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Stress, Stress Utilization, and Creativity

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THESIS ACCEPTANCE

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Stress, Stress Utilization, and Creativity

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This study investigated the effects of stress on creative problem solving. It was predicted that individuals in a stressful condition would perform worse on creative problem solving tasks than individuals in a relaxed condition and worse than individuals in a stressful condition where they successfully coped with the incident. It was also predicted that when in a stressful experience, individuals who are able to acknowledge and to advantageously use the information obtained from a stressful situation (high stress utilization) would perform better on creative problem solving tasks than individuals who are not able to acknowledge and use this information (low stress utilization). Participants wrote about one of the following personal incidents: (a) a stressful incident with which they did not successfully cope (stress), (b) a stressful incident with which they did successfully cope (cope), or (c) a relaxing incident (relax). The dependent variable, creativity, was measured using three different tasks: (a) divergent thinking, (b) category combination, and (c) creative problem solving. Individuals in the stress condition generated fewer divergent thinking ideas and fewer problem solutions than individuals in both the cope and relax conditions. No differences in solution quality were found between conditions. Also, there were no differences in creative performance between individuals high and low in stress utilization. Although the stress utilization predictions did not materialize, the stress utilization measure displayed adequate internal consistency

and discriminant validity. Implications regarding the influence of stress on idea generation is provided as well as suggestions for additional research on the stress utilization construct.

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Chapter 1

Stress, Stress Utilization, and Creativity

Creativity at Work

It is difficult to speak of performance at work without mentioning creativity. Why has creativity permeated the workplace? Csikszentmihalyi (1996) suggested that creativity makes life more interesting. People spend a good portion of their life at work, often times doing the same things day after day. Creativity breaks this monotony and makes work more enjoyable. Also, managers often expect new and different products or ideas from employees. These novel products and ideas are formed by organizing old ideas or products in different or new ways. According to Mumford and Gustafson (1988), this "re-organization" of past ideas or products is an important part of creativity.

Although creativity may be beneficial in the workplace, Mumford, Whetzel, and Reiter-Palmon (1997) pointed out that there might be specific work situations that are more conducive to creativity than others. They suggested that jobs that involve solving ill-defined problems, jobs in which novel tasks must be completed, and jobs in which the organization has reached a comfortable spot in development all provide advantageous environments for fostering creativity. Greenberg (1992) added that work environments that are more autonomous also facilitate creativity.

This research paper examined everyday creativity as it is found in the work setting. The types of tasks used are ill-defined problems that require novel solutions. These problems approximate those believed to exist in the workplace.

Defining Creativity

What is creativity? Although there is not one universal definition, there is some agreement among the creativity definitions found in the literature. For example, researchers agree on what should be judged as creative. Amabile (1983) suggested that regardless of the aspect on which researchers wish to focus, creativity is ultimately displayed in products or responses. She stated that, although important, it is difficult to measure the traits or the cognitive processes involved in creativity. Because of the difficulty in measuring these other aspects of creativity, researchers measure the product (Barron, 1970; Sternberg, 1988; Sternberg & Lubart, 1991,1995).

A second point of agreement in creativity definitions deals with the criteria used when deciding whether a product is creative. Mumford and Gustafson (1988), Sternberg (1988), and Sternberg and Lubart (1991, 1995) suggested that creativity involves producing work that is both novel and appropriate. Barron (1970) also stated that in order for a product to be creative, it must be both original and adaptive to reality. Amabile (1983) reiterated this point in her conceptual definition of creativity when she claimed that a product or response is judged as creative if it is novel and appropriate or valuable to the task presented.

The third point of agreement found among definitions of creativity deals with the social aspect involved in judging creativity. Whether something is deemed creative is purely a subjective judgment on the part of the rater or judge (Csikszentmihalyi, 1996; Torrance, 1993). In her operational definition of creativity, Amabile (1982) discussed this social aspect, stating that whether a product is creative depends on whether independent

raters, who are familiar with the area being judged, agree that the product is creative. Judges must be aware and take into account the societal norms for the particular domain being judged. Without considering the culture and environment in which we live, it would be impossible to assess creativity. This is an important consideration when defining creativity.

Although creativity is often measured using the product, it can also manifest itself in the person generating the product, or in the process leading up the product (Guilford, 1970; Amabile, 1983).

Creative People

Creativity in a person generally refers to personality traits of individuals that allow them to "be creative", but also may include the cognitive abilities thought to be necessary for creative production. Guilford (1950) first discussed creativity in terms of the person, stating that "creativity refers to the abilities that are most characteristic of creative people" (p.444). Amabile (1983) suggested that the study of the creative person flourished because of Guilford's statement. Guilford's interest in the creative person stemmed from the cognitive abilities thought to be necessary for creativity (Guilford, 1967; Guilford & Hoepfner, 1971). He reported that several factors emerged when factor-analyzing attributes of creative people: fluency of thinking, flexibility of thinking, originality, and elaboration. These four factors are now encompassed by the well-known divergent-production abilities of creativity.

Woodman and Schoenfeldt (1989) suggested that personality differences were the first to be recognized because creativity was originally attributed to individuals who

possessed particular personality traits. Using factor analysis, Guilford (1950, 1967, 1970) revealed base characteristics of those who were considered creative. Barron and Harrington (1981) suggested a list of characteristics that have been used as indicators of creative personalities, such as attraction to complexity, autonomy, ability to resolve or accommodate seemingly opposite or conflicting traits in self-concept, and firm sense of self as creative. Of the many characteristics listed by these authors, two have received particular attention in the literature, tolerance for ambiguity and openness to experience. Tolerance for ambiguity is the acceptance of insufficient, conflicting, or uncertain information (McLain, 1993). Openness to experience refers to the willingness to entertain novel ideas and unconventional values, and actively seeking experiences for their own sake (Costa & Widiger, 1994). Individuals judged as highly tolerant of ambiguities or highly open to experiences tend to be more creative (Barron & Harrington, 1981; McCrae, 1987; Mumford, Costanza, Threlfall, Baughman, & Reiter-Palmon, 1993).

Much of the early research involving creativity of the person characterized creativity as an all or none phenomenon, but Guilford (1967; Guilford & Hoepfner, 1971) believed that there was a continuum of creative ability. He stated that all individuals are able to acquire the abilities necessary for creativity. Similarly, Amabile (1983) suggested that it is theoretically possible that each individual with normal cognitive abilities can be creative to some extent for some tasks. She emphasized an intrinsic motivation component of creativity in which individuals find enjoyment or challenge in the task itself (Amabile, 1990; Ruscio, Whitney, & Amabile, 1998). This motivational component could be acquired; that is, if creativity was not totally dependent on the traits inherent in

an individual, it could be learned. By adding an ability component and a motivational component, Guilford (1967; Guilford & Hoepfner, 1971) and Amabile (1990) made it possible to research creativity in the general population and in solutions to every day tasks, such as those tasks performed every day by employees at the workplace.

Creative Processes

Creativity has been discussed in relation to the outcome produced and the person involved in producing that outcome. Another possible manifestation of creativity may be found in the process leading up to the outcome.

The creative process is an individualistic aspect of creativity that involves the cognitive processes that one uses to reach an idea or product. Guilford and Hoepfner (1971) linked creativity to traditional problem solving, stating that the intellectual abilities and the processing steps are similar for both traditional problem solving and creative problem solving. They suggested that both require a problem to solve or a task to complete and stated that without a problem or task, individuals would not behave creatively.

Mumford, Mobley, Uhlman, Reiter-Palmon, and Doares (1991) agreed that the two are similar but suggested that creative problem solving goes beyond typical problem solving in four ways. First, creativity occurs in ill-defined situations. Ill-defined situations occur when goals, information, or resources needed for the problem are not clearly specified. This is not to say that typical problem solving does not occur in ill-defined situations, but rather, that ill-defined situations are required for creative problem solving.

Second, Mumford et al. (1991) suggested that creative problem solving requires both divergent and convergent thinking, while typical problem solving relies specifically on convergent thinking. When individuals engage in divergent thinking, they use as many pieces of information as possible, even if these pieces of information are conflicting, and attempt to amalgamate all the pieces of information. In convergent thinking, the focus changes to reducing the information, taking each piece of information one at a time, and testing its fit in the schema for that solution. Mumford et al. stated that creative problem solving is dominated by cycles of divergent and convergent thinking whereas traditional problem solving is dominated by convergent thinking.

Third, the ill-defined nature required of creative problem solving allows for the generation and evaluation of more plausible solutions, while on the contrary, traditional problem solving typically does not. It is possible for traditional problem solvers to generate multiple solutions; however, often the goal of traditional problem solving is to find one efficient solution to the problem at hand. Mumford et al. (1991) suggested that the generation of more possible solutions might result in more demands on the individual's attention and more flexible control of the divergent-convergent process.

The fourth way that creative problem solving goes beyond traditional problem solving is the application of existing knowledge (Mumford et al., 1991). Mumford et al. (1991) noted that individuals store information in categorical structures (schemas). Individuals involved in creative problem solving may better classify this information in several different structures. They also use both convergent and divergent strategies for incorporating new information and go through combination and reorganization of

existing categories to come up with novel ideas. Individuals involved in traditional problem solving may call on this existing knowledge to see if it fits the particular problem at hand; however, they may not have as many different categories to search, or, they may not have classified the information into several relevant categories, leading to a decreased chance of using the information.

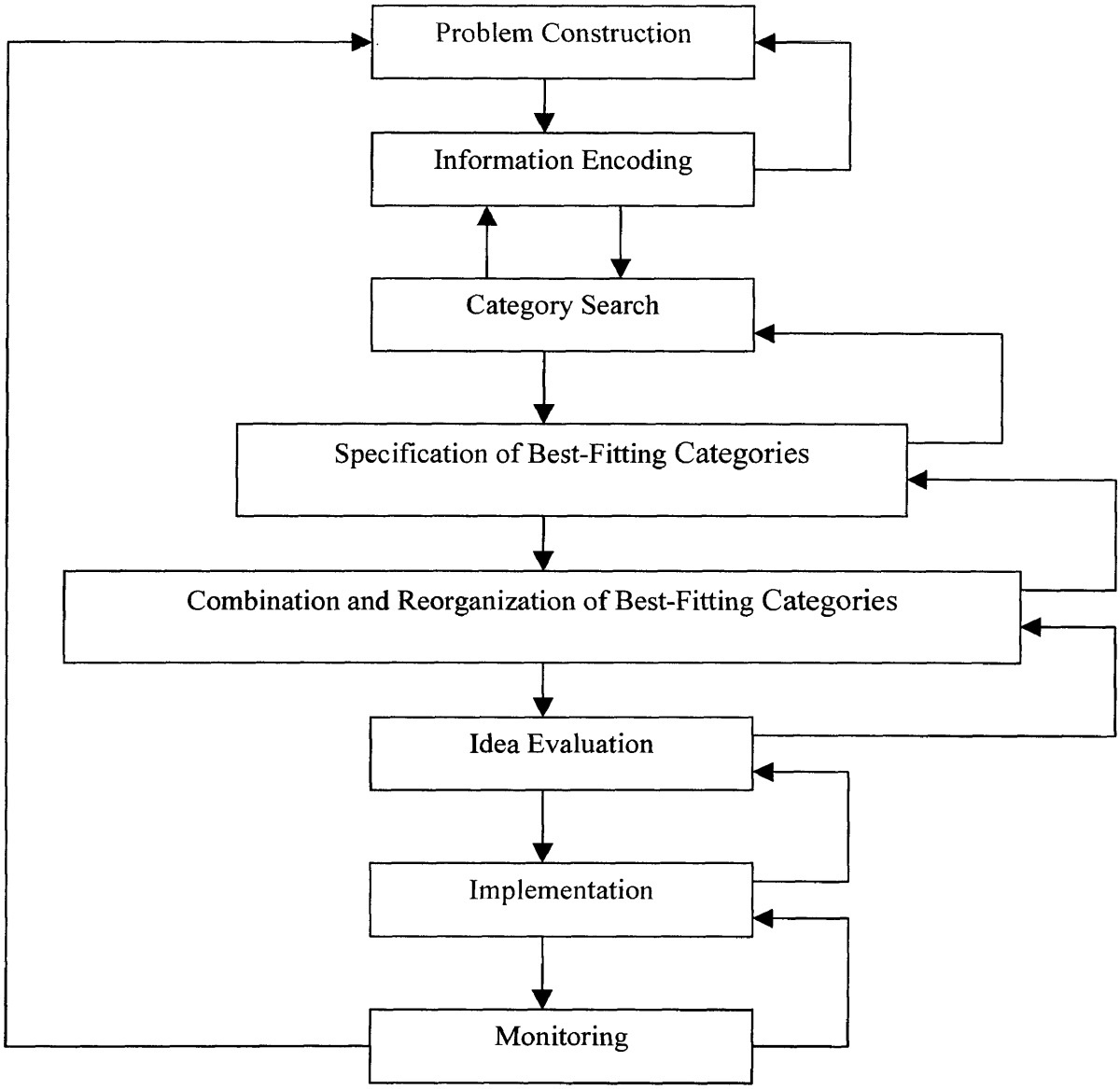
Acknowledging the similarities and the differences between these two types of problem solving enabled Mumford et al. (1991) to generate a model of creative problem solving (Figure 1). These authors suggested several processes an individual may go through when engaging in creative problem solving. The first process in this model is problem construction. Mumford, Reiter-Palmon, and Redmond (1994) defined problem construction as a "plan for process execution serving to structure and direct the problem-solving effort" (p. 6). Individuals who efficiently recognize and represent the problem are better equipped to search for relevant information and problem solving schemas, and therefore, are better equipped to solve the problem (Mumford et al., 1991; Smilansky, 1984).

The second process is information encoding, where information is collected and organized. Individuals locate old and new information and encode that information into categories or schemas. Mumford et al. (1991) stated that this might be where an individual's values, knowledge, skills, and abilities influence what information is collected.

The third process is category search. The categories formed during the previous process are scanned, and individuals determine whether the categories are relevant for

Figure 1.

Hypothesized relationship among core creative processes.



Note. Mumford, M. D., Mobley, M. I., Uhlman, C. E., Reiter-Palmon, R., & Doares, L. M. (1991). Process analytic models of creative capacities. Creativity Research Journal, 4, p. 106.

solving the problem.

The next process is specification of the best fitting categories. During the category search process, it is likely that many categories will be found that are relevant to the problem. If this is the case, it is necessary to determine which categories will be the most suitable for solving the problem. Mumford et al. (1991) suggested that many individual difference variables might influence this process, such as flexibility and openness.

The fifth process is combination and reorganization, where existing categories are combined in different ways. It is this process where generation of the problem solution occurs. Again, Mumford et al. (1991) suggested that variables such as openness and flexibility might influence the outcome of this process by allowing particular individuals to look at information longer and in different ways.

The next process in the model is idea evaluation. The potential solution generated during the previous stage must be evaluated for usefulness and efficiency in solving the problem. The decision maker may decide to keep, alter, or reject the solution. The result of this decision directs the individual to return to an earlier process or to move on to the implementation stage.

The final component of the creativity process is implementation. Mumford et al. (1991) emphasized that in order for a creative idea or product to be considered creative, it must be used, or at least publicized. This points us back to the social evaluation aspect of creativity. In order for a problem solution to be recognized as creative, it must be seen and judged by others.

