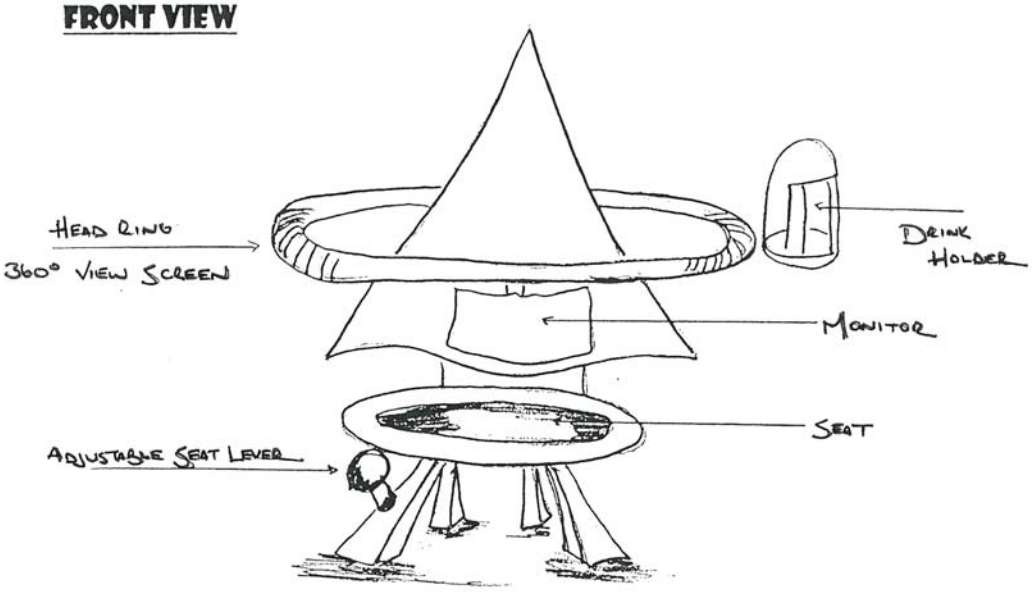


SIDE VIEW

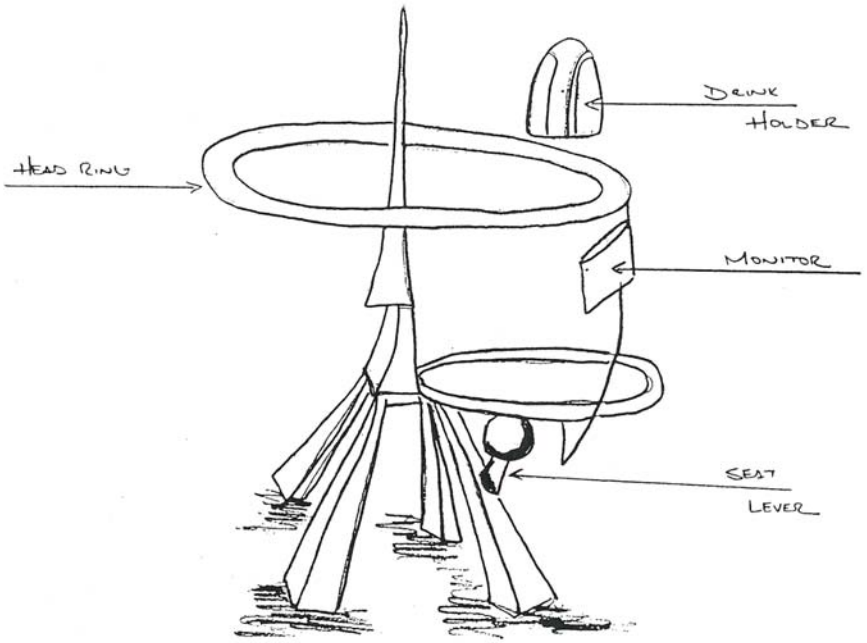


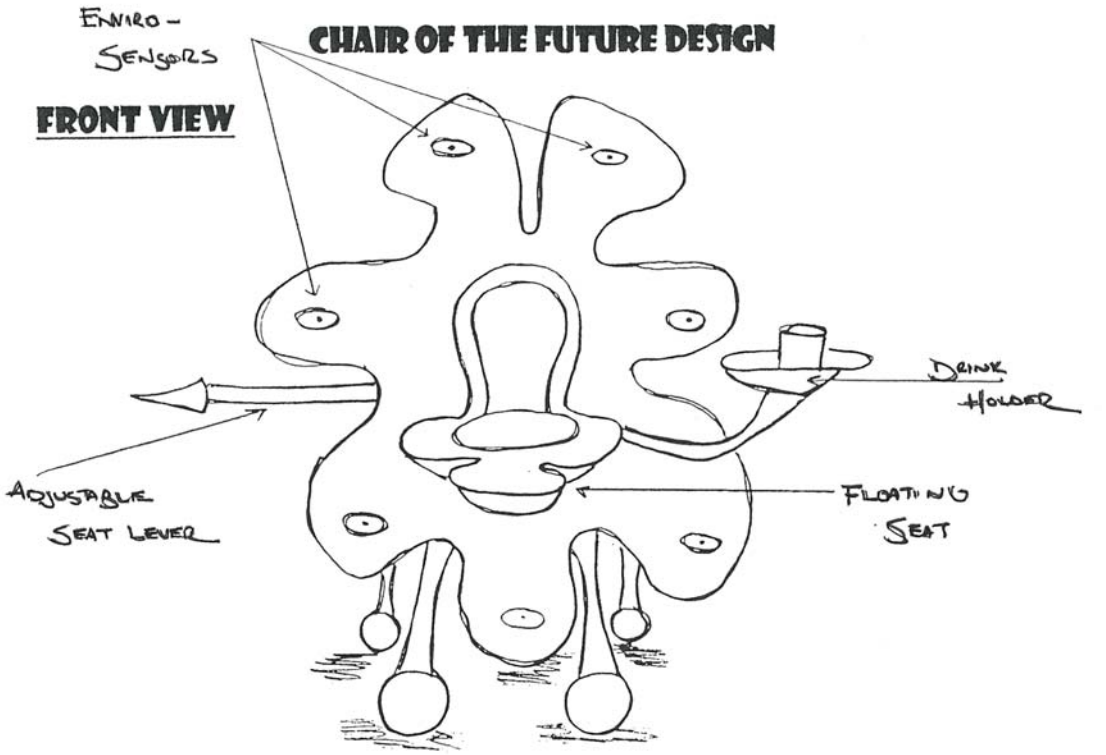
CHAIR OF THE FUTURE DESIGN

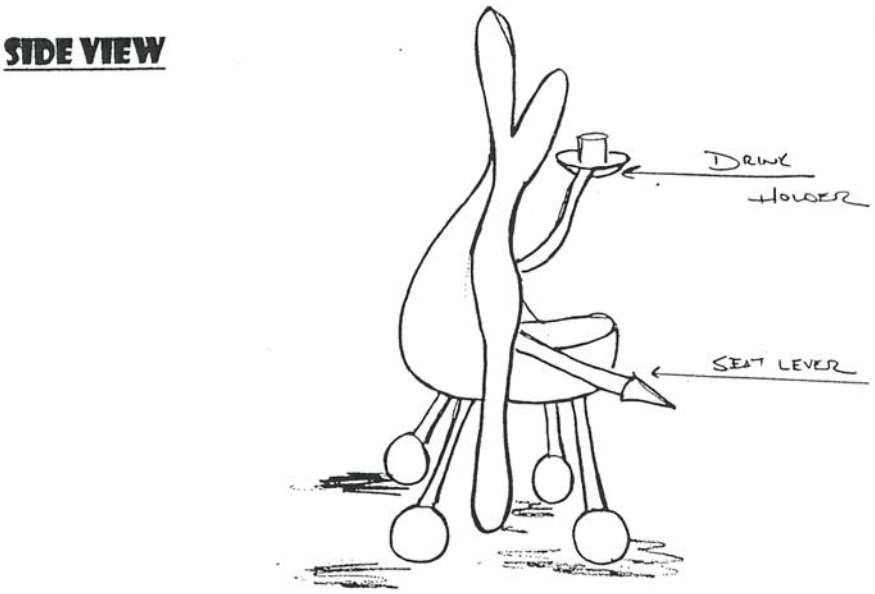
FRONT VIEW



SIDE VIEW




ENVIRO-
SENSORS
CHAIR OF THE FUTURE DESIGN
FRONT VIEW
DRINK
HOLDER
ADJUSTABLE
SEAT LEVER
FLOATING
SEAT


SIDE VIEW
DRINK
HOLDER
SEAT LEVER

APPENDIX C

IDEA GENERATION TASK: DESIGNING CHAIRS OF THE FUTURE

GROUP INSTRUCTIONS

CONTROL GROUP INSTRUCTIONS

For Facilitator:

Pass out design packets. Be sure that each student gets the specific packet that corresponds to his/her experimental number. Read the following instructions:

> "The year is 2015 and a lot about the ways humans live has changed. With this in mind, your task is to envision and draw what you think a chair of the future would look like. We will begin this task in two minutes. Please sit quietly until it is time to start."

