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The Effect of Dyad Interaction and Marital Adjustment on Cognitive Performance in Everyday Logical Problem Solving

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THE EFFECT OF DYAD INTERACTION AND MARITAL ADJUSTMENT ON COGNITIVE PERFORMANCE IN EVERYDAY LOGICAL PROBLEM SOLVING

by

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ABSTRACT

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by

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The theory of formal operations as a final stage of adult development has come under criticism for various reasons, primarily the overemphasis on logical thought processes which are based on invariant and absolute rules within a closed system. Everyday problems, in contrast, are typically "open-ended" and are defined by the context in which they are embedded.

The purpose of this study was to investigate cognitive behaviors that occurred between two individuals as they cooperatively worked together to solve logical problems. Of interest were the effects of marital adjustment on cognitive performance, the relation between social behaviors, marital adjustment, and cognition, and the influence of a familiar versus a stranger dyadic problem-solving setting on cognitive behaviors. It was hypothesized that well adjusted married and stranger dyads would

not only demonstrate mastery of problem-solving tasks at the formal operational level, but would also demonstrate more relativistic and/or dialectical problem solving, and more facilitative social behaviors, than poorly adjusted married and stranger dyads.

Forty couples between the ages of 35 and 50, who had been married between five and thirty years, were prescreened for verbal intelligence and marital adjustment. They were then randomly assigned to participate in one of four dyadic settings, that is, maritally well versus poorly adjusted couples solving problems in either married or unmarried/stranger dyads. Dyads were administered five formal operational problems. Two of the five were formal logical, or mathematical in nature, while three problems contained both mathematical and interpersonal, or social, elements. Each dyad was videotaped during the problem-solving process, beginning with the instructions. Participants averaged about 1 hour and 15 minutes to complete five problems.

Analyses of variance were performed on marital adjustment and dyadic setting as related to formal and relativistic cognitions. There were no marital adjustment or dyadic setting differences in overall ability to use formal operations. However, maritally well adjusted stranger and married dyads evidenced significantly more relativistic cognitions, particularly on problems involving a social/everyday element, than poorly adjusted married and stranger dyads. These differences also held constant across each of three increasingly complex levels of relativistic behaviors. Multivariate analyses were performed on four separate social behavior scales as related to formal and relativistic cognitions, as

well as marital adjustment and dyadic setting groups. Again, formal operations did not distinguish between the differing social behaviors; however, the social behavior scales, particularly avoidant versus cooperative behaviors, were strongly related to marital adjustment and relativistic thinking.

(127 pages)

CHAPTER I

INTRODUCTION

There are few abilities more useful to survival in the complex human experience than problem-solving skills. As stated by Anderson (1985),

> It seems that all cognitive activities are fundamentally problem-solving in nature. The basic argument . . . is that human cognition is always purposeful, directed to achieving goals and to removing obstacles to those goals. (p. 199-200)

Dewey (1933) described problem solving in two steps; first, a state of difficulty arises, and second, the individual goes through a process of searching for information to resolve the difficulty. According to Davis (1973), the solution is the creation of new ideas or combinations of preexisting ideas which make the solution possible (Davis, 1973; cited in Meacham & Emont, 1989).

Because of the tremendous interest in understanding the use of complex mental processes, literature in the area of problem solving is rapidly expanding. From questions related to logic, creativity, and concept formation, to questions related to life-span development, researchers and theorists alike are asking how individuals solve problems in "everyday" life. Extensive efforts have focused on understanding the broader aspects of problem solving as related to personal and interpersonal understanding and influence, psychosocial adjustment, social competency, interpersonal

negotiation, the development of social-cognitive, self-efficacy, and self-esteem. The majority of these studies have provided the underpinnings for models of social cognitive development in children and adolescents. It has only been within the last ten years that metatheories have begun to show promise in outlining new directions of research in adult development. Relative to the vast body of research in the area of child and adolescent development, comparatively little has been done to investigate social cognitive development of adults.

Viewed from the Piagetian perspective adults typically develop the capacity to solve problems logically, to evaluate all possible alternatives, and ultimately to select the most appropriate solution. However, studies have shown that not all adults are successful at solving logical problems, regardless of education, socioeconomic status, or other characteristics. As will be discussed, one shortcoming of these studies has been that they have focused primarily on solving well defined problems with well defined solutions, often in laboratory settings, in which the individual is expected to solve the problem in isolation and without the benefit of information otherwise available. This approach is contradictory to Piaget's argument that cognitive development occurs as the individual interacts with the environment.

This study examined the cognitions of individuals as they solved logical problems through association and interaction with another person. The purpose was to investigate the cognitive behaviors that occurred between two individuals as they

cooperatively work together to solve logical problems. Would they use formal operational thinking as suggested by Piaget, or would other cognitive behaviors, such as postformal operations, mediate problem solving in a social context? Another question to be addressed was whether or not the type of cognition would be related to the quality of the interaction between the two adults, such as individuals who are familiar and comfortable with one another, versus individuals who are familiar but uncomfortable, and/or individuals who are strangers. Our knowledge of adult cognitive development must be viewed as less than adequate until it is better understood how adults function cognitively in concert with other adults.

CHAPTER II

LITERATURE REVIEW

Overview

Recent theoretical and empirical work has begun to suggest that one of the most prominent theories of adult cognition, the theory of formal operations, may no longer be considered sufficient to fully explain adult cognitive behavior. The two most commonly cited shortcomings are first, the fact that most problems are "open-ended" and have multiple solutions, which are context-specific, yet the cognitive processes used to solve such problems are not clearly defined by Piaget. Second, the processes by which individuals influence one another's thinking as they solve problems together are also unclear in Piagetian theory. These two shortcomings suggest several issues which need to be considered in adult cognitive problem solving. First, if formal operations are inadequate in explaining all of the complexities of adult cognitive problem solving, it is possible there is another theoretical approach which might be more successful. Second, it is on very rare occasions that adults solve problems in social isolation (Meacham & Emont, 1989). The process of adult problem solving, therefore, must be understood in relation to the social context in which it occurs. For example, if another individual is participating in the problem-solving process, how might that person's presence influence the outcome, and would it vary depending upon the nature or quality of the interaction? Although empirical work in

the area of social cognitive development of children has explored the influence of interpersonal dynamics on the development of cognitive structure, similar work has not been done in the area of adult cognitive development. Similarly, cognitions may also be differentially influenced by the type of problem being solved. Mathematical problems would likely require very different cognitive processes than would social or interpersonal problems.