Interactional Approach to Creativity

Although Mumford et al. (1991) concentrated on the processes involved in creative problem solving, they frequently mentioned personality variables and environmental variables that may influence these processes. Similarly, Mumford and Gustafson (1988) suggested that in order to understand creativity, we must look for a complex interaction of environment and individual.

Along these same lines, Woodman and Schoenfeldt (1989) suggested that there are complex interactions between the social environment and the individual. They suggested looking at antecedent conditions, which may be assessed using background data including past experiences; cognitive conditions, such as divergent thinking; personality conditions, such as tolerance for ambiguity and openness to experience; and contextual issues (physical environment and culture), such as time constraints, rewards, and degree of autonomy.

Csikszentmihalyi (1988) also discussed an interactional approach to creativity that included environmental influences and examined interactions of these influences with the other aspects of creativity. He suggested that there is considerable variance left to be explained once personality is taken into account, and this variance may be found in an interaction of the environment and the individual.

Amabile (1983) discussed the interaction of social/environment, personality characteristics, and cognitive abilities. She argued that the trait approach to creativity is not enough and that creativity is best understood when considering the behavioral result of the above interaction. This behavioral result is shown in the products or responses. She

proposed three sets of skills necessary for creative production. The first set is domain-relevant skills, which are a necessary first step in creative production. These skills include factual knowledge, technical skills, and special talents for a specific domain. The next component is creativity-relevant skills, which include cognitive style, application of heuristics for exploration of new cognitive pathways, and working style. The third component is task motivation which accounts for motivational variables involved in creative production. She stated that these three components may build up slowly and then exist at differing levels of specificity with creativity-relevant skills ranking as least specific, domain-relevant skills ranking as moderately specific, and task motivation ranking as most specific. These components work together in the formation of creative products. Using this framework, Amabile (1983) emphasized the importance of considering the interaction of social/environment, personality characteristics, and cognitive abilities when examining creativity.

Creativity is multifaceted. There appears to be a plethora of evidence pointing toward the importance of acknowledging and studying creativity from an interactional point of view. By examining all aspects of creativity and including interactions with the environment, creativity will be better understood. This research attempted to integrate the person, process, product, and interactions of these with the environment to achieve a more thorough understanding of the phenomena. However, considering all the possible environmental factors that may influence creativity would be a formidable task. It seems necessary to choose a particular environmental factor and attempt to isolate its effects on creativity. The interest taken in this paper is creativity in the work setting. Stress is a

particularly salient environmental/social factor that comes to mind when considering the work setting.

Influence of Stress

Stress is generally considered negative, particularly in the workplace. Individuals who report higher levels of stress are more likely to have health problems (Cooper & Marshall, 1976; Frese, 1985; Schmitt, Collgan, & Fitzgerald, 1980; Spector, Dwyer, & Jex, 1988) and be absent from work (Hendrix, Spencer, & Gibson, 1994). Role overload, often seen as a work stressor, has been found to be related to depression and anxiety (Beehr & Newman, 1978; Edwards, 1992; House, 1974; Katz & Kahn, 1978; Lazarus & Folkman, 1984). The literature is overflowing with examples of the negative influences of stress in the workplace, but these studies seem to focus on the individual's health as noted above or on the negative effects to the organization (e.g., DeFrank & Ivancevich, 1998). Although important, these studies only indirectly assist in the search for the influence of stress on creativity.

The term stress is nebulous and has made the task of defining it difficult. Two definitions that are provided here might best encompass this construct. Selye (1974) defined stress as "the nonspecific response of the body to any demand made upon it" (p. 27), while Coon (1995) suggested that stress "is a condition that occurs when a challenge or a threat forces a person to adjust or adapt to the environment" (p.339). These definitions suggest two important things about the concept of stress. First, there are stressors or external stimuli that produce the stress response in an individual. Second, there are physical and emotional responses to these various stressors. Interestingly,

recognition of stress involves a psychological interpretation of a stressor as stressful. Without this psychological interpretation, a given incident may or may not be seen as stressful and may or may not produce the response of the body that Selye (1974) called stress.

McGrath (1976) discussed the notion of perceived stressfulness. He argued that the feeling of stress is unique to the individual and that the individual assesses the consequences of an event and the chance of successfully coping with it. Because the interpretation of a stressor is psychological in nature, it is also referred to as psychological stress. Psychological stress includes both an individual's cognitive and affective response to the stressor. Research discussing the influence of stress on creativity is lacking. There is, however, some research on the role of stress in problem solving and decision making.

Stress and Problem Solving

Janis and Mann (1977) presented the conflict theory of decision making. They suggested that human decision making involves not only rational choices but also "hot cognitions," or emotional and psychological processing. Because of these subjective and emotional aspects of decision making, individuals are more likely to consider self-esteem issues, social-evaluation issues, and evaluation-of-failure issues when making a decision. Events containing extremely negative stressors increase the likelihood of emotional and psychological evaluations. Janis and Mann (1977) concluded that when these issues are taken into account, individuals tend to make simpler, less-rational decisions.

Janis (1982) stated that individuals experiencing high levels of stress are more likely to end the decision-making process earlier, fail to provide all the alternative solutions, and disregard available information about outcomes. He continued that these high levels of stress reduce individual overall problem-solving capabilities by impairing attention and perception abilities.

Shaham, Singer, and Schaeffer (1992) conducted a study showing support for the ideas put forth in Janis and Mann (1977) and Janis (1982). Shaham et al. (1992) hypothesized that individuals who were exposed to a stressor would be more likely to use decision-making heuristics than would those not exposed to a stressor. Participants experienced loud noises while they completed a questionnaire containing decision-making problems used to assess the representative heuristic and risk taking. Shaham et al. (1992) found that individuals exposed to the stressor used the representative heuristic more often than those individuals not exposed to the stressor.

In another study, Berkun, Bialek, Kern, and Yogi (1962) exposed participants in army basic training to a simulation of a stricken passenger plane. Individuals in the stressful, ditched-grounded group performed worse on an arithmetic test than those in a less-stressful simulation. In a second experiment, Berkun et al. (1962) observed speed and reaction time to different tasks when individuals were exposed to a "lose-life" or "serious-injury" situation. Individuals in the lose-life situation performed worse on all measures; that is, they took more time to complete each of the tasks. Interestingly, individuals who were considered more experienced (had been in the army longer) performed better than those new to the experience.

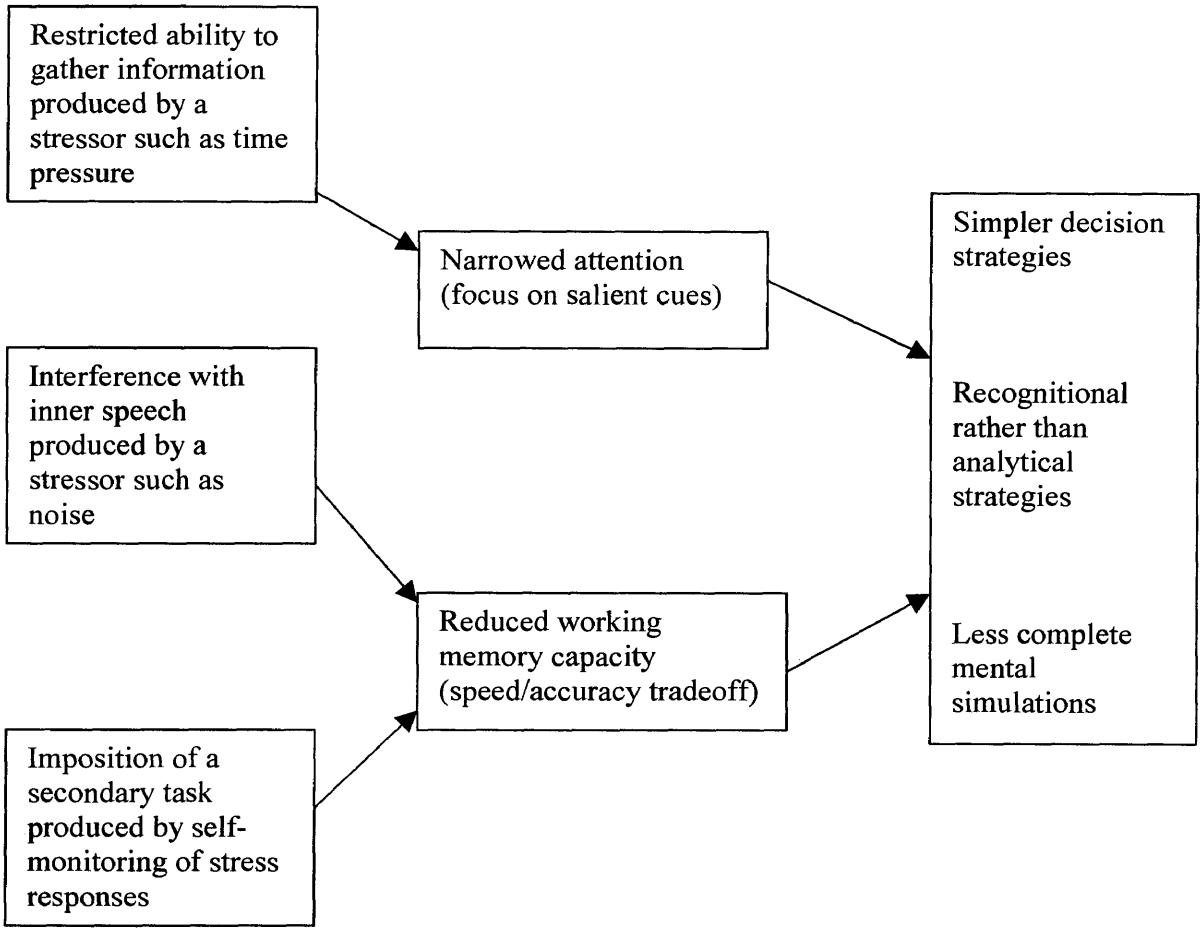
Janis (1982) suggested that stress does not always have detrimental outcomes in decision-making situations. Some aspects of coping may play a role in whether stress negatively affects an individual. In a field study, Janis and Rausch (1970) observed attitude changes of draft dodgers. The decision to resist the draft was a stressor for many men opposing the Vietnam War. Janis and Rausch seized the opportunity to discover how persuasive information, either for or against pledging to resist the draft, affected the men's attitudes about their previous pledge decisions. Resisters who definitely planned to refuse being drafted reported feeling tension and stress regarding the draft situation and were more likely to be interested in and review the counter-argument article.

Klein (1996) stated that stressors may prevent the use of analytic decision making but this type of decision making is not necessarily used in naturalistic settings. He discussed three kinds of stressors: those linked to impending failure at a task, those linked to task overload, and those linked to various types of threats. Each of these types can lead to mediating reactions to stress such as restriction of ability, interference with inner speech ("hearing" oneself thinking), and addition of a secondary task. He also offered cognitive reactions to stress: narrowed attention and reduced working memory capacity. Figure 2 displays these mediating reactions. The cognitive reactions mentioned by Klein (1996) have been empirically examined. Easterbrook (1959) and Wright (1974) both found that the presentation of a stressor, such as time pressure or task overload, led to restriction of perceptive field and restriction of cue utilization.

Klein (1996) stated that although some studies have shown that stressors narrow one's perceptive field and decrease the number of cues that one uses to reach a decision,

Figure 2.

Mediating, cognitive, and decision-making reactions to stress



Note. From Klein (1996). The effect of acute stressors on decision making. In J. E. Driskell & E. Salas (Eds.), "Stress and human performance" (p. 58). Mahwah, NJ: Lawrence Erlbaum Associates.

individual's reactions in naturalistic settings are adaptive rather than dysfunctional. He suggested that individuals use heuristics in which they acknowledge the problem, offer a quick solution, and attempt to move on. Although this may be beneficial for some types of problem solving, it may not be helpful for creative problem solving. In creative problem solving, one must keep all options open and consider and use many different pieces of information at one time. So, using such heuristics may help the decision maker actually solve the problem, but the solution may not be creative.

Classic learning literature has suggested that anxiety makes responses to simple tasks more prevalent whereas it makes responses to unusual (or more difficult) tasks less prevalent (Hull, 1943, 1951, 1952). This means that expected responses or solutions (those of habit) occur more often and responses or solutions that are unexpected (unique) occur less often. Anxiety, a negative drive, tends to inhibit reaction potential for difficult or unusual responses; that is, anxiety prevents the occurrence of unexpected or unique responses for difficult problems (Hull, 1951).

In the past, the concept of stress has been interchanged with the concept of anxiety; however, these two constructs are very different. Anxiety deals with an unfounded fear of something internal. There is no external referent for anxiety. The individual contrives a fear that is unrelated to an external threat (Basowitz, Persky, Korchin, & Grinker, 1955). Stress on the other hand is a response to some external stimulus. Both require psychological evaluation; however, stress occurs in connection to an external stimulus.

Taken as a whole, past research has suggested that stress impedes problem solving. Because there is a link between typical problem solving and creative problem solving (Guilford, 1971; Mumford et al., 1991), it was expected that stress will also impede creative problem solving.

Hypothesis 1: Individuals exposed to a stressful situation will be less creative than individuals exposed to a relaxing situation.

If the studies discussed above are considered together, it seems that stressors may impact decision making, but their effect may depend on the ability of the individual to cope with stressors (individual differences in coping).

Research in coping has suggested that coping may reduce perceived stress. For example, Anshel (1994) found that individuals who engaged in coping reported less negative affect and performed better on motor tasks than those who did not engage in coping.

Similarly, Kardum and Hudek-Knezevic (1996) found that coping, particularly problem-focused coping resulted in more positive affect than "avoidance" coping (avoiding the problem). Because of the reports that coping may itself influence perceived stress, it is possible that coping may also influence the ability to produce creative solutions.

Hypothesis 2: Individuals who successfully coped with the stressful situation will be more creative than individuals who did not successfully cope with the stressful situation.

As mentioned earlier, affect plays a role in the interpretation of a stressor as stressful. In addition, coping with stress often involves an affective component. Because there is an affective component involved in both interpreting stressors and coping with stressors, an examination of the affect literature seems appropriate.

Affective Component of Stress

Stress itself is subjectively determined. Individuals may react differently to the same stressor. Because of this, individuals may associate different affective states to a particular stressful situation. The actual psychological appraisals of stressful situations are affect laden. These affective states in turn influence the cognitive appraisal of the stressor or the stress response. Generally, psychological interpretations of stress lead to negative affect; however, stressors such as planning a wedding may induce both positive affect and negative affect. Because the emphasis of this research is creativity, it would be ideal to discuss studies dealing with affect and creativity. Unfortunately, most affect research using creativity as the dependent variable examines positive affect rather than negative affect. However, there are some studies that include negative affect when examining affect and creativity.

Alice Isen is a prominent force in affect research. She has conducted many research projects dealing with positive affect and on occasion, negative affect as well. One study examined the effects of positive affect on creative problem solving in physicians (Estrada, Isen, & Young, 1994). Participants were randomly assigned to a control group, a positive affect group that was given candy, or a group who read statements related to humanistic practices in medicine, a method derived from the Velton

mood induction technique. Creativity was measured using several items from the Remote Association Test, in which participants were asked to read a series of three words and then fill in another word that relates to each of the first three words. These authors discovered that participants in the positive affect manipulation scored better on the creative problem-solving measures. They concluded that positive affect improves creative problem solving in physicians.