Time two minutes.

Read the following instructions:

> "You are now getting a packet to use for this task. You may open it now."
>
> "In the next twenty minutes, I'd like for you to generate and draw as many new and innovative designs for your futuristic chair that you can think of. Be sure and label the parts of your chair as well as drawing the chair from both the front and side view. Include any interesting and unusual details about your chair on the page as well. Be as original as you can and do not incorporate any features of chairs from our time period. Remember, life on earth has changed and the chairs of today will be of little value in the future. You may begin."

Time the students for 20 minutes. If they complete one full drawing from both views with labels, they may continue on and start another drawing.

After the end of 20 minutes, time is up. Collect all design packets.

EXPERIMENTAL GROUP INSTRUCTIONS

For Facilitator:

Pass out design packets. Be sure that each student gets the specific packet that corresponds to his/her experimental number. Read the following instructions:

> "The year is 2015 and a lot about the ways humans live has changed. With this in mind, your task is to envision and draw what you think a chair of the future would look like."

Pass out example packets.

Read the following instructions:

> "You are now getting a packet that contains some of the ideas that other individuals have come up with. They are labeled so that you can see what they were thinking. Take a moment to look at these now."

Time the students for a two minute period and let them look at the examples. Collect the example page after the viewing period is up.

Read the following instructions:

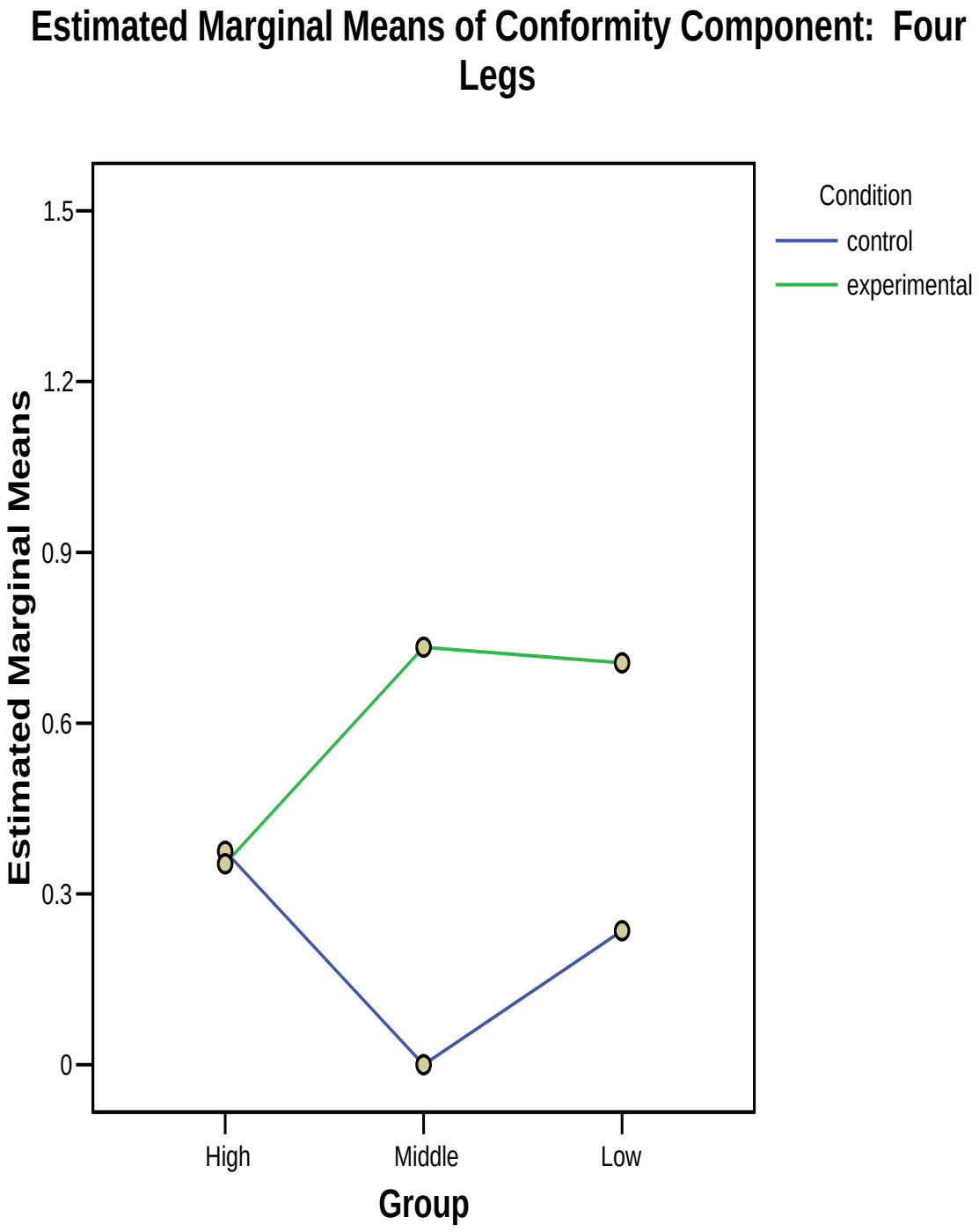
> "You have the same task as they did. In the next twenty minutes, I'd like for you to generate and draw as many new and innovative designs for your futuristic chair that you can think of. Be sure and label the parts of your chair as well as drawing the chair from both the front and side view. Include any interesting and unusual details about your chair on the page as well. Be as original as you can and do not incorporate any features of chairs from our time period. Remember, life on earth has changed and the chairs of today will be of little value in the future. You may begin."

Time the students for 20 minutes. If they complete one full drawing from both views with labels, they may continue on and start another drawing.