Recent research has begun to suggest styles of cognition may vary with the context and with each task, both of which may influence adult cognitive problem-solving processes. Relative to the issue regarding cognitive styles, research will be reviewed which has suggested that the literature regarding "postformal" (i.e., dialectical and relativistic) cognitions may be more successful in addressing the various types of cognitive behaviors demonstrated by adults. The second issue (i.e., the nature of adult cognition when solving problems in a social setting) will be addressed in an examination of the recent theoretical and empirical work which explores the relation between social interaction and cognitive processes. The issue related to the nature and quality of interaction will be addressed through the marital adjustment and social behavior literature. Examining the nature of social behaviors, particularly in a marital setting, will be useful in exploring the impact of the social context on cognitions. The third issue related to problem type (i.e., mathematical or social) will be addressed in terms of the influence of both types of reasoning on cognition as experienced by adults on a daily basis.

The Failure of Formal Operations

Formal operations are the final stage of Piaget's theory of cognitive development (Piaget & Inhelder, 1969). Formal reasoning typically develops between the ages of 11 and 15, through the formation of logical-mathematical thought structures (Piaget, 1971). This final stage of cognitive development represents Piaget's conceptualization of the nature of mature cognition. Piaget and Inhelder (1969) have identified three special characteristics associated with formal operational thinking: (a) formal thinkers are capable of constructing and testing abstract hypotheses by observing outcomes; and (b) they are able to reverse the relationship between possibility and reality. The realm of possibility may be envisioned as an infinite set of potentialities. This process allows the reasoner to generate testable hypotheses; and (c) the formal thinker is able to "think about thinking" by hypothetically generating propositions about what "could be possible" (Basseches, 1984a). The formal operational thinker, therefore, is able to generate all possible propositions and understand the various logical relationships between the propositions (Rybash, Hoyer, & Roodin, 1986).

The theory of formal operations as a final stage of adult development has come under criticism for various reasons. The primary criticism has been the overemphasis of scientific thinking processes which limit problem-solving operations to a finite number of relationships among variables, and are based on invariant and absolute rules and laws (Broughton, 1984; Kramer,

1983). Real-life, or "everyday" problems, in contrast, are typically "open-ended" problems which are defined and influenced by the context in which they are embedded. As such, they lend themselves to multiple solutions, and can be dealt with abstractly and systematically in more than one way (Basseches, 1978). Furthermore, although Piaget viewed individuals as self-transforming systems which develop through a subject-object relationship in which the subject and object mutually transform one another, he neglected to address the means by which cognition in adults is directed to personally meaningful problems, particularly problems that are social and interpersonal in nature (Broughton, 1984). Many Piagetian formal operational tasks have been shown to be relatively poor measures of complex problem-solving abilities, in that even intelligent adults often appear surprisingly incapable of solving formal problems. Meacham (1989) has suggested that formal operations "might be a poor foundation for further, positive development . . . because so few adults achieve complete formal operations" (p. 101). In a study by Papalia (1972) it was found that the proportion of adults who could successfully pass a volume task ranged from 50% to 75% (see also Papalia & Bielby, 1974). Hooper, Hooper, and Colbert (1984) found that in a sample ranging in age from 17 to 80 years 47% passed correlations tasks and 84% passed abstraction tasks. In a study which investigated formal operational ability using both "formal/logical" and "formal/everyday" tasks with two age groups, Sinnott (1975) found success rates varied from 11% to 100%. Early formulations of Piaget's theory assumed

that virtually all adults would achieve mastery over concrete and formal operations at some point in young adulthood (Inhelder & Piaget, 1958). These studies clearly indicate, however, that subjects do not always show mastery of the tasks at the formal operational level. These and other shortcomings of formal operational thinking have led researchers to search for, identify, and explicate adult styles of thinking that are qualitatively different from those espoused by Piagetian theory.

Inclusion of Postformal Operations

Styles of thinking unique to the adult years have been termed "postformal," and include various aspects of reasoning, which some have suggested are beyond those defined by formal operations (Basseches, 1980; Commons, Richards, & Kuhn, 1982; Labouvie-Vief, 1982; Pascual-Leone, 1983; Schaie, 1977-78; Sinnott, 1982). While each conceptualization remains theoretically unique, three characteristics of adult thought appear to be common among them, that is: (a) a non-absolute, relativistic understanding of the nature of knowledge; (b) an acceptance of contradiction as part of everyday reality; and (c) an approach to thinking which allows for integration of frames of reference (Kramer, 1983; Sinnott, 1984b). The two types of postformal cognitions most commonly discussed in the literature are dialectical processes and self-referential relativistic processes. Theoretical formulations for each of these processes, as well as the two combined, have received a great deal of attention in the recent adult cognitive literature.

Dialectical Operations

An early spokesperson for the dialectical perspective, Klaus Riegel, was one of the first to point out the inadequacies of Piagetian theory (Riegel, 1976). He suggested that individuals change via reciprocal interchange between various physical, social, and psychological states. Contradiction was viewed as the central feature of adult thought (Riegel, 1973). However, Riegel did not detail the elements of this interchange, nor did he apply his theoretical approach to systematic empirical study (Basseches, 1980; Bopp, 1983).

Sinnott and Guttmann (1978a) were the first researchers to study dialectic thinking in the adult years (Rybash, Hoyer, & Roodin, 1986). In a study on the use of dialectic principles in resolution of real-life problems, they examined thesis -> antithesis -> synthesis modes of thinking using Piagetian formal operational tasks. Different patterns of thought between conflict resolution and formal problem solving were found, with dialectical operations apparent in most cases. Basseches (1980) discussed the dialectical nature of postformal operations in terms of 24 conceptual schemata, grouped into four categories, which describe "moves in thought." Each of these calls attention to a specific type of dialectic thinking. Table 1 briefly summarizes each of these four categories of schemata (see Basseches, 1980 for a more detailed discussion).

Using these schemata, Basseches (1980) interviewed freshmen, seniors, and faculty members at a small college regarding their understanding of the function and process of education. He

Table 1

Overview of Basseches Dialectical Schemata

A. Motion-oriented schemata
1) Directs attention to actual or potential processes of change
2) Describes movement as dialectical in nature (e.g., thesis -> antithesis -> synthesis).
B. Form-oriented schemata
1) Directs attention to organized wholes
2) Recognizes and describes systems as systems
C. Relationship-oriented schemata
1) Directs attention to relationships
2) Describes relationships as two-way and reciprocal
D. Meta-Formal schemata
1) Directs attention to contradictions or sources of disequilibrium
2) Directs attention to resolution of disequilibrium through transformation
3) Directs attention to coordinating systems in relation
4) Directs attention to interdependence of form and content

(Adapted from Basseches, M.A. (1980). Dialectical Schemata: A framework for the empirical study of the development of dialectical thinking. Human Development, 23, 400-421.)

found that faculty members more often exhibited dialectic thinking than did seniors, and seniors more often displayed dialectic thinking than freshmen. In a similar study (Basseches, 1984b) conducted with freshmen, seniors, graduate students, and faculty members, he found that freshmen demonstrated more formal operational thought, that is, a single form of the dialectical schemata, and faculty exhibited all four of the groups of dialectical schemata. Both of these studies indicate that there is an increase in comprehension as well as preference for dialectical thought with progressively higher educational levels.