In another study, Isen and Daubman (1984) examined the influence of affect on categorization. They induced positive affect by giving the participants a candy bar (experiments one and two), or by having the participants watch a portion of a comedy film (experiment three). They induced negative affect by having participants watch a portion of a documentary on Nazi concentration camps. They also had a neutral condition in which participants watched a portion of a mathematics film. Participants then performed a categorization task in which they rated items using a 10-point scale to indicate whether they felt each item belonged in the category given. These authors hypothesized that individuals in the positive-affect state would be more likely to rate items not normally considered part of a category as belonging to that category, or, would rate items not normally considered part of a category as more similar to category members. Individuals in the positive-affect condition, regardless of which positive-affect manipulation was used, grouped more stimuli and included lower prototypic exemplars as members of these categories. Interestingly, they also found borderline significance for the negative-affect condition in two of the four experiments they performed; that is, individuals in the negative-affect condition included lower prototypic exemplars as

members of these categories, although not at a statistically significant level. Isen and Daubman suggested that perhaps the individuals in the negative-affect condition are attempting to cope with the negative affect and that this coping improved their mood. This interpretation suggests that negative affect as well as positive affect may influence creativity.

In another study observing the influence of positive affect on creative problem solving, Isen, Daubman, and Norwicki (1987) reasoned that the processes involved in producing positive affect and the processes necessary for creativity are similar because both involve making new associations and combining cognitive elements. Because of this similarity, Isen, Daubman, and Norwicki hypothesized that individuals in a positive-affect state would perform better on creative tasks than those not in a positive-affect state. In the first experiment, they manipulated positive affect by showing a portion of a comedy film. After receiving the manipulation, participants were asked to perform Duncker's candle task. They found that positive affect facilitated creative problem solving. In a second experiment, positive affect was manipulated by either showing participants a portion of a comedy film or by giving participants a small bag of candy. The authors also manipulated negative affect by showing a film about Nazi concentration camps. Isen, Daubman, and Norwicki stated that they did not expect negative affect to improve creative problem solving because it had been associated with constricted thinking and reduced cue utilization in the past. In this experiment, they found that individuals in the positive-film group performed significantly better than the neutral-affect group. Those in the negative-affect group did not differ significantly from the

neutral group. The authors then performed a third and a fourth experiment using a different measure of creativity - Mednick's Remote Associates Test. They also controlled for level of difficulty of items. Results showed that positive affect facilitated performance for moderately difficult items. No additional results were found for negative affect.

In a recent study, Vosburg (1998a) assessed positive and negative mood using an adjective checklist and then asked participants to complete divergent thinking tasks. She found that participants in a positive mood generated more divergent thinking ideas than participants in a negative mood. Vosburg suggested that individuals in positive moods may use satisficing strategies and thus produce more solutions whereas individuals in negative moods may use optimizing strategies and therefore may be more concerned with the quality of their idea rather than the number of ideas they generate.

In another study, Vosburg (1998b) examined whether individuals in a positive mood use satisficing strategies and whether individuals in a negative mood use optimizing strategies. In addition to the adjective checklist and divergent thinking measures she used in the previous study, Vosburg added a problem-solving measure in which participants were asked to read a situation and provide all the solutions they could think of for that situation. She found that positive mood was significantly related to idea production (fluency and flexibility) but not related to idea quality (originality and usefulness). She was unable to examine negative mood because of the severe skewness and kurtosis of the distribution. She stated that her hypothesis, that individuals in positive moods may use satisficing strategies and thus produce more solutions and individuals in negative moods may use optimizing strategies was partially supported. Vosburg (1998b)

concluded that task type and degree of solution constraint should be considered when looking at the relationship between mood and creativity.

Taken as a whole, these results display an inconsistency within the negative affect research. Isen (1984) concluded that negative affect is difficult to understand and explain; sometimes it facilitates, sometimes impairs, and sometimes has no effect on the behavior of interest. She explained the borderline significance of negative affect (Isen & Daubman, 1984) as cognitive repair, where participants attempt to remove the negative affect by improving their affective states. As a participant's affective state progresses from negative to positive, increases in behavior such as creative problem solving can be seen. On the other hand, Vosburg (1998a, 1998b) suggested that negative affect may indeed influence performance and that the findings have been hidden because researchers have not been considering the type of task and the degree of solution constraint of the task's instructions.

Individual Differences in Stress Research

It is possible that instead of cognitive repair, individuals react differently to affect. Kahn and Byosiere (1991) suggested that affective states are more prevalent and accessible to some individuals and thus may cognitively incorporate more information into their decision process. Creativity research has indicated that using numerous novel pieces of information is an important part of creativity (Mumford & Gustafson, 1988; Mumford et al., 1991). Considering this, it seems plausible that individuals who have greater access to affective states, and thus, access to more information may actually increase creative output. Kahn and Byosiere (1991) also suggested that personality

attributes such as type-A behavior pattern, self-esteem, and locus of control may act as mediators between the stressor and the stress response.

Other authors have suggested various individual difference variables that affect stress interpretations and coping. Bolger and Zuckerman (1995) discussed the role of stress exposure - the extent that an individual will experience (encounter) a stressful event, and stress reactivity - the extent that an individual will display reactions (emotional or physical) to a stressful event. These authors hypothesized that stress exposure and stress reactivity differ from person to person, thus influencing differential responses to stressors. In their study, Bolger and Zuckerman (1995) instructed participants to keep a diary, entering any conflicts they experienced, the way they handled or coped with the conflicts, and the affective states associated with the conflicts. A neuroticism measure was completed prior to the diary collection. They found that compared to individuals low in neuroticism, individuals high in neuroticism had greater exposure and reactivity to conflicts and differed in their choice of coping efforts and the effectiveness of those efforts. This study displays that individual differences in encounters of and responses to stressors do exist and are an important area to consider in stress research.

Lazarus and Folkman (1984) discussed individual differences in reactions to stressors, whereby different individuals react differently to the same stimuli. They suggested that individuals evaluate the situation when determining whether or not they will be successful in coping. Individuals must not only consider the stressor and their psychological interpretation of that stressor but also the environmental influences and all the interactions that accompany this additional factor. This adds another dimension to the

psychological aspect of stress and emphasizes the importance of individual differences in stress research.

Some researchers have indicated a need for examining individual differences in reactions to stressors in creativity research. Runco (1995, 1999) referred to a tension that exists from conflicting ideas or information. This idea is based on Piaget's (1976) notion of disequalibrium, a state individuals experience when they do not understand something they confront. Runco added that this conflict may be the initial process of creativity. A personality trait that allows individuals to utilize the information (tension) received from the conflict may enable them to be more creative.

Similarly, John-Steiner (1992) discussed a creative tension that exists between the environment and the individual. Individuals must incorporate their own ideas with those of the society. He suggested that this tension is productive when used and manifests itself as creativity.

Like John-Steiner (1992), Noppe (1996) characterized the creative individual as one who can overcome conflict and channel their energy into the resolution of a problem. Noppe suggested that to overcome this conflict, creative individuals flexibly blend cognitive processes.

Brophy (1998) also discussed the issue of tension. He described creative individuals as those who confront and find ways to live with the tension that results from conflict rather than ignoring the situation. He also suggested that the conflict among cognition, personality, and motivation might be useful when creative individuals synthesize ideas.

Muchinsky (1996) suggested that there might be a personality variable that enables particular individuals to persist despite adversity. He spoke of resiliency, or, moxie, and stated that this concept is under-researched. He proposed that motivation research has turned its focus first from the direction of behavior to the intensity of behavior and now to the persistence of behavior. He advised that it is this persistence of behavior that is important for understanding why particular individuals not only make it through rough times but also often thrive because of it.

Block and Block (1980) discussed ego-control and ego resiliency. Ego-control stems from psychoanalytic theory and focuses on impulse control. These authors theorized that individuals who are able to exert control over their impulses might incorporate more information and hold out for better solutions to stressful events. They provide a continuum of ego-control, with under-control at one end and over-control at the other. According to Block (1971), undercontrollers are spontaneous and make decisions rapidly. They display their emotions without concern and disregard social norms. Overcontrollers are organized and categorical in thinking. These individuals rarely express their emotions and will delay gratification for extended periods of time, even if no long-term negative effects are expected.

An individual's capacity to regulate ego-control is called ego-resiliency. Ego-resiliency allows individuals to incorporate environmental influences and to regulate behavior responses accordingly. The continuum for this variable has resourceful adaptation (ego-resilient) at one end and inflexible adaptation (ego-brittleness) at the other. According to Block and Block (1980), ego-resilient individuals provide integrative

solutions to problems when under stress and better handle competing pieces of information, whereas ego-brittle individuals are disorganized and immobilized by stressful situations.

Another personality concept concerned with handling stress is hardiness. Kobasa (1979) began research on hardiness as a reply to the numerous clinical studies stating that the more stressful events people had in their lives, the more likely they were to be ill. After examining the data, Kobasa (1979) found individuals who had experienced a large number of stressful events during their lives but who were quite healthy. She decided to focus her research on why some individuals who experienced a large number of stressful life events were able to remain healthy whereas most others became ill.

Kobasa (1979) defined a hardy individual using three characteristics: (a) feeling control over life events, (b) feeling committed to life activities, and (c) viewing change as a challenge. She tested each of these characteristics of hardiness and found that each one contributed to whether participants were classified as high- or low-illness individuals. Individuals high in each of the components (more hardy) were less likely to be classified as high-illness individuals and more likely to be classified as low-illness individuals (Kobasa, 1979). This research provides insight into the relationship between personality and the stress response. Hardy individuals who experience stressful life events are able to persist and thrive whereas less hardy individuals tend to be plagued by illness.

Finally, Barron (1953) constructed a measure for the MMPI he called ego-strength. Originally, ego-strength was used to determine whether patients improved their psychological health after psychotherapy treatments. After finding significant

correlations with measures of intelligence as well as measures of ego-resiliency and ego-control, Barron decided that the ego-strength measure could be used in a variety of settings and for normal populations as well as clinical populations (Barron, 1953, 1963). Although a clear definition was never stated, the ego-strength scale of the MMPI is said to estimate adaptability and personal resourcefulness (Barron, 1953, 1963). This description is similar to the combination of Block and Block's (1980) ego-resiliency and ego-control constructs.

Together these individual difference variables suggest that certain individuals are able to utilize the tension and the negative affect involved in the psychological appraisal of stress. In this paper, the term stress utilization will be used to refer to the ability to acknowledge and utilize information from a stressful event. One component of this definition is the acknowledgment of the stressful event as stressful. This is an essential component since the appraisal of stress is subjective. After acknowledging the information provided by the stressful situation, individuals may choose to ignore it, or may choose to use it. Those individuals who acknowledge and advantageously use the information from a stressful event engage in high stress utilization. Individuals who do not advantageously use the information provided by the stressful situation engage in low stress utilization.

Stress utilization has a cognitive focus. It is thought that individuals high in stress utilization are flexible in their decision-making process during stressful events. They are better able to both access and combine information because they have more sophisticated cognitive structuring. This sophisticated cognitive structuring allows them to better

assimilate all different types of new information into their structures. In essence, individuals high in stress utilization are expected to be more cognitively complex than individuals low in stress utilization. Because they are better able to understand and incorporate information, individuals high on stress utilization can respond to the stressful event using the assimilated situational information.

Along with the cognitive aspect of stress utilization, there appears to be many individual difference variables related to stress utilization. Individuals high in stress utilization are open to emotions and tension and are aware of how their emotions affect their cognitive processing. In addition, individuals high on stress utilization are aware of their cognitions and their personal motivations for their thoughts and actions. These individuals do not distance themselves from stressful events or the feelings, cognitions, and motivations they see within a stressful event, but rather, they embrace these pieces of information as an opportunity to grow.

Constructs already exist for many of these related concepts, such as social intelligence, emotional intelligence, academic intelligence, self-awareness, need for cognition, self-esteem, behavioral flexibility, cognitive flexibility, openness to experience, and tolerance for ambiguity. These constructs are all thought to be related to and work together with stress utilization; however, they do not make up stress utilization. The focus of stress utilization is recognizing and being able to use the information present during a stressful event.

Table 1 presents definitions of several of the individual difference variables discussed in this paper. It can be seen that the stress utilization concept is the most specific because it

deals with using information from a stressful situation. Ego-strength and ego-resiliency are the most similar concepts to stress utilization; however, there are differences between the constructs. Ego-strength makes no direct reference to using the information from a situation but rather adapting to situations, and although its has direct relevance to stress, ego-resiliency also includes mastering new circumstances, processing competing stimuli, and resisting sets and illusions, These components are not necessarily a part of stress utilization, but touch on several individual difference variables relating to creativity: flexibility, tolerance, and openness.

The purpose of this study is to examine how individuals handle the tension from a perceived stressful incident and to observe how this affects creativity. The concept of stress utilization best serves this purpose. Creativity involves associating and integrating various types and forms of information. It seems logical that individuals who engage in high stress utilization will be more creative than those engaging in low stress utilization.

Hypothesis 3: When exposed to a stressful situation, individuals who score high in stress utilization will be more creative than individuals who score low in stress utilization.

As mentioned earlier, another way of handling stress that may influence creativity is the saliency of coping behavior. When individuals think about how they successfully handled a stressful situation, positive affect may ensue. That is, if how an individual successfully coped with a particular situation is made salient, that individual will likely feel good about having been able to cope with the situation, and may in turn experience positive affect. The positive affect individuals feel from knowing that they conquered a

Table 1

Individual Difference Variables

Variable Name	Definition
Stress Utilization	Ability to acknowledge and to advantageously use the information obtained from a stressful incident.
Ego Strength (Barron, 1953)	An estimation of adaptability and personal resourcefulness.
Ego-Resiliency (Block & Block, 1980; Gjerde, Block, & Block, 1986)	Ability to adapt behavior to changing environmental demands.
Ego-Control (Block & Block, 1980)	Ability to manage the expression or containment of impulses and feelings.
Moxie/Resiliency (Muchinsky, 1996)	Ability to persist despite adversity.

stressor, or, effectively coped with a stressful situation, may be enough to increase creativity. As was discussed before with the work of Isen, positive affect appears to facilitate creativity. This research study attempted to control for this effect by asking half of the participants in the stressful situation condition to report coping and half not to report coping.

Hypothesis 4: Individuals who wrote about an incident where they coped with a stressful event will be comparable to individuals who wrote about a relaxing situation.

Hypotheses

The four hypotheses are listed below to remind the reader of the predictions made between stress, stress utilization, and creativity.

1. Individuals exposed to a stressful situation will be less creative than individuals exposed to a relaxing situation.
2. Individuals who successfully coped with the stressful situation will be more creative than individuals who did not successfully cope with the stressful situation.
3. When exposed to a stressful situation, individuals who engage in high stress utilization will be more creative than individuals who engage in low stress utilization.
4. Individuals who wrote about an incident where they coped with a stressful event will perform comparably to individuals who wrote about a relaxing situation.

Chapter 2

Method

Participants

One hundred sixty-two participants who were attending a Midwestern university and who were enrolled in introductory psychology courses were used. Individuals were recruited in classes, given a packet of materials to be completed at home, and asked to select a time for an experimental session. They received course credit for participating in the experiment after they completed both the packet and the experimental session.