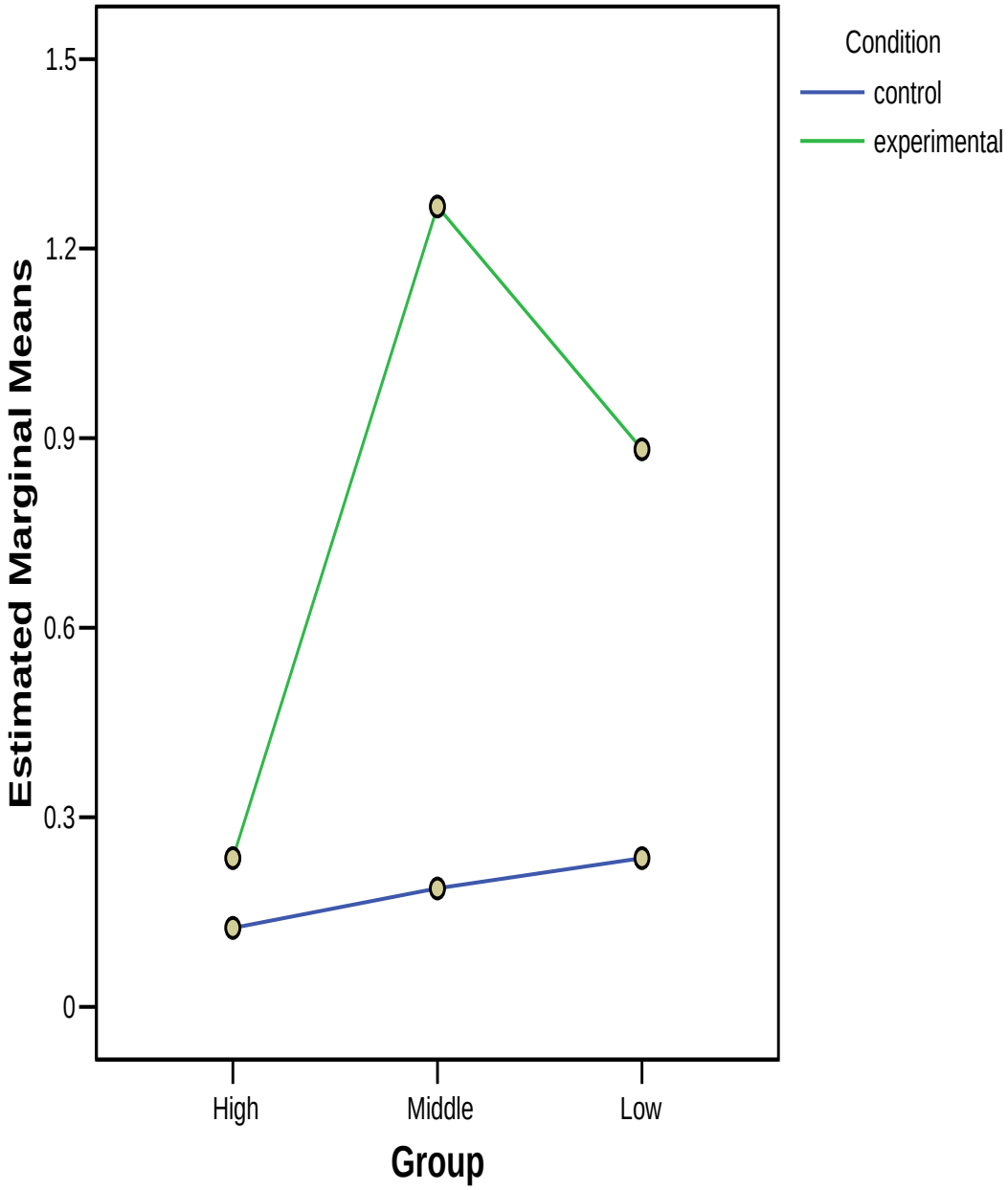
After the end of 20 minutes, time is up. Collect all design packets.