Relativistic Operations

The relativistic approach to postformal operations, as discussed by Sinnott (1981, 1984b), suggests that logical operations can be systematically used to relate, order, and select as most useful, one of several contradictory, but "true" formal operational systems. The main characteristics of relativistic postformal operations are (a) self-reference, and (b) the ordering of several formal operations. Self-reference is the awareness that all knowledge has a subjective component, and is, therefore, incomplete. One must ultimately select a set of rules for interpreting a problem. When an individual comes to recognize that higher order, self-referential truth systems must necessarily guide lower level decisions, self-referential thinking can then be consciously applied. The self-referential truth system gives order to lower level formal truth systems which can then be tested using the scientific method. Relativistic operations are, therefore, necessarily both logical (in that they imply use of formal operations) and subjective (in that they imply a choice of a formal system).

Interpersonal relations are similarly constructed and changed by individuals as they determine how the relationship will be defined. Each individual's frame of reference allows for subjective choice in definitions, as well as the ability to switch between alternative frames of reference depending upon context. The process of tolerating and permitting consensus between opposing perspectives, which arise through interaction, allows for alteration

in cognitive strategies and serves as the impetus of personal growth and development. Sinnott (1982) tested the presence of relativistic thought in mature adults by utilizing six problems designed to test for both formal and relativistic operations. These problems were administered to 79 adults between ages 26 and 89. It was not only found that most adults, particularly the older adults, demonstrated some form of relativistic thinking, but that relativistic operations were most frequently found when subjects responded to problems with an interpersonal relational component. In a study on the effect of presence of a partner on problem-solving performance, Sinnott (1984a) found that respondents in dyads more often solved formal operational tasks correctly than individuals solving problems alone. To date, however, no published studies have investigated in depth the relativistic nature of problem solving in dyads.

A Synthesis

Kramer (1983) synthesized both dialectical and relativistic thinking by reconceptualizing Piagetian theory within the framework of Peppers' (1942) analytic world views: formism, an absolute form of thinking; mechanism, systematic and scientific thought; contextualism, pragmatic present-oriented thinking; and organicism, integrated, growth-oriented thought. These world views provide the structure for a developmentally sequential framework for cognition in adolescence and adulthood. Formistic reasoning is characterized by absolutist thinking in which

contradiction is viewed to be logically impossible. Mechanistic reasoning, which developmentally follows absolute reasoning, is characterized by the process of reductionism in which the individual "elements" (such as traits) of social phenomena define the event (or relationship). Contextualism is characterized by the development of relativistic or pragmatic reasoning in which the individual becomes aware of multiple, and sometimes conflicting, frames of reference, as well as the influence of the contexts in which they are embedded. As the contexts change, so also do the frames of reference. Thus, change is an inherent part of reality.

Dialectical thought emerges from the organismic world view and is believed to develop during middle age (Basseches, 1980; Blanchard-Fields, 1986; Kramer, 1983; Kramer, Melchior, & Levine, 1987; Kramer & Woodruff, 1986; Labouvie-Vief, 1984; Pascual-Leone, 1983). This form of thought is characterized by an awareness of relational meaning as well as relative meaning. The individual elements of a system are influenced and defined by the system of which they are a part (such as a marital relationship or a family). A change in any part of the system results in changes in the system itself. Conflict is an inherent part of that process and is viewed as the impetus for growth. With each developmental level, beginning with formism which develops in early adolescence, to the more advanced levels of dialectical reasoning, which begin to appear in middle adulthood, the individual has progressively more reasoning tools available.

In a study which explored age differences in relativistic and dialectical thought using formal operational problems as well as two dilemmas designed to measure postformal reasoning, it was found that older adults showed higher frequencies of dialectical and relativistic thought (Kramer & Woodruff, 1986). Relativistic thought, however, was shown to be a necessary precondition to the development of formal operations; a finding which was quite unexpected. In a study on the communication processes of dating couples, relativistic and integrated thinkers reported more effective problem solving than non relativistic thinkers (Kramer & Levine, 1987). The social cognitive interactions and behaviors specific to problem solution, however, were not investigated, which has been the case throughout most of the adult problem-solving literature. Several researchers have suggested that social interaction is a significant factor in understanding adult cognition; however, this area has remained relatively unexplored.

Social Problem Solving

As suggested by the previous discussion, many researchers have begun to question whether problem solving is an internal process which occurs in social and intellectual isolation or a process which can only be adequately examined in relation to the context in which it occurs (Habermas 1984; Labouvie-Vief, 1982; Meacham & Emont 1989; Sinnott, 1984b; Vygotsky, 1978). Meacham & Emont (1989) have suggested that we are able to restructure our cognitions in creative ways. Specifically,

> . . . it is in dialogue with others that one's mental sets are broken, as friends suggest new ways of thinking about situations, point to inconsistencies in our logic, provide a counterbalance to our emotional attachments in the situation, and suggest new means for solving our problems. (p. 10)

Each individual makes a contribution to the process of problem solving, in a way that, perhaps, no other can make, thus providing a "missing link" to the solution.

Social cognition is the process of two or more individuals creating--on a moment to moment basis--the nature of the interaction. This interplay exists in any relation between individuals, and is manifested through the type of problem-solving behaviors brought to bear on the situation. Sinnott (1989b) has described "knowing" in postformal thinking as,

> an exercise in the study of ill-structured problems and their solutions. Since the known is co-created by the awareness of the knower and the qualities of the known, the consciousness of the knower, the filters of the knower, the intentions of the knower, and the emotions of the knower are important to the cognitive experience. (p. 65)

Viewed from a developmental perspective, it follows that developmental level will influence how the individual perceives the relationship, the interaction, and the solution of problems.