Design

Participants were randomly assigned to one of three levels of the stress manipulation: (a) a stressful situation where they successfully coped (cope), (b) a stressful situation where they did not cope (stress), or (c) a relaxing situation (relax). Stress utilization was measured and a median split was performed to obtain two levels of the variable. The dependent variable, creativity, was measured using three different tasks: divergent thinking, category combination, and creative problem solving. The effect of stress and stress utilization on creativity were examined separately for each task because it is possible that the stress variable will influence some aspects of creativity and not others.

Independent Variables

Stress manipulation. All participants were asked to generate, in writing, a story about either an extremely stressful incident in which they coped, an extremely stressful incident in which they did not cope, or a relaxing incident. This story-writing method has

been used successfully in the past to induce affect (Larsen, Billings, & Cutler, 1996). In addition, the story-writing method was successful in the pilot study for this study, which will be discussed in a later section. Finally, this manipulation was chosen because of the individual differences in the perception of events as stressful. It would be difficult to find a stressful event that all participants would perceive as stressful. By asking participants to generate their own stressful situation, this individual difference in perceived stress should be minimized. Also, because generation of the stressful event is personally relevant, the manipulation should be stronger.

The stressful incident condition was broken into the coped or the did not cope conditions because all individuals may choose situations in which they coped. When an individual copes with a situation, they may be left with positive affect from handling the incident. Therefore, the manipulation would not produce a stressful state for that participant. Individuals were asked to provide as much detail as possible about the incident and were reminded that their names were not being used on any of the materials. They were also asked to think about how they felt during that time and to imagine feeling that way now. The complete instructions are provided in Appendix A.

Participants in the differing conditions were run separately so that the experimenter could answer specific questions for each condition. The groups were randomly assigned to a condition before the experimental session.

Stress utilization. Positive stress utilization was defined as the ability to acknowledge and to advantageously use the information (i.e. tension, affect, cognitions, and motivations) obtained from a stressful incident. Participants completed the stress-

utilization measure comprised of biodata items specifically designed for this study (Appendix B). The biodata procedure is predicated on the understanding that past behavior in a specific situation predicts future behavior in a similar situation. In this study, biodata allowed an assessment of how individuals managed stress in the past. It was assumed that an individual's behaviors in past stressful situations would indicate their level of stress utilization. The literature in this area has found biodata to be a valid predictor when used to measure a construct (Mumford & Owens, 1987). There were 55 items written to cover the stress-utilization construct. Items with low item-total correlations were dropped, leaving 38 items. The stress-utilization measure had adequate internal consistency in this study (alpha = .83).

Pilot Studies

In the first pilot study, individuals completed the stress manipulation, writing about a stressful situation or writing about a relaxing situation. Using a five-point scale, they rated to what degree they experienced particular feelings and emotions, such as energetic, distressed, tense, and excited. The manipulation check used was a modified version of the Multiple Affect Adjective Checklist (Baker, Zevon, & Rounds, 1994; Zuckerman, Lubin, & Rinck, 1983). Unfortunately, this manipulation check did not indicate whether the stress manipulation had the desired effects. When the participants were verbally asked why they selected a particular adjective, they responded with reasons that did not relate to the study. For example, several participants in the relax condition stated that they were tense because they had an exam after the experiment.

Because the results regarding the manipulation were inconclusive, a second pilot study was conducted. As in the first pilot study, participants were asked to write about a personal incident. Instead of the adjective checklist, participants were given a condensed list of particular feelings and emotions and were asked to circle four that they were experiencing. In addition to choosing four words, they also wrote why they chose those particular feelings or emotions (see Appendix C). The specific feelings and emotions were taken from the Multiple Affect Adjective Checklist (Baker, Zevon, & Rounds, 1994; Zuckerman, Lubin, & Rinck, 1983).

After completing the affective word choice questionnaire, participants were specifically asked to rate to what extent writing the personal story made them feel relaxed or stressed (Appendix C). This task forced the participant to consider the experience they just wrote about and not any other event that may not be related to the story. For example, a participant may choose the word "frustrated" on the affect report method because they were driving around looking for a parking spot for 30 minutes. This event is not related to writing the personal incident and may lead to inaccurately concluding that writing about the relaxing incident did not have the intended effect.

Finally, individuals were asked to rate how easy or difficult it was to think of a personal incident. A participant may feel frustrated because they had a difficult time finding an incident about which to write. This again would not be shown in the affect report method and could lead to a faulty conclusion.

The manipulation brought about the desired outcome of perceived stress as measured by self report. Individuals who wrote about a stressful situation in which they

did not cope rated themselves as experiencing more stress ($t = 8.47$, $p < .05$) and endorsed more negative words ($t = -1.99$, $p < .05$) than individuals who wrote about a relaxing situation. Means and standard deviations are provided in Table 2.

Dependent Variables

As discussed earlier, creativity is multifaceted. Because there are different aspects of creativity, three different measures were collected. These measures are provided in Appendix D.

Divergent thinking. Guilford (1979) suggested that divergent thinking is important for creative production and since that time, divergent thinking tests have been used extensively in creativity research. It should be noted that although divergent thinking is an important component of creativity, it should not be equated with overall creativity (Brophy, 1998). Divergent thinking was assessed using The Consequences Test Form A-1 (Christensen, Merrifield, & Guilford, 1953). This test provides a novel situation and asks participants to list as many consequences as they can for this situation.

There were two different situations and participants were given as much time as they wished to take for answering each situation. The number of ideas the participant generated was summed for each problem. A composite score was computed and used in all analyses.

Creative problem solving. Creative problem solving was measured to assess the global creativity construct. The problem chosen presented a real-life work incident that was ill defined, allowing for multiple possible solutions. Participants were asked to

Table 2

Pilot Means and Standard Deviations

Variables	M	SD
Question Sum		
Stress	8.22	1.56
Relax	3.22	.83
Word Choice		
Stress	3.44	.88
Relax	2.56	1.01

generate as many solutions to the problem that they could. Participants were also asked to choose a "best solution" to the problem.

The problem solutions were rated for both appropriateness and originality. Two trained raters were used for each scale. An initial meeting was held where the raters were given the solutions and the rating scales. The rating scales and sample items were discussed. Raters then completed the ratings individually.

The appropriateness rating scale used to rate the solutions for the problem-solving task is a four-point scale defined by three criteria: a) pragmatic, b) socially responsible, and (c) ethical (Reiter-Palmon, Collins, & Scherer, 1997). Raters assigned a rating to each solution based on these three criteria. A meeting was held where raters discussed disagreements and came to a consensus rating (Hennessey & Amabile, 1988). The interrater reliability for the appropriateness ratings was .93.

The originality rating scale used to rate the solutions for the problem-solving task is a six-point scale. Originality was defined by two main criteria: (a) the degree to which the solution is not structured by the problem presented and goes beyond the problem and (b) the degree of novelty and uniqueness of the solution (Reiter-Palmon et al., 1997). Raters were asked to use only the first criteria to determine whether the solution fell in a 1-3 rating category or a 4-6 rating category. So, if the solution was structured by the problem, it was placed in the 1-3 category. If the solution was not structured by the problem, it was placed in the 4-6 category. A second meeting was held where this categorization was discussed. Raters discussed disagreements and reached a consensus grouping for each solution. The Kappa coefficient of rater agreement was significant,

indicating that the raters agreed significantly more than would be expected to occur by chance ($\underline{K} = .59$, $\underline{z} = 10.26$, $\underline{p} < .01$). Raters then independently assigned ratings within the 1-3 or 4-6 groupings. A third meeting was held to discuss disagreements, and consensus ratings were reached. The interrater reliability for the originality ratings was .96.

Participants generated more than one solution for the problem and therefore received appropriateness and originality ratings for each solution. These ratings were averaged across solutions so that each participant had one appropriateness rating and one originality rating. The average appropriateness and average originality ratings were then converted into z-scores and averaged to obtain one composite creativity score for each participant (Harrington, Block, & Block, 1983). Because participants were asked to generate as many solutions as they could, a count of the number of solutions generated was taken. This count was used as another measure of divergent thinking ability.

In addition to average appropriateness, average originality, and average composite creativity, there are other possible ways to examine the creativity ratings. One way is to look at the participants' choice of best solution. So, instead of averaging across all solutions, one could examine just the solution the participant thought was their best solution. In this study, analyses were also conducted for participants' choice of best solution. Composite creativity and both of the component parts of creativity, best appropriateness and best originality were examined.

Another way to incorporate all of the solutions that the participant generated is to calculate a proportion of scores that are highly creative. To do this, cut-off scores for high

appropriateness and high originality were determined. A tally was taken, counting how many solutions the participant had that met or exceeded the cut-off criteria. This number was then divided by the total number of solutions that the participant generated. This was also done for composite creativity by converting the appropriateness and originality scores to z-scores, summing the two z-scores, tallying the number of solutions that met or exceeded the criteria and dividing this number by the number of solutions generated. The cut-off ratings used were a four on originality and a three on appropriateness. In this study, analyses were conducted on the composite creativity rating as well as both creative components. The composite was called Propor (proportion); the originality variable was called Opropor (originality proportion); and the appropriateness variable was called Apropor (appropriateness proportion).

Finally, it is possible to use just the number of most creative (composite), most appropriate, or most original solutions from the above example. The cut-off criteria was still used, however, the number of solutions generated that met the cut-off criteria was not divided by the total number of solutions generated. Analyses were conducted with the composite creativity ratings as well as the individual components. The composite variable was called z-above; the originality variable was called Oz-above and the appropriateness variable was called Az-above

Category combination. The category combination task attempts to assess one of the core creative processes (Mumford et al., 1991). In this task, participants are given two problems containing several lists of words, to which they must provide a category name

that covers all the words in the lists and then must generate exemplars for that category name (Mobley, Doares, & Mumford, 1992).

Category combination titles were rated using the appropriateness scale found in Appendix E. The interrater reliability was .86 for the first category combination problem and was .87 for the second category combination problem. Originality was obtained by calculating a proportion: how often the title was given divided by the number of total solutions. This number was then converted to a rating ranging from 1-5 based on the distribution of proportions. The two ratings were summed to get a composite creativity score for each category combination problem. The scores for the two problems were then summed to get a composite category combination creativity score. As with the divergent thinking measure, category combination is one component of creativity and should not be equated with overall creativity.

Additional Measures

Along with the measures mentioned above, several individual difference variables were assessed because of their effects on the dependent variables and possible relationship with stress utilization: tolerance for ambiguity, openness to experience, flexibility, need for cognition, and ego-strength.

Tolerance for ambiguity is the acceptance of insufficient, conflicting, or uncertain information (McLain, 1993). Individuals who are highly tolerant of ambiguity are thought to be more creative (Barron & Harrington, 1981; Mumford et al., 1993). Literature on ego-resiliency suggested that individuals who are tolerant of ambiguity may be more ego-resilient (Block, & Block, 1980). Because ego-resiliency is similar to stress

utilization, the relationship between tolerance for ambiguity and stress utilization may be similar. In this study, tolerance for ambiguity was measured using the Tolerance scale from the California Psychological Inventory (CPI). Gough (1987) reports an internal consistency of .68 for the tolerance scale.

Openness to experience refers to the willingness to entertain novel ideas and unconventional values and actively seek experiences for their own sake (Costa & Widiger, 1994). Individuals who are more open to experiences tend to be more creative (Barron & Harrington, 1987; McCrae, 1987). Openness to experience was measured using 23 biodata items constructed for this study (Appendix F). Four items were deleted because of low item-total correlations. The openness to experience measure had adequate internal consistency in this study (alpha = .74).

Flexibility is one of the individual difference characteristics identified by Guilford (1967) as important to creativity. Also, this variable as measured by the flexibility scale of the CPI loads highly on ego strength (Gough, 1967). Because of its relationship with both creativity and ego-strength, flexibility was measured using the CPI. Gough (1987) reported an alpha coefficient of. 70 for the flexibility scale.

Need for cognition involves an individual's enjoyment in performing effortful cognitive tasks (Cacioppo & Petty, 1982). Individuals high on need for cognition tend to perform better on idea generation (Scudder, Herschel, & Crossland, 1994). Because idea generation is an aspect of creative problem solving, it is speculated that individuals high on need for cognition may perform better on creative problem solving tasks than individuals low on need for cognition. The need for cognition scale constructed by

Cacioppo and Petty (1982) was used in this study (Appendix F). These authors report split-half reliability of .87.

Ego-Strength involves the ability to handle the conflict between one's ego and the external environment. Although no clear definition was given, Barron (1953,1963) stated that the Ego-Strength measure of the MMPI estimates adaptability and personal resourcefulness. This measure has an odd-even reliability of .76 and a test-retest reliability of .72 (Barron, 1953). Since the ego-strength concept is similar to stress utilization, the Ego-Strength measure from the MMPI was compared to the stress utilization measure to check for discriminant validity. Although both concepts are individual difference variables in handling stress, they differ in their specificity. A positive correlation between these variables would suggest discriminant validity. Stress utilization was significantly correlated with ego-strength ($r = .50$, $p < .05$), providing evidence for the validity of the stress utilization measure.

Procedure

Students were recruited from introductory psychology classes. The researcher explained that the experiment would be conducted in two parts. The first part consisted of a packet of questionnaires that the participants took home with them. The packet contained the informed consent sheet (Appendix G), the biodata items assessing stress utilization, and the individual difference measures (tolerance for ambiguity, openness to experience, flexibility, need for cognition, and ego-strength). The second part required that participants attend an experimental session on campus. Individuals agreed on a time for the on-campus session and were asked to bring the completed packet with them.

Participants were assigned to a classroom in the Arts and Sciences building and were run in groups. Individuals sat at separate desks and completed the materials independently.

After all participants arrived, the participant number that was on the completed questionnaire was written on the experimental packet. The completed questionnaire was collected and the experimenter checked whether the informed consent had been signed. Standardized instructions were given to participants, asking them to complete each task in turn (Appendix H). Individuals were asked to describe one of three incidents: (a) an extremely stressful incident in which they coped, (b) an extremely stressful incident in which they did not cope, or (c) a relaxing incident. Participants then completed each of the dependent measures: The Consequences Test Form A-1, creative problem solving, and category combination. The order of the first two dependent measures was alternated because it was unclear how long the effects of the manipulation would last. The last dependent measure, category combination, appeared to be the dependent measure that was the least supported by research so was always placed third. If that variable had been alternated also, the number of participants receiving any one of the dependent measures first would be dramatically decreased.

Participants were asked not to go back to previous pages. They were instructed to take their time, carefully read all instructions, and completely answer all questions. They also completed an affective word-choice task at the beginning of the packet and at the end of the packet. This allowed the researcher to assess the mood of the participant before beginning the study and at the end of the study. Individuals in the stressful situation condition (where they did not cope well) were asked to write about a relaxing incident at

the end of the session to negate any lingering effects of the stress manipulation. When completed with the entire packet, individuals handed in all materials, were asked if they had any questions or comments about the study, and were given their credit.

Analyses

SPSS/X was used to run all analyses. Means, correlations among dependent measures, and correlations between dependent measure and stress utilization were run. In addition, correlations between the individual difference variables and stress utilization were examined to provide discriminant validity for the stress utilization construct.

It is not known whether one aspect of creativity would be affected by stress and not another; therefore, each dependent measure was examined separately. Because the different measures of creativity are theoretically tapping different parts of overall creativity, multivariate analysis is not appropriate.