APPENDIX D

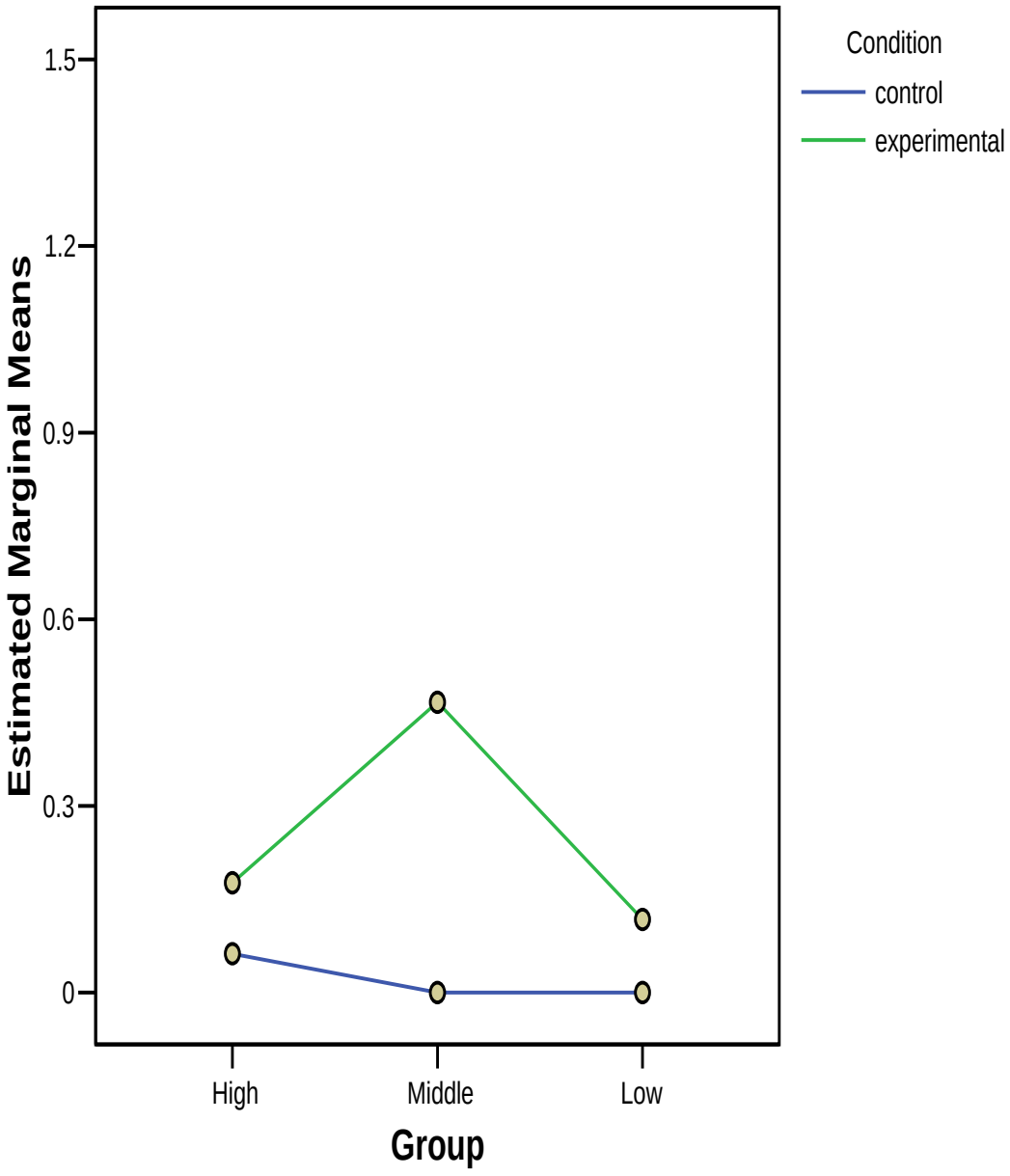
PROFILE PLOTS FOR CONFORMITY FEATURES BY EXPERIMENTAL GROUP AND TREATMENT CONDITION


Estimated Marginal Means of Conformity Component: Four Legs
Condition
control
experimental
Estimated Marginal Means
1.5
1.2
0.9
0.6
0.3
0
High
Middle
Low
Group

Estimated Marginal Means of Conformity Component: Drink Holder



Estimated Marginal Means of Conformity Component: Lever



VITA

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EDUCATION

August, 2004	Ph.D. in Educational Psychology, Texas A&M University, College Station, TX.
August, 1999	M.S. in Educational Psychology, Texas A&M University, College Station, TX.
December, 1997	B.A. in Psychology, Texas A&M University, College Station, TX.

PROFESSIONAL EXPERIENCE

- Presenter, 2002 American Creativity Association Conference, Philadelphia, PA. "Fostering academic and social development in gifted and talented adolescents through a career exploration summer program."
- Presenter, 2002 National Association of Gifted Children Conference, Denver, CO. "Stimulating academic and creative development through summer programs."

WORK HISTORY

Spring, 1997 - 2001	Graduate Assistant. Educational Psychology, Texas A&M University, College Station, TX
Summers, 1997 - 1999	Recreation Director. Youth Adventure Program. Institute for the Gifted and Talented, College Station, TX
Summer, 2000 - 2001	Associate Director. Youth Adventure Program. Institute for the Gifted and Talented, College Station, TX
Summer, 2002 – Present	Director / Program Coordinator. Youth Adventure Program. Institute for the Gifted and Talented, Educational Psychology, Texas A&M University, College Station, TX.