The relation between social interaction and cognitive development has been investigated from various perspectives. In the clinical area, interpersonal problem solving in the marriage has generally addressed adjustment and negotiation processes within couples by observing as the couple attempts to resolve marital

issues in an experimental setting (Jacobson, 1984; Miller, Lefcourt, Holmes, Ware, & Saleh, 1986). In the social psychology literature researchers have investigated the relation between social adjustment and social cognitive development in children and adolescents (Selman, 1980, 1981; Selman & Demorest, 1984; Selman & Yeates, 1987). The relation between positive adaptive functioning and cognitive performance has been noted in studies reviewed by Yeates and Selman (1989). The presence of "social perspective-taking" in interpersonal negotiation strategies in children is a basic structure of social reasoning in Selman's (1977) Structural-Developmental Model of Social Cognition in early childhood and primary years. In two studies conducted with children between the ages of 5 and 8, Doise, Mugny, and Perret-Clermont (1975) demonstrated that children working in a social setting were able to successfully perform a task involving spatial coordinations that children of the same age working alone could not. Similarly, children who had not previously demonstrated conservation acquired the operations after having actualized them in a social setting. Pre-test and post-test results from a control group demonstrated that learning had not occurred as a consequence of maturation. These results suggest that social interaction may in fact exercise a causal effect on cognitive development in children. It was suggested by these authors that the mechanism by which this occurs is through the cognitive conflict which arises from the discussion of differing points of view and later resolved as a function of the social setting.

In a discussion of social regulations in the cognitive development of children Mugny, De Paolis, and Carugati (1984) suggest that opposition arising from divergent cognitive structures enables a child to question his or her own system of responses. This creates a "disequilibrium" and results in the elaboration or "co-elaboration" of a more advanced cognitive structure. Social dynamics which hinder the progress of cognitive development would include those in which one partner becomes more submissive or chooses to "take a back seat" to avoid conflict, thus denying the equal participation of both partners.

Clearly the above work suggests that social interaction is a significant corollary of cognitive development in children. No studies, however, have attempted to extend these same conceptual assumptions to the cognitive development of adults. A possible reason for this is the difficulty in identifying and defining cognitive behaviors as adults solve logical problems, and the process by which they alter cognitive structures in a social setting. Children may be more able and willing to investigate their own thinking in view of opposing perspectives, whereas adults, who perform formal operations, may not be as willing to evaluate the internal cognitive structures which produce solutions. The use of problems which resemble those commonly encountered by adults on an everyday basis and the thinking aloud methodology will allow for the investigation of cognitive behaviors which contribute to problem solving in a social setting.

Social Cognition in the Marriage

Implied throughout this review has been an underlying assumption that cognitive behaviors are an integral part of the nature of a martial relationship. Several researchers have discussed the relation between cognitive behaviors and marital adjustment (Basseches, 1984b; Bopp & Weeks, 1984; Fitzpatrick, 1988; Kramer, 1989). For example, Basseches (1984b, p. 26-27), described a couple who characteristically demonstrates "formal" thought as likely to view the marriage as composed of two distinct individuals, each maintaining a fixed and stable set of traits which exist independently. The relationship would likely be characterized by simple and static interactions. Conflict would be viewed as the result of permanent flaws or shortcomings in either the husband's or wife's personality (one of the partners had "made a bad choice"). The dialectical couple on the other hand would likely view the relationship as constantly evolving over time. The personalities of both individuals would be viewed as existing only in the context of the relationship in which they were created. In both cases, the couple "co-creates" their knowledge of one another and that knowledge becomes the basis from which they act to co-create their relationship.

Similarly, from the theoretical approach based upon Pepper's world views, Kramer (1989) has recently developed a model of change and stability in marital relationships. It was suggested that those reasoning absolutely would tend to blame the cause of conflict on one individual in the relationship, via enduring psychological

traits, thus reducing the likelihood that a relativistic perspective would occur. The "one correct" solution would be selected at the expense of alternative perspectives. Absolute reasoning is characterized by "polarized thinking," or the tendency to think in "black and white" terms. This type of reasoning often leads to stereotypic and defensive responses, which are considered maladaptive (Deutsch, 1969).

A question to be addressed is whether or not social behaviors demonstrated by high adjusted or low adjusted married couples are also related to types of cognitive behavior. A seminal work in this area is that of Fitzpatrick (1988) in which she suggests that,

> the study of communication in marriage represents a potentially rich intersection of the cognitive and the social. The construction of dialogues is the way social cognition manifests itself. Conversation is inherently social because it involves the transmission of messages between at least two eople and it is cognitive in that communication requires cognitive activity. (p. 256)

To fully establish the relationship between cognition and marital adjustment, it is useful to explore the specific social behaviors demonstrated by couples as they solve problems in a social setting.

The literature regarding social characteristics of well and low adjusted couples, marital adjustment, and conflict resolution suggests that a primary predictor of marital satisfaction is the communication processes between married partners (Fitzpatrick & Badzinski, 1985; Gottman, 1979; Noller, 1980). Happy couples exhibit more nonverbal positive affect cues (Rubin, 1976); agreement and approval (Birchler, Weiss, & Vincent, 1975);

attempts to avoid conflict (Rausch, Barry, Hertel, & Swain, 1974); supportive behaviors and compromises (Birchler et al., 1975); agreement than disagreement in conversations with their spouses (Gottman, 1979); and less criticism of each other (Gottman, Markman, & Notarius, 1977; Rubin, 1976).

Unhappy couples are more likely to use negative communication behaviors, to demonstrate an imbalance in emotional dominance (Levenson & Gottman, 1983); and to use a multitude of behaviors which allow one or both spouses to avoid the conflict. An assumption of several models of marital communication and conflict resolution is that avoidance leads to constricted communication, less ability to solve problems, and the increased probability of poor marital adjustment (Fitzpatrick, 1988).

Sillars (1986) has developed a coding scheme which identifies seven differences in couples' communication strategies which can be organized into three basic categories: (a) avoidance behaviors, which include denial, evasiveness, topic avoidance, and joking; (b) cooperative behaviors, which include disclosure, description of the problem, requesting feedback, empathy or support, and making concessions; and (c) competitive behaviors, such as criticism, hostility, sarcasm, or rejection. Pruitt and Rubin (1986) have identified four basic strategies for dealing with conflict, that is, (a) conflict avoidance, which includes unassertive or noncooperative behaviors; (b) accommodation or yielding, which is the process of yielding to a stronger or more dominant partner, in the attempt to

avoid conflict; (c) problem solving or collaboration, which is accompanied by behaviors indicative of assertive cooperation, validation, and empathy; and (d) competition or contending, which is high in assertiveness and low in cooperation. Birchler et al. (1975) have identified agreement, approval, and humor as positive verbal social reinforcers in marital interaction, and assent, laughter, smiling, or positive physical contact, as positive non-verbal social reinforcers. Criticism, denial of responsibility, use of excuses, and complaining were considered negative verbal social reinforcers, and ignoring, or inattention as negative non-verbal social reinforcers. These three models suggest that there are distinctive behaviors specific to well and low adjusted couples, and that the behaviors either facilitate or inhibit communication, which ultimately affects marital adjustment.