To test hypotheses one, two, and four, a one-way analysis of variance was conducted. These three hypotheses stated that there would be differences in creative performance between individuals in the stress and relax conditions (hypothesis 1) and between the stress and cope conditions (hypothesis 2) and no differences between the relax and cope conditions (hypothesis 4). Homogeneity of variance was analyzed. Because a priori predictions were made, contrasts were performed to further test hypotheses one, two, and four.

To test hypothesis three, a t-test was performed. Hypothesis three stated that when in a stressful situation, individuals high in stress utilization would be more creative than individuals low in stress utilization.

Chapter 3

Results

Means and Correlations

Means and standard deviations are provided in Table 3. On average, participants provided about 17 ideas to the divergent thinking tasks with a standard deviation of 9 ideas. For the ill-defined problem, the average appropriateness rating was about 3 and the average originality rating was about 2. Participants provided about 4 solutions to the problem with a standard deviation of 2 solutions. The average creativity rating for the composite category combination titles was about 6.

Correlations between pairs of creativity measures as well as between creativity measures and the stress utilization measure are provided in Table 4. Divergent thinking was positively correlated with zscore ($r = .22$, $p < .01$). Category combination was marginally correlated to average composite problem creativity ($r = .13$, $p = .056$). Among other correlations, average problem originality was positively correlated with average composite creativity ($r = .72$, $p < .01$), best solution originality ($r = .52$, $p < .01$), and best solution creativity ($r = .41$, $p < .01$). Similarly, average problem appropriateness was positively correlated with average composite creativity ($r = .62$, $p < .01$) and best solution creativity ($r = .30$, $p < .01$) but not with best solution appropriateness ($r = .01$, ns). Average problem appropriateness and average problem originality were not correlated ($r = .07$, ns). This supports the notion that creativity is composed of two separate components, originality and appropriateness. Stress utilization was negatively correlated with proportion of highly appropriate solutions ($r = -.17$, $p < .05$). This suggests that

Table 3

Means and Standard Deviations

Variables	M	SD	Possible Range
Divergent Thinking	17.20	9.24	0-
Average Problem Appropriateness	3.15	.49	1-4
Average Problem Originality	2.21	.88	1-6
Number of Problem Solutions	4.44	1.97	0-
Category Combination Rating	6.30	1.10	2-10
Stress Utilization Score	110.23	14.39	38-190
Flexibility	14.72	3.96	0-28
Tolerance	18.63	3.68	0-32
Openness	62.88	8.21	19-95
Ego Strength Score	32.65	3.68	0-52

Table 4

Correlations - Creativity Measures and Stress Utilization

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 D.T.	1.0	.03	.04	.04	.04	.00	.11†	.10	.22*	.02	.56**	.24**	.41**	.00	-.04	.11†
2 Category Comb.		1.0	.06	-.11	-.13††	.05	-.04	.00	-.08	-.07	.02	-.08	-.04	-.09	-.03	.12†
3 Average Orig.			1.0	.07	.72**	.52**	.03	.41**	.75**	.82**	.07	.76**	.23**	.79**	14*	.08
4 Average Approp.				1.0	.62**	.08	.01	.30**	.22*	.32**	-.14*	.05	.30**	.15*	.21**	.09
5 Composite Creativity					1.0	.45**	.03	.52**	.60**	.75**	-.07	.52**	.29**	.64**	.23**	.01
6 Best Solution Originality						1.0	.23*	.67**	.47**	.56**	.07	.39**	.12†	.38**	-.05	.12†
7 Best Solution Appropriateness							1.0	.47**	.08	.04	.12	.11	.14*	.09	.05	-.01
8 Best Solution Creativity								1.0	.42**	.51**	.08	.31**	.23**	.32**	.01	.04
9 Z-Above									1.0	.86**	.33**	.87**	.57**	.67**	.08	.09
10 Proportion										1.0	.03	.67**	.31**	.73**	.16*	.07
11 Number of Solutions											1.0	.41**	.71**	.06	-.06	.09
12 Oz-above												1.0	.58**	.76**	.18*	.07
13 Az-above													1.0	.34**	.20**	.04
14 O-Propor														1.0	.63**	-.04

Table 4 continued

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
15 A-Propor															1.0	-.17*
16 Utilization																1.0

Note. Z-Above = number of solutions equal to or above a rating of 4 on originality and 3 on appropriateness. Proportion = proportion of solutions equal to or above a rating of 4 on originality and 3 on appropriateness. Utilization = stress utilization measure. $^{t}p \leq .09$, $^{tt}p = .056$. $^{*}p < .05$. $^{**}p < .01$.

individuals who scored high on stress utilization generated proportionally more inappropriate solutions than individuals scoring low on stress utilization.

Stress utilization was marginally correlated with category combination ($r = .12$, $p = .06$) and divergent thinking ($r = .11$, $p = .09$). This suggests that individuals who acknowledge and who advantageously use the information from a stressful event receive higher ratings on category combination title generation and produce more divergent thinking ideas.

Table 5 displays correlations between the stress utilization measure and the other personality measures. Stress utilization was positively correlated with the two measures from the California Psychological Inventory (CPI): flexibility ($r = .21$, $p < .05$) and tolerance ($r = .23$ $p < .05$). Stress utilization was also positively correlated with the need for cognition measure ($r = .45$, $p < .05$), the openness measure ($r = .23$, $p < .05$) and the ego strength measure ($r = .50$, $p < .05$). These correlations suggest discriminant validity for the stress utilization measure.

Average Composite Problem Creativity

A one-way analysis of variance was used to test hypotheses one, two, and four. These hypotheses predicted main effect differences in creative performance between the stress and the relax conditions (hypothesis 1) and between the stress and the cope conditions (hypothesis 2). No difference was expected between the cope and relax conditions (hypothesis 4). The one-way analysis of variance for average composite problem creativity was not significant (F (2, 159) = .05, ns). Because the specific

Table 5

Correlations with Stress Utilization Measure

Variable	1	2	3	4	5	6
1 Utilization	1.00	.45**	.21**	.23**	.23**	.50**
2 Need for Cognition		1.00	.18*	.30**	.50**	.30**
3 Flexibility			1.00	.22*	.07	.15*
4 Tolerance				1.00	-.01	.20*
5 Openness					1.00	.05
6 Ego Strength						1.00

Note. Utilization = stress utilization measure. *$p < .05$. **$p < .01$.

relationships were predicted a priori, contrasts were performed to examine the hypotheses further. The contrasts were not significant. Table 6 shows the means for these cells.

A t-test was conducted to test hypothesis three, which stated that when in a stressful situation, individuals who scored high in stress utilization would be more creative than individuals who scored low in stress utilization. In order to test this, it was necessary to divide participants' stress utilization score into high or low positive stress utilization using a median split. Table 7 displays the means in creative problem solving for both individuals high in stress utilization and individuals low in stress utilization. For individuals in a stressful situation, there was no difference in creative performance between high and low stress utilization (t (52) = .23, ns).

In addition to the average, composite creativity ratings, analyses were conducted for each of the two components of this composite creativity rating, average problem originality and average problem appropriateness.

Average Problem Originality

The one-way analysis of variance for average problem originality was not significant (F (2, 159) = .26, ns). The contrasts testing hypotheses one, two, and four were also not significant. Table 8 shows the group means.

A t-test was run on average problem originality. The difference in average originality scores for individuals in a stressful situation was not significant (t (52) = 1.19, ns). Table 9 shows the cell means.

Average Problem Appropriateness

The one-way analysis of variance was not significant for average problem

Table 6

Group Means for Average Composite Problem Creativity

Condition	M	SD
Stress	.0094	.4246
Cope	.0022	.3468
Relax	-.0122	.3618

Table 7

T-Test for Individuals in Stressful Situation - Average Composite Problem Creativity

Condition	M	SD
High Stress Utilization	-.00	.35
Low Stress Utilization	.02	.50

Table 8

Group Means for Average Problem Originality

Condition	M	SD
Stress	2.27	.77
Cope	2.21	.88
Relax	2.15	.98

Table 9

T-Test for Individuals in Stressful Situation - Average Problem Originality

Condition	M	SD
High Stress Utilization	2.15	.66
Low Stress Utilization	2.40	.87

appropriateness (F (2, 159) = .61, ns). Contrasts revealed no significant differences between conditions. Group means are shown in Table 10.

The t-test revealed that no differences existed in average appropriateness scores between individuals who scored high on stress utilization and individuals who scored low on stress utilization in the stress situation (t(52) = .08, ns) Table 11 shows the means for both cells.

Best Solution Composite Creativity

The one-way analysis of variance was not significant for best solution composite creativity (F(2, 159) = 1.05, ns). Contrasts revealed no differences between conditions. Table 12 displays the group means.

The t-test revealed no mean difference for individuals in a stress situation (t(52) = .61, ns). Table 13 displays the means.

Best Solution Originality

The one-way analysis of variance was not significant for best solution originality (F(2, 159) = 1.02, ns). Contrasts revealed no differences between conditions. Table 14 displays group means for best solution originality.

The t-test found no mean differences between individuals who were high in stress utilization and individuals who were low in stress utilization when individuals were in the stressful situation (t(52) = .26, ns). Cell means are provided in Table 15.

Best Solution Appropriateness

The one-way analysis of variance was not significant for best solution appropriateness (F(2, 159) = 1.57, ns). Homogeneity of variance was violated for best

Table 10

Group Means for Average Problem Appropriateness

Condition	M	SD
Stress	3.09	.53
Cope	3.19	.47
Relax	3.17	.46

Table 11

T-Test for Individuals in Stressful Situation - Average Problem Appropriateness

Condition	M	SD
High Stress Utilization	3.10	.53
Low Stress Utilization	3.08	.55

Table 12

Group Means for Best Solution Composite Creativity

Condition	M	SD
Stress	.11	.69
Cope	-.02	.72
Relax	-.08	.65

Table 13

T-Test for Individuals in Stressful Situation - Best Solution Composite Problem Creativity

Condition	M	SD
High Stress Utilization	.05	.64
Low Stress Utilization	.16	.74

Table 14

Group Means for Best Solution Originality

Condition	M	SD
Stress	2.35	1.58
Cope	2.21	1.51
Relax	1.93	1.63

Table 15

T-Test for Individuals in Stressful Situation - Best Solution Originality

Condition	M	SD
High Stress Utilization	2.30	1.38
Low Stress Utilization	2.41	1.78

solution appropriateness (Cochran's C = .47, p = .02). Separate variance estimates were used to test hypotheses one, two, and four. No differences were found. Group means are shown in Table 16.

The t-test revealed no significant difference in best solution appropriateness for individuals in the stressful situation (t(52) = .44, ns). Table 17 displays means.

Number of Problem Solutions

A one-way analysis of variance was run for the number of problem solutions generated. There were no differences between groups (F(2, 159) = 1.73, ns). Group means are provided in Table 18. Homogeneity of variance was violated so separate variance estimates were used in the analyses. Contrasts revealed mean differences between conditions. Individuals in the stress condition produced significantly fewer solutions than those in the cope condition (t(78) = -1.67, p < .05). Marginal differences were found between the stress and relax conditions (t(106) = -1.48, p = .071). Individuals in the stress condition produced fewer problem solutions than individuals in the relax condition. These findings support hypotheses one and two. No difference was found between the cope and relax conditions, lending support to hypothesis four (t(81) = .66, ns). Because the number of problem solutions is just one component of creativity, these results provide only partial support for these hypotheses.

A t-test was performed to examine hypothesis three. There was no difference between individuals who scored high on stress utilization and individuals who score low on stress utilization when in a stressful situation (t(52) = .77, ns). The cell means are provided in Table 19.

Table 16

Group Means for Best Solution Appropriateness

Condition	M	SD
Stress	3.50	.93
Cope	3.47	.91
Relax	3.18	1.23

Table 17

T-Test for Individuals in Stressful Situation - Best Solution Appropriateness

Condition	M	SD
High Stress Utilization	3.44	.93
Low Stress Utilization	3.56	.93

Table 18

Group Means for Number of Problem Solutions

Condition	M	SD
Stress	4.07	1.41
Cope	4.77	2.70
Relax	4.49	1.53

Table 19

T-Test for Individuals in Stressful Situation - Number of Problem Solutions

Condition	M	SD
High Stress Utilization	3.93	1.49
Low Stress Utilization	4.22	1.34

Divergent Thinking

The one-way analysis of variance was not significant ($F(1, 159) = 2.17$, ns). Table 20 displays the means for this analysis. Contrasts were conducted to test hypotheses one, two, and four. Homogeneity of variance was violated for the divergent thinking variable (Cochran's C = .48, $p = .01$) so separate variance estimates were used. Contrasts revealed that divergent thinking scores did differ depending on the experimental condition. Supporting hypothesis 1, individuals who experienced a stressful situation in which they did not cope provided fewer solutions than individuals who experienced a relaxing situation ($t(102) = -2.23$, $p = .01$). The difference in means for the second hypothesis was marginally significant. Individuals who experienced a stressful situation in which they did not cope produced fewer solutions than individuals who experienced a stressful situation which they did cope ($t(88)=-1.58$, $p = .06$). As predicted, individuals who experienced a stressful situation in which they coped well did not differ in number of solutions produced from those individuals who experienced a relaxing situation ($t(100) = -.34$, ns). This supports hypothesis four.

A t-test was conducted to test hypothesis three. Table 21 displays the cell means. When in a stressful situation, no difference in divergent thinking is found between those who scored high on stress utilization versus those who scored low on stress utilization ($t(52) = -.61$, ns).

Category Combination

The one-way analysis of variance was not significant ($F(2, 159) = .03$, ns). Contrasts were conducted to test hypotheses one, two, and four. The contrasts were not

Table 20

Group Means for Divergent Thinking

Condition	M	SD
Stress	15.11	7.08
Cope	17.91	11.03
Relax	18.56	9.02

Table 21

T-Test for Individuals in Stressful Situation - Divergent Thinking

Condition	M	SD
High Stress Utilization	15.70	8.32
Low Stress Utilization	14.52	5.67

significant. Table 22 shows the group means for this variable.

A t-test was performed to test hypothesis three. Table 23 displays the cell means. When in a stressful situation, there was no difference in category combination creativity ratings between individuals high and low in stress utilization ($t(52) = .14$, ns).

Other Measures of Creativity

Several other ways of looking at the creativity ratings were discussed in the method section. These variables assess the most creative solutions based on criteria of highly appropriate (rating of 3 or above) and highly original (rating of 4 or above) solutions. The same analyses that were used for the variables discussed in this section were run for these additional variables. Although most of the analyses were not significant, a main effect result for the number of solutions receiving a score of 3 or above on appropriateness (highly appropriate solutions) is worth mentioning. Individuals produced fewer highly appropriate solutions in the stress condition than individuals produced in the cope condition ($t(159) = -1.65$, $p = .05$). This adds support to hypothesis two, which stated that individuals in the stress condition would perform worse on creative tasks than individuals in the cope condition. However, because this result was found for only one of the variables, it should be interpreted with caution.

Table 22

Group Means for Category Combination

Condition	M	SD
Stress	6.30	.97
Cope	6.33	1.07
Relax	6.28	1.25

Table 23

T-Test for Individuals in Stressful Situation - Category Combination

Condition	M	SD
High Stress Utilization	6.28	1.15
Low Stress Utilization	6.31	.79

Chapter 4

Discussion

Overview

This study examined the influence of an environmental factor, perceived stress, and a personality variable, stress utilization, on creativity. Creativity was discussed as an interaction among personality traits, socially judged products, and a complex set of cognitive processes. It was predicted that generally, stress would impede creative performance, possibly at particular stages within the creative problem solving process and possibly at the overall creative product level. A more specific prediction suggested that certain individuals have the ability to handle stressful situations by acknowledging and advantageously using the information obtained from that situation and that this ability would lead to increased creative performance.

Summary of Findings

Hypotheses one, two, and four. There were four hypotheses. Three of the hypotheses focused on mean differences in creative performance between manipulation conditions. It was hypothesized that individuals who experience psychological stress would perform worse on creativity tasks compared to individuals who experience a relaxed state (hypothesis one). This hypothesis was based on the theoretical work of Janis and Mann (1977) and Janis (1982) as well as the empirical findings that suggested that individuals who were in a stressful situation performed worse on decision making tasks than those not in a stressful situation (Berkun et al., 1962; Shaham et al., 1992). Similarly, it was predicted that individuals who experience psychological stress would

perform worse on creativity tasks compared to individuals who experienced stress but who successfully coped with the stressful situation (hypothesis two). This hypothesis was proposed because it was thought that individuals feel happy when they are able to successfully cope with an unpleasant situation. This happiness would negate any negative feelings associated with the stressful situation and leave the individual in a pleasant mind state. Using the same logic, no difference in creative performance was expected between individuals who experience a stressful situation in which they successfully coped and individuals who experienced a relaxing situation (hypothesis four). That is, individuals in the cope condition and individuals in the relax condition were expected to perform similarly on creativity tasks.

Hypothesis one, two, and four were partially supported when examining the number of problem solutions and the number of divergent thinking ideas generated by participants. These results indicate that individuals in the stress condition produced fewer problem solutions and generated fewer divergent thinking ideas than individuals in the relax or the cope conditions (hypotheses one and two). Also, there was no difference in the number of problem solutions generated or in the number of divergent thinking ideas provided between individuals in the relax and the cope conditions (hypothesis four). Although statistical significance was found for these divergent thinking variables, this pattern of results was not found for the general creativity measures. Because results were found for only one component of creativity, divergent thinking, and not for composite creativity, these three hypotheses were only partially supported.

The results found for these three hypotheses suggest that perceived stress may determine whether an individual will be able to generate numerous ideas or solutions to problems. This adds support to Isen's research findings: that individuals in a positive mood tend to be more creative than individuals in a negative mood (Estrada, Isen, & Young, 1994; Isen & Daubman, 1984; Isen, Daubman, & Norwicki, 1987). However, divergent thinking is just one process individuals use when they are creative, and this pattern of results was not found for other measures of creativity, including an overall measure of creative problem solving. Also, the manipulation here was stress, and although it has an affective component, it is not strictly a manipulation of affect as Isen used in her research. Because of these differences, the results from this study do not fully coincide with Isen's research.

The divergent thinking findings from this study also support Vosburg's (1998a, 1998b) results: individuals in a positive mood produced more divergent thinking solutions than individuals in a negative mood. She suggested that individuals in a negative mood might be using optimizing strategies by generating fewer solutions that may be of a higher quality. This interpretation corresponds with Klein's (1996) suggestion that decision makers may use heuristics when solving a problem under stressful conditions. In this case, the heuristic would be the optimizing strategy of generating fewer possible ideas. Stress impedes the decision maker's idea-generation process so that the individual ends the decision-making process sooner (Janis, 1982). When individuals are involved in creative problem solving, their ideas go through numerous evaluations and refinements (Mumford et al., 1991). In fact, Mumford et al.

(1997) stated that in order to be creative, individuals need time and cannot be rushed to find a solution. If decision makers end the decision process sooner, the probability of producing fewer solutions is increased. Interestingly, this study found no difference in the quality of the solutions produced, even though individuals in the stress condition produced fewer solutions. So, even though individuals in a stressful situation use a heuristic - produce fewer solutions - the quality of these solutions is not lower than individuals in a relaxing situation.

Hypothesis three. Hypothesis three stated that individuals who are able to utilize the tension, affects, cognitions, and motivations from a stressful situation (high stress utilization) would produce more creative solutions in the perceived stress condition than individuals who were less able to utilize the tension, affect, cognitions, and motivations from a stressful situation (low stress utilization). This hypothesis was based on the idea that an individual difference variable exists in which some individuals are able to handle tension and stress better than other individuals. This ability was thought to stem from the individual's past experience in handling stressful situation. This prediction suggested that individuals who handled stressful experiences well in the past would handle current stressful situations well. Also, research has suggested that there is a tension component involved in creative production and that there may be an individual difference in the ability to differentially handle this tension (Barron, 1953; Block & Block, 1980; Brophy, 1998; John-Steiner, 1992; Muchinsky, 1996; Noppe, 1996; Runco, 1995, 1999). Not only would individuals be able to handle the tension from the stressful situation better but they may also be more creative than individuals who are not able to handle the tension.

Unfortunately, hypothesis three was not statistically supported with any of the measures of overall creativity or with any of the measures of the component processes of creativity. The distribution of stress utilization scores may reflect restriction of range. The range of possible scores was 38 to 190 whereas the range of actual scores was 72 to 148. This may be due the nature of the sample used - psychology students in a university setting who have had similar experiences throughout their lives. Also, the mean stress utilization score was 110 and the standard deviation was about 12. This indicates that the variability is somewhat low. Low variability contributes to difficulty in finding statistical significant (Pedhazur & Schmelkin, 1991).

It is also possible that individuals did not use the entire scale when completing the biodata items. It has been suggested that raters are unwilling to use the extremes of a scale (Nunnally & Bernstein, 1994). Analysis of the scale showed that 6% of average ratings fell in the one to two range, 56% fell in the two to three range, 44% fell in the three to four range, and 0% fell in the four to five range. Clearly participants were not utilizing the entire scale. These data support the notion that participants were unwilling to use the scale extremes.

Interpretation of Findings

The previous section presented the general results from this study. Patterns in these findings seem to emerge. Each of these patterns will be briefly introduced and then discussed extensively.

First, it should be noted that the hypothesis supported depended on the type of creativity measure being used. For example, the main effect hypotheses, one two, and

four, were statistically supported when examining the divergent thinking measures, number of problem solutions and number of divergent thinking ideas but not the measures of appropriateness, originality, or composite creativity.

Second, none of the hypotheses were supported when examining category combination, a single process of creativity. Similar to the lack of results for the category combination dependent measure, no hypotheses were supported when using the creativity ratings. These patterns will be discussed in turn, and suggestions as to why they occurred will be offered.

It is interesting that the more simplistic prediction, the mean differences among conditions, were supported by the more simplistic dependent measures. The term simplistic as it is used here means only that the divergent thinking measures concentrate on just one component of creativity. On the other hand, creative problem solving involves many components and processes and is therefore considered more complex. Besides category combination, which will be discussed later, the other measures used in this study assessed this complex process as a whole. It is possible that stress affects more simplistic aspects or components of the creative process, but when it comes to the overall process, variables such as stress utilization and other variables not examined in this study may help determine who will perform more creatively. However, it is important to mention that the other dependent measures were not significant when looking at differences between manipulated conditions. Failing to find significant differences using the other measures of creativity suggests that perhaps only divergent thinking tasks are influenced by stress.

Vosburg (1998a, 1998b) stated that it is necessary to take into account what measure one uses when assessing creativity. Vosburg (1998b) found differential results depending on the dependent measure: idea quantity was higher when participants were in positive moods but there was no increase in idea quality when participants were in positive moods. Vosburg's results parallel one of the patterns found in this study: when number of solutions/ideas (idea quantity) was used, a main effect difference was found. When other measures were used, including idea quality, no main effect differences were apparent. Vosburg attributed her results to the kind of task used and to the degree of solution constraint. She explained that divergent thinking tasks facilitate an unrestricted evaluative process because participants are asked to generate as many ideas as they can. Problem solutions on the other hand usually require some evaluative process, solution appropriateness and quality.

In this study, a solution was operationally defined as creative if it was both appropriate and original. It makes sense then to look at the combination of these two rating components in the analyses. However, much of the past research in creativity has looked exclusively at the components separately (Mumford, Baughman, Maher, Costanza, & Supinski, 1997; Mumford, & Gustafson, 1988; Mumford, Supinski, Baughmanm, Costanza, & Threlfall, 1997; Reiter-Palmon et al.,1997; Runco & Charles, 1993; Vosburg, 1998b). In this study, neither the components of creativity nor the combination of these components significantly differed. Although these results are disappointing, there is evidence in this study that stress utilization is an important variable to research and may be important for creativity. First, the reliability of the

measure was good (alpha = .83), particularly for a biodata measure. Second, the discriminant validity of stress utilization was shown by the numerous significant correlations with variables such as ego-strength, tolerance, openness, flexibility, and need for cognition. Although these are all positive indications for the stress utilization construct, much more research needs to be conducted on both the construct and the measurement of the construct.

Although important in the creative process, differences in the category combination process of creativity were not supported. One explanation is that the process of category combination is unaffected by stress. This however seems unlikely because of the pervasive nature of stress and the past findings regarding the disruption of the decision-making process when stress is induced. Another possibility is that the stress manipulation did not last long enough to influence participants when they were working on the category combination task. Participants were asked to complete three different dependent variable tasks. The order of the first two tasks, divergent thinking and creative problem solving were alternated, and the last task, category combination, was always the third and final dependent measure. It is probable that participants were no longer affected by the manipulation when working on the category combination task because it was the final task that they completed. It has been suggested that induced affect, especially negative affect last for only a short period of time (Isen, 1984). This may help explain why no results were found for this process of creativity.

Finally, no hypotheses were supported when the creativity ratings were used. An examination of the distribution of the ratings may offer some information regarding this

lack of results. For example, the problem appropriateness ratings are negatively skewed, that is, most individuals provided solutions that are considered appropriate. The scale ranged from one to four yet only .6% of participants were given average solution ratings between one and two, 27% of participants were given average solution ratings between two and three, and 73% of participants were given average solution ratings between three and four. Almost three-quarters of the participants' average solutions were rated as highly appropriate, ranging between a three and a four.

On the other hand, the problem originality was positively skewed. This scale ranged from one to six; however, most of the solutions fell into the "common solution" categories: 55% of participants were given an average solution rating between one and two, 28% of participants were given an average solution rating between two and three, 12% of participants were given an average solution rating between three and four, 4.3% of participants were given an average solution rating of four to five. There were no average ratings between five to six on the originality measure.

These distributions are quite skewed. Although some skewness is expected given the dependent variable, the extent of deviation from the normal distribution found in this study likely contributed to the difficulty in finding statistical significance.

Limitations and Future Research

Several limitations exist in this study. First, there was difficulty in reaching statistical significant, particularly for hypothesis three, which stated that when in a stressful situation, individuals high on stress utilization will be more creative than individuals low on stress utilization. The analysis used to examine this prediction was a t-

test within one condition, which required using only one-third of the participants. In addition to a smaller sample size, the effect size is small (e.g., problem creativity effect size =.17). A combination of low power and a low effect size makes it difficult to reject the null hypothesis (Cohen, 1988; Kraemer & Thiemann, 1987). It is likely that this combination lowered the probability of finding statistical significance in this study. To correct this, future research should consider the expected low effect size and attempt to increase the number of participants in each cell. Also, if the effect size is expected to be low, a priori alpha levels could be set at a less stringent level to allow for more statistical power (Cohen, 1988).

The difficulty in finding statistical significance may also be due to another factor - the nature of the variables used in this study. Particularly the case in personality and social psychology research, it is difficult to find significance when trying to explain a broad and complex behavior such as creativity, using one specific individual difference variable, such as stress utilization (Mischel & Shoda, 1995). Future research may consider examining several individual difference variables together and to investigate the behavior over a period of time to improve explanation of that behavior (Mischel & Shoda, 1995.)

A second limitation in this study was the skewed distribution of the dependent measures. As discussed earlier, the distributions for the creativity ratings were notably skewed, one positively and one negatively. Because skewed distributions may violate important statistical assumptions, nonparametric statistical tests may be needed to look at these ratings (Siegel & Castellan, 1988). Also, the raters may not have used the rating

scales to best discriminate between solutions or the solutions may not have sufficiently represented the set of possible solutions. Both of these problems might result in skewed distributions of the solution ratings.

A third limitation was the restriction of range on the stress utilization variable. As discussed earlier, the participants were unwilling to use the extremes of the scale. This resulted in restriction of range at both the high and low levels of the scale. In addition, the variability in stress utilization scores was low. More research is needed on the stress utilization construct, particularly on how to adequately measure it.

A fourth limitation was the dwindling stress manipulation. It has been found that affect manipulations last for only a short period of time (Isen, 1989). Because the procedure used in this study was taken from an affect manipulation method, and because stress has an affective component, it is possible that a dwindling stress manipulation occurred in this study. The short life of the manipulation raises suspicion as to which dependent measures were completed while the manipulation was working. It would be wise to run this study using one dependent measure at a time, both to ensure that the manipulation is working and to better isolate the affects of stress and stress utilization on each dependent measure. Also, a combination of manipulations, such as the story writing method and the Velton technique (Velton, 1968) might make the manipulation stronger. Also, it would be possible and easy to measure the time it takes participants to finish each measure. In addition to serving as another dependent measure, this information may help establish whether the participants were still under the effects of the manipulation by examining the time to complete tasks over numerous studies.

A failure to collect demographic information was another limitation of this study. Demographic information may help establish informative patterns regarding both the creativity measures and the stress utilization measure for the sample. For example, it is possible that male and female participants differ in their stress utilization level. Future research should examine demographic variables in relation to creativity and stress utilization.

Overall Conclusions

There are three general conclusions that may be drawn from this study. First, stress negatively influences the quantity of ideas or solutions that an individual generates. Second, although the quantity of ideas or solutions decreases when in stressful situations, there is no respective decrease in the quality of those solutions. Finally, a new construct, stress utilization has been proposed. This construct suggests that there is an individual difference variable to distinguish individuals who are able and are not able to advantageously use the information from a stressful situation.

Implications

Facing stressful situations at work, at home, and at school has become a prominent event for all of us. How we handle these stressful events will influence the decisions we make in our relationships and careers. It is helpful to have information on how stressful situations will influence our lives. This study has implications about how stress influences everyday problem solving and specifically, how stress influences creative problem solving.

Stress and creativity. First, this study supported the general notion that stress impedes certain aspects of performance. If an individual perceives a situation as stressful they will likely not generate as many ideas or solutions to a problem. Although this may not have detrimental effects in everyday life, it is an important process needed to be creative. At work, at home, and at school, individuals find or are required to behave creatively. From the student who must brainstorm research ideas to the computer software developer who must constantly generate new software ideas, creativity manifests itself in many aspects of our lives. It is important to be aware of the environmental stressors that fill our lives so that they may be reduced. This in turn may help foster more effective idea generation. Of course, being able to acknowledge and put a stop to stressors before they impede performance may be unrealistic, especially if we consider trying to stop all of them from occurring. However, understanding why performance is impeded is the first step in isolating the causal factors and makes it possible to catch some of the stressors some of the time.