It is possible these social behaviors may be related to the type of cognitions demonstrated as well. Lewis and Spanier (1979) have characterized high quality marriages as those in which spouses maintain high mutual positive regard, open emotional expression, mutual validation of self and other, and identity of the couple as a couple. Relativistic and dialectical reasoning allows for the validation and synthesis of opposing perspectives, as well as for development and transformation of couple identity through open communication and mutual respect. Thus, if a low adjusted couple typically uses more intrusive or negative problem-solving strategies, as suggested by Pruitt and Rubin (1986), it is possible that less dialectical or relativistic cognitions will be found. If, on

the other hand, a relationship is characterized by open, supportive, collaborative efforts to explore all possible solutions, indicators of high marital adjustment, dialectic or relativistic cognitions would be more probable.

As suggested earlier, the nature of the problem may also differentially affect the type of cognitions couples use, or vice versa, couples may demonstrate different types of cognitions, depending upon the nature of the problem, as well as the nature of the relationship. The use of two types of problems will allow for the exploration of these differences in adult cognitive problem solving.

Difference in Problem Solving as a Function of Problem Type

Formal/logical problems are typically mathematical problems based upon Piaget's view that knowledge of the physical world evolves through the formation of logical-mathematical systems of thought. According to Piaget, the formal thinker uses logical, rational analyses to provide the single correct solution. Formal operational problems typically contain some mathematical tasks, such as combinations, hierarchical classifications, class inclusions or proportions, based upon logical operations (Rybash et al., 1986; Sinnott, 1989a).

More recently, however, researchers have begun to suggest that adults might show mastery of formal operations under conditions similar to those consistent with "everyday" experiences. Problems have been developed (see Sinnott & Cook, 1989 for an

overview of problems commonly used) which retain the same underlying "logical" reasoning but which test formal operational ability within nonmathematical contexts adults experience on a daily basis.

Another factor relevant to problem type is what is referred to as "structuredness." Traditionally problem-solving research has been from an individualistic approach using well-defined tasks with only one correct solution. Typically the tasks are presented one at a time, they include no value judgements, and create a relationship of inequality in power between the research participant and the researcher, in that the researcher is in possession of the answer and has no intention of disclosing it (Meacham & Emont, 1989). Researchers have questioned the ecological validity of research as applied to everyday problem solving when viewed from this perspective (Guttmann, Sinnott, Carrigan, Holahan, Flynn, & Mullaney, 1977; Meacham and Emont, 1989; Sinnott, 1975; Sinnott & Guttmann, 1978b). Rather, ecologically sound problem-solving research should allow the respondent to (a) draw from interpersonal resources, (b) solve problems in which both goal and solution are unclear, and (c) address value issues as part of the process of defining and solving the problem. This approach allows for the solution of several interwoven problems; and concomitantly, the generation of several possible solutions. Formal/logical or "abstract" problems, then, are those with well-defined boundaries and/or solutions, and are based upon scientific or logical concepts. "Ill-structured," "everyday" problems are those with no single

correct answer, and which are embedded in everyday life experiences (Sinnott, 1982, 1983, 1989a). The perspective of the problem solver often determines how the problem will be viewed. It is possible that the same problem may be viewed from both the formal/logical perspective as well as from the formal/everyday perspective by the same and/or different individuals. Which approach is used, if either, will depend upon how the dyad chooses to define and solve the problem.

The methodology for exploring these types of cognitions is critical to understanding not only the outcome of the problem-solving process, but the process itself. One unique methodology which has shown promise in this type of research has been referred to a "thinking aloud methodology," and will be discussed below.

Thinking Aloud Methodology

With its beginnings in artificial intelligence literature (Ericsson & Simon, 1984) the thinking aloud (TA) approach to problem solving provides the vehicle for observing the flow of cognitive operations during problem solving. This methodology has been used with success in several developmental and aging studies to investigate cognitive operations during problem-solving tasks (Giambra, 1983; Kramer & Woodruff, 1986; Rowe, 1984; Sinnott, 1983, 1984; see Ericsson & Simon, 1984a, 1984b; for a complete bibliography).

In their book published in 1984, Ericsson and Simon addressed the significant aspects of thinking aloud methodology,

that is, theoretical assumptions, instructions, coding, hypothesis testing, and effect of TA method on results. They differentiated between three levels of verbalization. The first level is the simple "vocalization of covert articulatory or oral encodings," i.e., responding verbally to rehearsal tasks in short-term memory. The second level involves description or explication of one's thought content, and the third level requires the subject to explain the thought process. This third level includes linking thought content to previously encoded information.

Studies have been designed to evaluate the effects of level two verbalizations on cognitive performance. Experimental and control groups were exposed to identical conditions. Experimental groups were instructed to think out loud while solving the problem and control groups solved the problem silently. Several such studies found no reliable differences in number of correctly solved problems, or speed of decision, between the thinking aloud groups and control groups (Brehmer, 1974; Walker, 1982; Weisberg & Suls, 1973). One study found that thinking aloud increased solution time, but did not have an effect on the average number of solutions (Deffner, 1983). Another method for examining thinking aloud protocols is to compare concurrent verbal reports and retrospective verbal reports for similarity. One such study found no overall differences between the control and experimental conditions which provided concurrent reports and retrospective reports, with the exception that concurrent verbalizing took longer than the silent condition (Russo, Johnson, & Stephens, 1984). Based upon these results and others, Ericsson and Simon (1984) suggest that verbally

reported data are reflective of, and do not significantly alter, sequence or content of cognitive processes.

There are several approaches to the TA strategy which include, (a) presenting a written problem and asking respondents to verbalize their thoughts as they work on a problem, (b) taking notes rather than recording, and asking questions upon completion, (c) following the same procedure as outlined in (a) above, with the exception of asking questions to clarify comments which were made while thinking aloud, and (d) asking respondents to say whatever comes to their mind as they work on the problems, even if it doesn't seem to matter. When the respondent has completed the task, the experimenter would ask questions to clarify thought processes (Sinnott, 1989a). The last approach is the least intrusive strategy yet allows for obtaining the most information.