Also, it should again me mentioned that although stress impeded idea generation so that individuals who were in a stressful situation generated fewer solutions than individuals in a relaxing situation, stress did not appear to influence the quality of those ideas. Appropriateness ratings, originality ratings, and proportion of these ratings to the number of solutions generated were all equal between manipulation conditions. Even though participants generated fewer solutions, the quality of their solutions did not decrease. This is particularly important for creativity research because fluency of ideas (idea generation) has been equated with creativity (Brophy, 1998). Therefore, stress does

indeed affect creativity, however, it appears to impede idea generation and not necessarily the quality of those ideas.

Second, this study suggested that an individual difference variable exists where some individuals are better able to advantageously use the information from a stressful situation. This variable, stress utilization, has both theoretical and applied implications.

Stress utilization - theoretical implications. In this study, stress utilization emerged as an individual difference variable with acceptable reliability and discriminant validity. Although it is a new measure, there is promise for this variable not only in creativity research but also in problem-solving and decision-making research, social interaction research, communication research, and clinical research. Individuals who are high in stress utilization may make better decisions, may be more attentive to cues from others and their environment and therefore, may behave more competently in stressful situations. Behaving more competently may enable individuals to feel better about themselves in stressful situations, which in turn may be related to better health benefits.

Stress utilization may also supplement coping research. Using the information from a stressful event will result in coping with the emotions and cognitions involved in that event. Researchers could examine how individuals high in stress utilization handle the cognitions and emotions from stressful situations. Once researchers fully understand how individuals with high stress utilization use the information from a stressful event to their benefit, these beneficial behaviors may be taught to others.

It is important to note that much more research is needed on this measure to help establish it as a valid and reliable predictor. Caution should be taken when using stress

utilization to predict or explain relationships until the nature of this variable is better understood.

Stress utilization - applied implications. Once the stress utilization measure has been thoroughly tested, it may be useful in applied settings, especially in the workplace. Companies would be able to assess which employees possess high stress utilization. This information may eventually be used for selection and placement into stressful positions requiring the generation of creative ideas or solutions. In order to be truly effective however, stress, creativity, and stress utilization would have to be established as essential components to the job and the environment surrounding the job. Establishing job relevance for these variables would also help avoid discrimination issues. In addition to selection and placement, training programs focusing on coping with stress and the stress utilization concept may be taught to employees who are low in positive stress utilization. Although there are many possibilities for this construct, additional research is needed to better understand the nature of stress utilization.

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Appendix A

Instructions for the Stress Manipulation

Stressful situation - did cope well

Imagine an extremely stressful situation you were in within the last 5 years where you coped well with the problem. Think about everything that led up to the situation and everything that happened during the situation. Also think about how you felt during the stressful incident. Try to bring yourself to feel those emotions again. You may close your eyes if it helps you to concentrate on the situation.

Now, write all the details that you just thought about. Tell what led up to the incident and what happened during the incident. Describe all the thoughts and feelings you had during the stressful incident. Please be as complete and detailed as possible. Remember, your name will not be connected with your writing, so please be as honest and detailed as you can be. You may use the front and back of the sheets provided. The experimenter has more paper if you run out.

Please begin on the following sheet of paper.

Stressful situation - did not cope well

Imagine an extremely stressful situation you were in within the last 5 years where you **DID NOT COPE well with the problem.** Think about everything that led up to the situation and everything that happened during the situation. Also think about how you felt during the stressful incident. Try to bring yourself to feel those emotions again. You may close your eyes if it helps you to concentrate on the situation.

Now, write all the details that you just thought about. Tell what led up to the incident and what happened during the incident. Describe all the thoughts and feelings you had during the stressful incident and explain why you think you did not cope well with the problem. Please be as complete and detailed as possible. Remember, your name will not be connected with your writing, so please be as honest and detailed as you can be. You may use the front and back of the sheets provided. The experimenter has more paper if you run out.

Please begin on the following sheet of paper.

Relaxing situation

Imagine an extremely relaxing situation you were in within the last 5 years. Think about everything that led up to the situation and everything that happened during the situation. Also think about how you felt during the relaxing incident. Try to bring yourself to feel those emotions again. You may close your eyes if it helps you to concentrate on the situation.

Now, write all the details that you just thought about. Tell what led up to the incident and what happened during the incident. Describe all the thoughts and feelings you had during the relaxing incident. Please be as complete and detailed as possible. Remember, your name will not be connected with your writing, so please be as honest and detailed as you can be. You may use the front and back of the sheets provided. The experimenter has more paper if you run out.

Please begin on the following sheet of paper.

Appendix B

Original Stress Utilization Items

*ER1. How often have you found yourself volunteering for unpleasant tasks?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*ER2. How often have you found yourself fascinated by ideas that other people criticized?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*ER3. How much have you enjoyed being in work situations that you're not sure you'll be able to handle?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

-*ER4. How often have you found yourself gaining respect for the people who had pushed you really hard?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*ER5. To what extent have you made friends with people from rather different backgrounds?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

*ER6. How often have people described you as "taking the hard road"?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-LC7. How often have you felt that personal problems prevent you from performing at your best?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-SA8. How often have you failed to meet responsibilities because you had taken on too much?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*SA9. To what extent can you accept a viewpoint that goes against what you believe?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

*SE10. In the past, to what extent has criticism from peers/bosses contributed to your performance?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

*SE11. How often have you argued with peers, teachers, or other superiors?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-TF12. How difficult has it been for you to continue working on something after you've been criticized a number of times?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

-TF13. When someone has criticized you, to what extent has it affected your mood for the rest of the day?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-C14.How difficult have you found it to work with people after a fight?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

-EC15.To what extent have unexpected changes in home or occupational requirements tended to upset you?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-EC16. To what extent have you tended to dwell on accidents or mishaps that happened during the day?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-EC17. To what extent have you found it desirable to avoid confrontations about personal problems?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-ES18. To what extent do you tend to avoid or withdraw from situations where there is a lot of emotional conflict?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-ES19. How difficult have you found it to turn your attention away from problems you could not solve in time?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

ES20. How often are you to become uncomfortable around people who are easily excited?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-ES21. To what extent have you been bothered by rejection or undue criticism?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-ES22. How often has your sleep schedule been disrupted by problems cropping up at work or home?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-ES23. To what extent have you found yourself getting upset about conflict amongst friends?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

*ES24. To what extent has it been typical of you to seek out new activities or people even when this might cause problems?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*CC25. How often have you been described as someone who takes things in stride?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*CC26. How often have you chosen to work on projects with short turn around times?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*CC27.How often have teachers/peers/superiors said they were surprised about the work you did under difficult circumstances?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

CC28. How often have you requested special support when faced with an impending deadline?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*CC29.How often have you chosen a hobby because it was something you did not know how to do?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*CC30.How often has criticism resulted in a significant improvement in your performance?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*CC31.How difficult has it been for other people to tell when you were under stress?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

-CC32.How often have you felt that you could have done better in life if you could have had a few more breaks?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

CC33.How likely have you become frustrated with unexpected chores (i.e. unexpected car repairs, family demands, lost paper work)?

A) Much More Likely Than Most People

B) Somewhat More Likely Than Most People

C) About As Likely As Others

D) Somewhat Less Likely Than Most People

E) A Good Bit Less Likely Than Most People

-DE34.How often have problems at home affected your school work?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*DE35.How often have you gotten upset with people who seem to judge others?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*DE36.How often have you stirred up trouble just to see what will happen?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-DE37. In college, how often did you find yourself avoiding talking to your parents?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

DD38. When something is bothering you, how often do you find the best way to deal with it is just to give it time?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-DE39. How difficult has it been for you to cope with situations that forced you to see yourself in a different way?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

-DE40. How upset have you become when your parents argued?

A) Extremely Upset

B) Very Upset

C) Upset

D) Not Very Upset

E) Not At All Upset

-DE41. How difficult has it been for you to accept the fact that you were not as good at something as you thought you were?

A) Extremely Difficult

B) Very Difficult

C) Difficult

D) Not Very Difficult

E) Not At All Difficult

-DE42. How long did it take you to start dating again after a relationship ended?

A) A Very Long Amount Of Time

B) Longer Than Average

C) About An Average Amount Of Time

D) Shorter Than Average

E) A Very Short Amount Of Time

*DE43. How often have you found yourself getting annoyed with people who see things in absolute rights and wrongs?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*DE44.How often have you confronted a girlfriend/boyfriend with an important problem concerning a relationship?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*DE45.In college, to what extend did you enjoy having roommates that were very different from each other?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-DE46.How much did conflicts among close friends bother you?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

*DE47.How many times did you move while growing up?

A) More Times Than Most People

B) Somewhat More Times Than Most People

C) About As Many Times As Others

D) Somewhat Fewer Times Than Most People

E) A Good Bit Less Times Than Most People

-DE48.How much did it bother you when you lost close friends or family members due to death or divorce?

A) Very Much

B) Much

C) Some

D) Little

E) Never Lost A Friend Or Family Member

*DE49.To what extent did members of your family pursue different kinds of sports and hobbies while you were growing up?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*DE50.To what extent do you ignore or disregard daily stresses?

A) Great Extent

B) Largc Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-DE51.How much does it bother you when others make conflicting demands on your time?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

DE52. How much do you ascribe to the opinions and point of view of your parents?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

-*DE53.How much did you enjoy writing compare and contrast papers?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

-*DE54.How often have your parents expressed different views with regard to politics, religion, etc.?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*DE55.How much do you enjoy political satire?

A) Very Much

B) Much

C) Some

D) Little

E) Very Little

* = recoded item
- = item remained in final stress utilization measure after reliability analysis

Appendix C

Manipulation Check

Please circle **four** of the following words that best describe how you feel **RIGHT NOW.** Indicate in the space next to the word why you believe you are experiencing this emotion. For example, I might circle frustrated and explain that I had just been driving around for 30 minutes looking for a parking spot. If you do not know why you are feeling a particular way, just write "I don't know."

distressed

happy

pleasant

frustrated

pleased

satisfied

nervous

delighted

tense

irritated

Please circle the number that best represents how you feel RIGHT NOW.

Writing about the personal incident made me feel relaxed.

1	2	3	4	5
Not at all relaxed		Neutral		Extremely relaxed

Writing about the personal incident made me feel stressed.

1	2	3	4	5
Not at all stressed		Neutral		Extremely stressed

It was easy for me to think of a story to write about.

1	2	3	4	5
Not at all easy		Neutral		Extremely easy

Appendix D

Creativity Measures

Consequences Test

This is a test of your ability to think of a large number of ideas in connection with new and unusual situations.

Sample item:

What would be the result if people no longer needed sleep?

Sample answers:

1. Get more work done
2. Alarm clocks not necessary
3. No need for lullaby song books
4. Sleeping pills no longer used

Of course, there are many more possible results that could have been written. There will be two different situations somewhat like the one above, each on a separate page. Four examples will be included for each item. Your answers need not be in complete sentences. Your score will be the total number of different consequences that you write in the time given. Please number each of your answers.

Problem 1 - LIST AS MANY DIFFERENT CONSEQUENCES AS YOU CAN

What would be the result if none of us needed food in order to live?

a. No need for farmers

b. No plates, knives, and forks

c. No grocers

d. Save time

1.

Problem 2 - LIST AS MANY DIFFERENT CONSEQUENCES AS YOU CAN

What would be the result if everyone suddenly lost the sense of balance and were unable to stay in the upright position for more than a moment?

a. People would fall down

b. Could not walk

c. Many accidents

d. Confusion

1.

Category Combination

This is a test of category combination in which you will deal with categories of words. Some definitions you should keep in mind during the test are:

A CATEGORY is a general class to which a group of items logically belongs.

A CATEGORY LABEL is a descriptive word or phrase which classifies or summarizes a category.

There are two problems in this test. In each problem, you will be given three categories of words and will be asked to 1) combine the three categories of words into one category, 2) write down the label of the new category you created, 3) give examples of your new category.

For example, after reading the instructions for the problem, you will read the three categories of four words:

jury	crayon	survey
bailiff	pencil	deed
attorney	marker	title
witness	fountain pen	birth certificate

In this example, the first category is "things found in a courtroom", the second category is "a writing implement", and the third category is "records/documents". You would then have to combine the three categories into one new category. In the above example you could say "things found in city hall" combines the three given categories. You would write this category label down. Note that your new category label should be

more than just listing the three categories given; it should be a new category label that combines the three given.

Next, you would write down examples of the new category that you have created. Some examples of this new category are: mayor, courtroom, and city council. Write down as many examples as you can. You may not use the words given in the problem as examples of the new category.

Problem 1

Combine the word lists below to form a new category. Write down the name of the new category and examples of this category.

wood	head	table
copper	mattress	night stand
stone	footboard	bed
plastic	canopy	desk

Category label:

Examples of the category:

Problem 2

Combine the word lists below to form a new category. Write down the name of the new category and examples of this category.

French horn	ribbon	mirror
recorder	paper	hamper
alto sax	staples	toilet bowl
piccolo	telephone	linen closet

Category label:

Examples of the category:

Creative Problem Solving

Brian graduated with an MBA three years ago and has risen through the managerial ranks quickly at a large bank. Approximately a year ago, Brian had a position to fill in his department and hired his college friend's sister, Laura, who had just graduated from college and was in need of a good job. Brian is very close to his college friend Lance, and Lance had highly recommended his sister as a hard worker. In addition, the vice president for human resources at the bank was pleased that Brian had hired a woman for the position since 90% of the employees in Brian's department are men. Laura gets along well with other people in the department, but the quality of her work has been substandard, and she has missed several department meetings. Brian met with Laura and explained what she needed to do to improve her work, but one month after their discussion, Laura missed another meeting. Brian realizes the importance of recruiting women to work in the department and does not want to upset his friend by firing Laura, but he feels that the poor quality of her work may slow down his career progress. Brian does not know what to do.

Write as many solutions as you can think of for this problem. Please number your answers and circle the answer (one answer) you think is the best solution.

Appendix E

Rating Scales for Creativity Measures

Appropriateness - An appropriate solution is one that is realistic, practical, feasible, and socially appropriate.

1 Solution is highly inappropriate.

2 Solution is somewhat inappropriate.

3 Solution is neither appropriate nor inappropriate.

4 Solution is somewhat appropriate.

5 Solution is highly appropriate.

Originality - The degree to which the solution is not structured by the problem presented and goes beyond it. The degree of novelty and uniqueness of the solution.