Summary

Complex cognitive processes of the adult solving problems within a social context are not well understood. Piagetian theory has been one of the most productive in terms of generating information regarding adult cognition. However, Piaget's conceptualization of mature cognition is unable to address many kinds of thought processes researchers are now beginning to identify. In many instances, adults have not demonstrated mastery of abstract logical thinking as expected from the Piagetian perspective. Furthermore, it has been suggested that formal operations are not, in fact, the final stage of adult cognitive

development as described by Piaget. Styles of thinking beyond those identified as formal operational may be more effective in explaining some logical problem-solving behaviors, particularly those which mediate problem solving in a social setting.

It is possible that one reason why adults have not been shown to be highly successful in solving logical problems is that they have been studied from an individualistic perspective in which the adults were required to solve logical problems in isolation. Yet, this methodology would be inconsistent with the everyday experience of adults in which very few problems are actually solved without at least some access to external resources and feedback through social interaction.

Finally, because most studies have examined how adults solve logical problems in isolation, little is known about how social composition of dyadic problem solving will affect cognitive performance. What aspects of the interaction, if any, are related to the cognitive style of problem solvers? Will the interaction alone be enough to generate variation in thinking style, or will differences be related to the type and/or quality of the relationship? The literature has suggested that the best way to study how these cognitive mechanisms operate, and whether or not they vary according to dyadic adjustment, is to provide everyday logical problems in a social setting in which adjustment is a factor, using the thinking aloud methodology.

CHAPTER III

PURPOSE AND METHOD OF THE STUDY

Purpose of the Study

The purpose of this study was to explore the nature of cognitive performance of dyads in a social setting; to examine the effects of social environment, as measured by marital adjustment, on cognitive performance; and to determine whether or not a familiar relationship, versus an unfamiliar relationship, is a factor in logical problem solving. Problem-solving behaviors were examined in four settings, that is, high adjusted and low adjusted married couples solving problems as a dyad; and high adjusted and low adjusted married couples solving problems in stranger dyads.

In regard to whether or not social interaction would contribute to dyadic problem solving, it was proposed that high adjusted couples would be more effective problem solvers. Kramer (1989) has suggested that "mature" cognitive processes, characterized by relativistic and/or dialectical reasoning, are seen as necessary for healthy adaptation in marital dyads. The process of tolerating contradiction, and permitting consensus between opposing perspectives as partners generate solutions, serves as an impetus for personal growth and development. Low adjusted couples, on the other hand, would be resistant to adopting relativistic and dialectical modes of thinking when necessary in that they would be, (a) less able to flexibly adapt to the demands of the situation, and (b) less likely to gain from those "missing links"

which generate answers (i.e., they would be less able to consider multiple solutions generated by interactiveness). Conflicts would not be viewed as an opportunity for development through resolution or synthesis, but as the result of opposing frames of reference to which only one correct solution can apply. The lack of creative and cooperative behaviors would reduce the opportunity for exploration of opposing perspectives, thus, problem-solving effectiveness would likely be reduced, and less relativistic or dialectical modes of thinking would be observed. Cognitive behavior, therefore, may mediate problem-solving behavior in marriages, which would in turn affect growth and development between the partners, and ultimately, marital adjustment.

The advantage of including the female/male stranger dyad in this study was that, theoretically, it would separate cognitive performance from "relationship" performance for both well and low adjusted couples. As indicated earlier, individuals who are familiar and comfortable with one another are likely to generate and agree on ideas and solutions quickly through creative and cooperative problem solving. Solving problems in stranger dyads would allow for the investigation of cognitive functioning in a social setting without the direct influence of relationship issues. The boundary between personal a priori's and marital relations is less permeable than that of married couples, thus, marital dynamics would be less related to the cognitions produced by stranger dyads. The comparison of high adjusted couples and low adjusted couples in

stranger dyads would allow for the exploration of cognitions produced outside of the marital relationship.

Table 2 briefly summarizes each of these objectives and related hypotheses.

Table 2

Overview of Objectives and Hypotheses

Objective 1. To examine cognitive performance of individuals as they solve logical problems in a social setting.

Hypothesis 1: The interactive process will allow for creative cognitive problem solving. Formal and postformal operations will be observed as measured by:

1.a: mastery of tasks at the formal operational level

1.b: presence of relativistic and dialectical reasoning.

Objective 2. To examine whether or not there is a relationship between marital adjustment and the type of cognition generated.

Hypothesis 2: High adjusted couples will be more effective problem solvers in that they will evidence better cognitive development demonstrated by:

2.a: mastery of tasks at the formal operational level

2.b: relativistic and/or dialectical problem-solving behaviors (flexibility in problem exploration, ability to gain from differing or opposing perspectives through synthesis or integration, more able to consider multiple solutions, etc.).

2.c: social behaviors which serve to facilitate effective cognitive problem solving (more cooperation in problem exploration, use of collaborative, supportive, or flexible communication styles, etc.).

Hypothesis 3: Low adjusted couples will be less effective problem solvers in that they will demonstrate:

3.a: less mastery of tasks at the formal operational level.

3.b: less relativistic and/or dialectical problem-solving behaviors (less flexibility in problem exploration, less synthesis or integration of opposing perspectives, production of fewer solutions.

3.c: social behaviors which either inhibit or fail to promote effective cognitive problem solving (less cooperation, overly assertive, withdrawal, avoidance, hostility, etc.).

Objective 3. To discover whether problem-solving behaviors of stranger dyads are qualitatively different than married dyads.

(table continues)

Table 2 (Continued)

Hypothesis 4. High adjusted married dyads will be more effective problem solvers than high adjusted stranger dyads as evidenced by:

4.a: greater mastery of tasks at the formal operational level.

4.b: more relativistic and/or dialectical problem solving behaviors (flexibility in problem exploration, ability to gain from opposing perspectives through synthesis or integration, more ability to consider multiple solutions, etc.).

4.c: more frequent social behaviors which serve to facilitate effective cognitive problem solving (more cooperation in problem exploration, use of collaborative, supportive, or flexible communication styles, etc.).

Hypothesis 5. High adjusted stranger dyads will be more effective problem solvers than low adjusted stranger dyads as evidenced by:

5.a: greater mastery of tasks at the formal operational level.

5.b: more relativistic and/or dialectical problem-solving behaviors (less flexibility in problem exploration, less synthesis or integration of opposing perspectives, production of fewer solutions).

5.c: more frequent social behaviors which serve to facilitate effective cognitive problem solving (more cooperation in problem exploration, use of collaborative, supportive, or flexible communication styles).

Hypothesis 6. Stranger dyads who are well or low adjusted will be more effective problem solvers than low adjusted married dyads as evidenced by:

6.a: greater mastery of tasks at the formal operational level.

6.b: the tendancy to agree to view the problem formally, with greater flexibility in considering multiple solutions, but less tendancy to raise issues which result in discussion of opposing perspectives, fewer solutions.

6.c: more frequent social behaviors which facilitate effective cognitive problem solving (less tendancy to challenge others' perspective, increased cooperation), yet more emphasis will be placed upon accommodation and/or yielding than might be found in high adjusted couples.

In Summary: Hierarchically, high adjusted married couples will demonstrate more postformal cognitions, and more positive social behaviors. Stranger dyads will likely demonstrate postformal thought processes, however, not to the same extent as high adjusted couples, and they will be qualitatively different in social behaivors. High adjusted and low adjusted stranger dyads will evidence more postformal cognitions and more positive social behaviors than low adjusted married dyads.

Method of the Study

Subjects

Approximately 40 couples between the ages of 35 and 50[1], who had been in their present marriages between five and thirty years, were recruited through advertisements placed in several local university and college campuses, and in the local newspapers. Several counseling centers were also contacted for possible referrals of couples involved in marriage and/or family counseling. The mean age of the overall sample was 40.5 years (SD = 5.0). Of the high adjusted group, mean age was 41.1 years (SD = 5.2) and mean age of the low adjusted group was 39.8 (SD = 4.7). Educational level appeared to be similar across the two groups with educational levels ranging from high school degrees to Ph.D.'s. Income was also quite similar across the two groups. However, with at least half of the sample earning $3500.00 per month, and over, it appears these participants were fairly well educated and from the middle income bracket. Generalizability to lower income groups may, therefore, be limited. This is also true of racial background. Of the 80 participants, 76 were Caucasian, two were African American, and two were Hispanic. This sample is not sufficiently balanced across racial groups to allow cross-racial generalizability. Approximately 25% (N = 20) of the sample reported having been married

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[1] Several researchers have suggested that one becomes aware of contradiction, and to think relativistically in early middle age, or around the age of 35. Whereas, older adults, 60 and older, tend to produce dialectical cognitions. Thus, to allow for maximum performance of relativistic thinking , the age range was restricted to 35 to 50 (Labouvie-Vief, 1980; Pascual-Leone, 1983; Levinson, 1978).

previously. Of the high adjusted group, as measured by the Dyadic Adjustment Scale, all of those who had been married previously (N = 10) reported the current marriage was "much better." Of the low adjusted group, only four of those previously married (N = 10) described the present marriage as much better. A summary of the sample characteristics can be found in Table 3.

Materials

Dyadic Adjustment Scale

The Dyadic Adjustment Scale (DAS) (Spanier, 1976) is a widely used self-report questionnaire which measures individual's perceptions of marital adjustment. Spanier (1976) viewed marital adjustment as a process, or "movement along a continuum which can be evaluated in terms of proximity to good or poor adjustment" (p. 17). This measure has four dimensions: dyadic cohesion, dyadic satisfaction, dyadic consensus, and affectional expression which were empirically verified during test construction. When compared to the Locke Wallace Marital Adjustment Scale (an earlier, frequently used measure for marital adjustment, Locke, 1951), an overall correlation of .93 was found. The Locke Wallace was not selected because standardized scores for highly adjusted and divorced couples are not available for the Locke Wallace. Using the Cronbach's Coefficient Alpha, the authors reported reliability coefficients for the DAS total scale as well as each of the subscales. Total scale reliability is .96, with subscale reliability ranging from .73 for affectional expression to .94 for dyadic satisfaction. Dyadic

Table 3

Sample Characteristics of Individual Participants

	Overall (N = 80)	High Adjusted (N = 40)	Low Adjusted (N = 40)
Education			
High School	12	4	8
One to Three Yrs Col.	27	14	13
Bachelor's Degree	21	8	13
Master's Degree	17	12	5
Ph.D. Degree	3	2	1
Income Per Month			
$0-1500	6	3	3
$1501-2500	14	3	11
$2501-3500	16	6	10
$3500 and above	37	23	14
Income Fluctuates	7	5	2
Race			
Caucasian	76	40	36
African American	2		2
Hispanic	2		2
Number of Years			
Present Marriage	14.8 (5.7)	15.4 (6.0)	14.1 (5.3)
Previous Marriage			
Yes	20	10	10
No	60	30	30
Number of Years			
in Previous Marriage	9.7 (4.6)	10.3 (5.2)	9.1 (4.0)

Note: Standard deviations are reported in parentheses.

Consensus reliability was .90 and Dyadic Cohesion was .86. In a study of concurrent validity with a sample of 218 married couples and 94 divorced couples, the mean total scores were 114.8 and 70.7, respectively. These total scores were significantly different at the .001 level.

Internal consistency for the scores obtained in this sample was assessed through the Cronbach's Coefficient Alpha. Reliability coefficients closely reflected, or exceeded, those reported by the authors, in that total scale reliability was .96, affectional expression reliablility was .65, dyadic satisfaction reliability was .92, dyadic consensus was .91, and dyadic cohesion was .89.

The subscales determined to be most theoretically related to cognitive functioning were dyadic cohesion, dyadic consensus, and dyadic satisfaction. The first of these (dyadic cohesion) consists of five questions which address involvement in outside interests, and the ability to exchange ideas, laugh together, calmly discuss a subject, and work together on a project. The dyadic consensus subscale consists of 13 questions which measure agreement between spouses on finances, religion, sexuality, philosophy of life, household tasks, and career decisions, among others. Dyadic satisfaction addresses issues related to communication between spouses, that is, frequency of discussing divorce, leaving the house after a fight, frequency of quarreling, and the ability to confide in the spouse. This scale consists of ten questions. Each of these content areas suggests the use of relativistic and dialectical thinking, that is, the ability to switch between alternative frames of

reference depending upon the demands of the context, and the ability to permit consensus between opposing perspectives. Although it was suggested that the three subscales mentioned above would be most related to cognitive functioning, in terms of measuring overall marital adjustment, the three subscales were so highly correlated with the total dyadic adjustment score ($r = .99$; $p < .001$) that the decision was made to incorporate the fourth scale as well. Scores on each of the subscales were obtained, as well as a score for overall adjustment. A sample of the Dyadic Adjustment Scale can be found in Appendix A.