1 Very common response. Solution is completely structured by the problem as presented.

2 Solution is less common but very structured by the problem as presented.

3 Solution is somewhat unique but very structured by the problem as presented.

4 Solution is relatively common but not structured by the problem as presented.

5 Solution is somewhat novel and unique and not structured by the problem as presented.

6 Solution is novel and unique, and, not structured by the problem as presented.

Appendix F

Additional Measures

CPI Scales

131. I looked up to my father as an ideal man. A-F

132. Our thinking would be a lot better off if we would just forget about words like "probably," "approximately," and "perhaps." F-F; A-F

133. I liked *Alice in Wonderland* by Lewis Carroll. A-T

134. Several times a week I feel as if something dreadful is about to happen. T-F

135. I have had very peculiar and strange experiences. T-F

136. My daily life is full of things that keep me interested. A-T

137. I always like to keep my things neat and tidy and in good order. F-F

138. It makes me feel like a failure when I hear of the success of someone I know well. T-F

139. I tend to be on my guard with people who are somewhat more friendly than I had expected. T-F

140. I have very few fears compared to my friends. A-F

141. For most questions there is just one right answer, once a person is able to get all the facts. F-F; A-F

142. I seem to be about as capable and smart as most others around me. A-T

143. The trouble with many people is that they don't take things seriously enough. F-F; A-F

144. I have often met people who were supposed to be experts who were no better than I. F-F

145. It is always a good thing to be frank. F-F; A-F

146. I feel sure that there is only one true religion. T-F

147. When I get bored I like to stir up some excitement. F-T

148. There have been times when I have been very angry. T-T

149. Most of the arguments or quarrels I get into are over matters of principle. F-F

150. I do not like to see people carelessly dressed. T-F

151. With things going as they are, it's pretty hard to keep up hope of amounting to something. T-F; A-F

152. People today have forgotten how to feel properly ashamed of themselves. A-F

153. I set a high standard for myself and I feel others should do the same. F-F

154. It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he really believes. F-F; A-F

155. I don't blame people for trying to grab all they can get in this world. T-F

156. I do not always tell the truth. F-T

157. I was a slow learner in school. A-F

158. I like poetry. T-F; A-T

159. I think I am stricter about right and wrong than most people. F-F

160. Sometimes without any reason or even when things are going wrong I feel excitedly happy, "on top of the world." A-F

161. Most people make friends because friends are likely to be useful to them. T-F

162. It is all right to get around the law if you don't actually break it. T-F

163. I enjoy hearing lectures on world affairs. A-T

164. Parents are much too easy on their children nowadays. A-F

165. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it. T-F

166. I have a tendency to give up easily when I meet difficult problems. A-F

167. People should adapt their ideas and behavior to the group that happens to be with them at the time. T-F

168. I hardly ever get excited or thrilled. F-F

169. Teachers often expect too much work from the students. A-F

170. I do not have a great fear of snakes. A-T

171. I never make judgments about people until I am sure of the facts. F-F

172. Sometimes I feel as if I must injure either myself of someone else. T-F

173. I have had more than my share of things to worry about. T-F

174. Only a fool would ever vote to increase his own taxes. A-F

175. I like to plan a home study schedule and then follow it. A-T

176. I have often found people jealous of my good ideas, just because they had not thought of them first. T-T; A-F

177. Most people are honest chiefly through fear of being caught. T-T

178. It makes me angry when I hear of someone who has been wrongly prevented from voting. T-T

179. Most people inwardly dislike putting themselves out to help other people. T-F

180. People pretend to care more about one another than they really do. A-F

181. People don't need to worry about others if only they look after themselves. T-F

182. The future is too uncertain for a person to make serious plans. T-F; A-F

183. The person who provides temptation by leaving valuable property unprotected is about as much to blame for its theft as the one who steals it. T-F; A-F

184. I sometimes feel that I am a burden to others. A-F

185. Only a fool would try to change our American way of life. A-F

186. I often feel as though I have done something wrong or wicked. T-F

187. Lawbreakers are almost always caught and punished. A-F

188. I dread the thought of an earthquake. A-F

189. I think most people would lie to get ahead. T-F

190. I like science. T-T

191. I am bothered by people outside, on streetcars, in stores, etc., watching me. A-F

192. I like to read about science. A-T

193. As a child I was suspended from school one or more times for disciplinary reasons. T-F

194. I feel that I have often been punished without cause. T-F; A-F

195. I would be willing to give money myself in order to right a wrong, even though I was not mixed up in it in the first place. T-T

196. I often wish people would be more definite about things. F-F

197. I would rather have people dislike me than look down on me. T-F

198. I find that a well-ordered mode of life with regular hours is congenial to my temperament. F-F

199. It is hard for me to sympathize with someone who is always doubting and unsure about things. F-F

200. I often start things I never finish. F-T

201. There are times when I act like a coward. T-T

202. I must admit I am a pretty fair talker. F-T

203. A strong person will be able to make up his or her mind even on the most difficult questions. F-F

204. I like to have a place for everything and everything in its place. F-F

205. I don't like to work on a problem unless there is a possibility of coming out with a clear-cut and unambiguous answer. F-F; A-F

206. It bothers me when something unexpected interrupts my daily routine. F-F

207. Disobedience to any government is never justified. A-F

208. I am known as a hard and steady worker. F-F

209. I don't like things to be uncertain and unpredictable. F-F

210. Once I have my mind made up I seldom change it. F-F

211. I am in favor of a very strict enforcement of all laws, no matter what the consequences. F-F

212. I have more trouble concentrating than others seem to have. A-F

213. People who seem unsure and uncertain about things make me feel uncomfortable. F-F

First Letter: T- tolerance scale; F- flexibility scale; A- achievement via independence scale

Second Letter: T- true; F- false

Openness to Experience

-*1. How often have you gotten into trouble because you were too willing to try something new?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-2. How many different kinds of music do you listen to?

A) none

B) 1

C) 2

D) 3

E) 4 or more

-*3. To what extent do you find yourself losing interest in projects or stories after you figured out what's going on?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*4. To what extent have you made friends with people from rather different backgrounds?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*5. To what extent have you found yourself trying to keep up with changes in science, technology, and public policy?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*6. How often have you read a book just to learn something about a topic?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*7. To what extent have you enjoyed listening to people debate rather emotional issues?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

8. To what extent have you worked hard to maintain a daily routine?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*9. How often have you been the one to volunteer to take on projects where nobody really had the requisite background?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*10. To what extent have you enjoyed talking to people about the events in their lives?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*11. To what extent have you sometimes described your life as a soap opera?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*12. How often have you taken on projects or tasks when you did not know where it would end?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

*13. How often have your friends described you as a bit of a gossip?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

14. To what extent have you typically tried to do just one or two things but to do them really well?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*15. To what extent would others describe you as never being satisfied with one answer to a problem?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*16. To what extent do you need variety in your work to keep from being bored?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*17. How likely have you been to look forward to changes in your work environment or personal life?

A) Very Likely

B) Likely

C) Neither Likely nor Unlikely

D) Unlikely

E) Very Unlikely

18. How much information have you typically asked for before taking on a new work assignment?

A) Great Amount of Information

B) Large Amount of Information

C) Moderate Amount of Information

D) Slight Amount of Information

E) No Information

-19. How many different hobbies have you had?

A) 0

B) 1

C) 2

D) 3

E) 4 or more

-*20. How likely have you been to take on yourself a project in a new area?

A) Much More Likely Than Most People

B) Somewhat More Likely Than Most People

C) About As Likely As Others

D) Somewhat Less Likely Than Most People

E) A Good Bit Less Likely Than Most People

-*21. Compared to others, to what extent have you done a broad range of activities?

A) Great Extent

B) Large Extent

C) Moderate Extent

D) Slight Extent

E) Not At All

-*22. How often have you attended cultural events when you were uncertain of whether you would like it?

A) Very Often

B) Often

C) Sometimes

D) Seldom

E) Never

-*23. When dining out, how likely have you been to order a dish you have never tried before?

A) Much More Likely Than Most People

B) Somewhat More Likely Than Most People

C) About As Likely As Others

D) Somewhat Less Likely Than Most People

E) A Good Bit Less Likely Than Most People

* = recoded item
- = item remained in final openness measure after reliability analysis

Need for Cognition

For each of the statements below, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) please place a "1" on the line to the left of the statement; if the statement is extremely characteristic of you (very much like you) please place a "5" on the line to the left of the statement. You should use the following scale as you rate each of the statements below:

somewhat somewhat

uncharacteristic uncharacteristic

1----------2----------3----------4----------5

extremely uncertain extremely

uncharacteristic characteristic

___ I prefer complex to simple problems

___ I like to have the responsibility of handling a situation that requires a lot of thinking

___ Thinking is not my idea of fun

___ I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.

___ I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.

___ I find satisfaction in deliberating hard for long hours

___ I only think as hard as I have to

___ I prefer to think about small daily projects to long-term ones

___ I like tasks that require little thought once I've learned them

___ The idea of relying on thought to make my way to the top appeals to me

___ I really enjoy a task that involves coming up with new solutions to problems

___ Learning new ways to think doesn't excite me much

___ I prefer my life to be filled with puzzles that I must solve

___ The notion of thinking abstractly is appealing to me

___ I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought

___ I feel relief rather than satisfaction after completing a task that required a lot of mental effort

___ It's enough for me that something gets the job done; I don't care how or why it works

___ I usually end up deliberating about issues even when they do not affect me personally.

Ego-Strength(MMPI)

79. I have a good appetite. T

80. At times I have fits of laughing and crying that I cannot control. F

81. I find it hard to keep my mind on a task or job. F

82. I have had very peculiar and strange experiences. F

83. I seldom worry about my health. T

84. I have a cough most of the time. F

85. My sleep is fitful and disturbed. F

86. I am in just as good physical health as most of my friends. T

87. Parts of my body often have feelings like burning, tingling, crawling, or like "going to sleep." F

88. When I am with people, I am bothered by hearing very strange things. F

89. I am easily downed in an argument. F

90. I do many things which I regret afterwards (I regret things more than others seem to). F

91. I have met problems so full of possibilities that I have been unable to make up my mind about them. F

92. Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right. T

93. I like collecting flowers or growing house plants. F

94. I like to cook. F

95. During the past few years I have been well most of the time. T

96. I have never had a fainting spell. T

97. When I get bored I like to stir up some excitement. T

98. I feel weak all over much of the time. F

99. My hands have not become clumsy or awkward. T

100. I have no difficulty in keeping my balance in walking. T

101. I like to flirt. T

102. I frequently find myself worrying about something. F

103. I like science. T

104. I like to talk about sex. T

105. I get mad easily and then get over it soon. T

106. I brood a good deal. F

107. I dream frequently about things that are best kept to myself. F

108. My way of doing things is apt to be misunderstood by others. F

109. I have had blank spells in which my activities were interrupted and I did not know what was going on around me. F

110. I can be friendly with people who do things which I consider wrong. T

111. If I were an artist I would like to draw flowers. F

112. When I leave home I do not worry about whether the door is locked and the windows are closed. T

113. I believe my sins are unpardonable. F

114. At times I hear so well it bothers me. F

115. Often I cross the street in order not to meet someone I see. F

116. I have strange and peculiar thoughts. F

117. Sometimes I enjoy hurting persons I love. T

118. Sometimes some unimportant thought will run through my mind and bother me for days. F

119. I am not afraid of fire. T

120. I feel unable to tell anyone all about myself. F

121. My plans have frequently seemed so full of difficulties that I have had to give them up. F

122. I would certainly enjoy beating criminals at their own game. T

123. One or more members of my family are very nervous. T

124. The man who had most to do with me when I was a child (such as my father, stepfather, etc.) was very strict with me. T

125. I am afraid of finding myself in a closet or small closed place. F

126. Dirt frightens or disgusts me. F

127. I am made nervous by certain animals. F

128. I feel tired a good deal of the time. F

129. I sometimes feel that I am about to go to pieces. F

130. I have often been frightened in the middle of the night. F

T -true

F -false

Appendix G

Informed Consent

IRB# Page 1 of 3

Adult Consent Form

Problem Solving

INVITATION TO PARTICIPATE

You are invited to participate in this research study. The following information is provided in order to help you make an informed decision whether or not to participate. If you have any questions, please do not hesitate to ask.

BASIS FOR SUBJECT SELECTION

You are eligible to participate because you are a student at the University of Nebraska at Omaha.

PURPOSE OF THE STUDY

The purpose of this study is to examine solutions to complex problems.

EXPLANATION OF PROCEDURES

Participation in this study will require approximately two hours. In this experiment, you will be asked to complete a questionnaire about your preferences and experiences at home. You will sign up for an experimental session and will bring the completed questionnaires. You will be asked to perform numerous tasks including generating a story about an experience, generating solutions to complex problems, and reporting feelings and emotions.

POTENTIAL RISKS AND DISCOMFORTS

There may be some discomfort associated with this research because of the types of problems that you will be asked to complete. If you are uncomfortable about completing any part of the experiment, you may end your participation without penalty.

POTENTIAL BENEFITS TO SUBJECT

There are no direct benefits to you as a participant.

Subject's Initials _____

POTENTIAL BENEFITS TO SOCIETY

Results obtained from this research may help determine how particular experiences influence different tasks. This information could be used by organizations to help their employees with problem solving.

ALTERNATIVES TO PARTICIPATION

If you choose not to participate, your instructor can identify other ways for you to earn the same amount of credit.

COMPENSATION FOR PARTICIPATION

You will receive research credit for participating in this study.

ASSURANCE OF CONFIDENTIALITY

The information obtained will be used only together with information from other participants. No information will be linked directly to you. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but your identity will be kept strictly confidential.

RIGHTS OF RESEARCH SUBJECTS

Your rights as a research participant have been explained to you. If you have any additional questions concerning your rights as a research subject, you may contact the University of Nebraska Institutional Review Board (IRB), (402)559-6463.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

You are free to decide not to participate at any time without adversely affecting your relationship with the investigators or the University of Nebraska. Your decision will not result in any loss of benefits to which you are otherwise entitled.

DOCUMENTATION OF INFORMED CONSENT

YOU ARE VOLUNTARILY MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE CERTIFIES THAT THE CONTENT AND MEANING OF THE INFORMATION ON THIS CONSENT FORM HAVE BEEN FULLY EXPLAINED TO YOU AND THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ

_____ Subject's Initials

AND UNDERSTOOD THE INFORMATION PRESENTED. YOUR SIGNATURE ALSO CERTIFIES THAT YOU HAVE HAD ALL YOUR QUESTIONS ANSWERED TO YOUR SATISFACTION. IF YOU THINK OF ANY QUESTIONS DURING THE STUDY, PLEASE CONTACT THE INVESTIGATORS.

YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

_____ _____

SIGNATURE OF SUBJECT DATE

IN MY JUDGMENT THE SUBJECT IS VOLUNTARILY AND KNOWINGLY GIVING INFORMED CONSENT AND POSSESSES THE LEGAL CAPACITY TO GIVE INFORMED CONSENT TO PARTICIPATE IN THIS RESEARCH STUDY.

_____ _____

SIGNATURE OF INVESTIGATOR DATE

IDENTIFICATION OF INVESTIGATORS

PRINCIPAL INVESTIGATOR

Dr. Roni Reiter-Palmon 554-4810

SECONDARY INVESTIGATOR

Lisa Kobe 554-4812

Appendix H

Instructions to Participants

Thank you for participating in this study. During the next hour or so, YOU WILL BE PROVIDING VERY IMPORTANT INFORMATION FOR US. IT IS ESSENTIAL THAT YOU ANSWER ALL QUESTIONS HONESTLY AND PUT FORTH SOME EFFORT IN WORKING ALL THE PROBLEMS THAT ARE IN THE PACKET. The packet you have in front of you will probably take from 45 minutes to and hour and 15 minutes, and you will work at your own pace. We really appreciate you helping us out with this experiment!

First you will be asked to discuss how you feel. After that, you will have to write about an incident that occurred in your life. We ask that you read the instructions for this task twice and think about what it is asking you to do before you begin writing. The experimenter has extra paper if you need some, and you may use pen or pencil. After you have completed this task, there will be several problems that you must solve. Please read the instructions for each task carefully. If you have any questions about the tasks at any time during the experiment, please do not hesitate to ask! Finally, you will again be asked to describe how you feel, and you may have another writing task. When you have completed the entire packet, please bring it to the experimenter and s/he will give you your experimental credit.

Thanks again for your help! If you do not have any questions, you may go ahead and begin. We ask that you please complete the packet in the order it is given to you. Thanks!