Ammons Quick Test

The Ammons Quick Test (Ammons & Ammons, 1962) was designed for quick screening of verbal-perceptual intelligence in practical situations. It can take between 3 and 20 minutes to administer and score depending upon the number of forms used. Studies investigating the concurrent validity of the QT using the verbal subscale of the WAIS (Wechsler, 1955) as the standard, have shown the QT and WAIS Full Range Picture Vocabulary Test to be measuring similar abilities (Abinidin & Byrne, 1967; Cull & Colvin, 1970). Product-moment correlations of the WAIS Verbal Scale and the QT were .80. QT validity estimates, obtained during standardization for white adults who were representative of U.S., non-farming population, for forms 1, 2, and 3, were .89, .90, and .85, respectively. In a reliability study with a sample of 90 U.S. Caucasian adults age 25-43, predicted reliabilities ranged from .92 to .95, depending upon forms.

Two forms, forms 1 and 3, were used for this study to allow for determining equivalence reliabilities. This was done using a Pearson's Product Moment Correlation matrix for form 1, form 3, and form 1+3. Equivalence reliabilities ranged from .65 to .91, depending upon the form. These correlations range from moderate to high. Form 1+3 was used for participant screening.

Demographics Questionnaire

This brief questionnaire provided information regarding age, race, education, occupation, income, and number and length of present and previous marriage(s). This information was useful in post hoc analyses related to problem solving, and is reported in the results section. A specimen copy of the demographics questionnaire can be found in Appendix B.

Problems

Five problems, developed by Sinnott (1984b), were used in this study (located in Appendix C), and can be described as formal/logical and formal/everyday. Each of the problems contains salient response variables which, depending upon the cognitive a priori's of the participants, elicit different types of responses. Two of the five problems are formal logical (or mathematic in nature), while three problems are formal/everyday with both mathematic and interpersonal, or social, elements. These problems have been the resource of other studies (Sinnott, 1975, 1982, 1983, 1984a, 1984b, 1987).

Probe Questions

Questions (or probes) were used to determine how the problem was resolved, to clarify solutions verbalized during the problem-solving process, to determine whether or not both partners agreed upon the solution, and to explore previous experience with similar problems. The purpose for these probes was to clarify moves in thought which were not made explicit while thinking aloud about the problem. As discussed in the literature review, these moves of thought are often characteristic of levels of formal and postformal operativity. These probes can be found in Appendix D.

Procedure

To ensure adequate verbal skills, the participants were required to meet minimum requirements for verbal ability using the Ammons Quick Test. With a standardized mean of 125 and standard deviation of 16, participants were screened from the study if verbal intelligence scores were less than a raw score of 95, or approximately two standard deviations below the mean. Subjects were also screened according to their present level of marital adjustment using the Dyadic Adjustment Scale. A standardized mean of 114 with a standard deviation of 17 was reported by Spanier (1976) for high adjusted couples. Thus, a cut-off score of 115 was used to select high adjusted couples, and resulted in an overall mean of 126 for the maritally high adjusted group. To create a low marital adjustment group, only those

subjects scoring 105 or below, approximately one-half standard deviation below the standardized mean for high adjusted couples, were included in the study. This created an overall mean of 89 for the maritally low adjusted group. The means for the two groups were approximately two standard deviations apart.

Eighty-three couples were recruited for participation; however, screening scores for verbal ability and marital adjustment resulted in the elimination of 33 couples from the study. Five couples were also dropped because one or both partners did not meet the age requirements, and five couples were dropped because standardized testing procedures were not followed. Because it became increasingly difficult to recruit couples who met the age, verbal IQ, and DAS score criteria, toward the end of the testing period it became necessary to advertise the availability of a stipend for participation. Twelve couples were awarded either $40.00 or $50.00 stipends, depending upon whether or not babysitting was required. The final sample consisted of 40 couples, twenty high adjusted couples and twenty low adjusted couples, each of whom were then randomly assigned to participate in one of two dyadic settings, stranger or married.

Following the prescreening process and random assignment of each participant, the dyads were assigned participant numbers, which were used for identification purposes, then escorted to a room equipped with a table, two chairs, and paper and pencils lying on the table at each seat. The experimenter read the "thinking aloud" instructions to the participants while they followed along

with the instructions presented at the front of their test booklets. They were then asked to read the first question out loud for practice, and to inform the experimenter when they reached a solution. The problems were presented in a booklet arranged in a counterbalanced order to control for learning effects.

Each session was videotaped by the experimenter, beginning with the instructions, and participants averaged about 1 hour and 15 minutes to complete all five problems. Following each problem, the experimenter probed the dyad's responses. Participants were debriefed about the purpose of the study (i.e., cognitive problem solving in interpersonal relationships where adjustment may be a determining factor in cognitive performance) at the conclusion of the problem-solving exercises. Those participants who were awarded stipends were given the stipends immediately following testing.

Coder Training

Three independent coders, who were blind to the hypotheses under investigation as well as the marital adjustment or dyadic setting of the dyads whose videos they scored, were trained in observational evaluation procedures. Each coder was to rate a particular couple for presence of (a) formal operations, (b) relativistic operations, (c) self referential operations, (d) dialectical operations, and (e) social behaviors.

The coders were first given several research papers describing each of the categories and subcategories of cognitive

behaviors to be scored. Examples were presented in a training video of three problem-solving episodes. These examples were discussed and scored under the direction of the principal investigator. Following these training procedures, coders were given a second training video of five pre-scored episodes and asked to score them independently. The experimenter then met with the coders and all discrepancies and questions were clarifed. The coders were required to achieve proficiency at .80 inter-rater reliability before beginning. When sufficient inter-rater reliability was not achieved within the five training exercises, additional training was provided, and coders were evaluated for possible rater biases. Inter- and intra-rater reliabilities were randomly checked. When scoring slippage occurred, additional retraining was provided. One rater was unable to complete all of the scoring, and one rater was unable to achieve sufficient inter-rater reliability. The majority of the tapes were scored by one rater although inter-rater reliabilities were well established before the scorers dropped out.

Scoring

Cognitive Behaviors

Verbal behaviors indicative of formal and postformal thought processes were operationalized and scored within the guidelines of the paradigm outlined by Sinnott (1984b). An overview of the steps utilized in the scoring procedure for cognitive behaviors can be found in Table 4. Each problem received a quantitative score, and two qualitative scores. The quantitative score represented the

Table 4

Cognitive Behavior Scoring Procedure

Step One: Formal Operational Scoring

A. Abstract Formal Operations. A correct numerical answer must be given, plus a description of the variables to be manipulated and the heuristic used to do so. The correct numerical solutions are as follows:

Camp: 15 trips
ABC: 15 pairs
Bedroom: 15 combinations
Power: 9 possible relationships
Vitamin C: 15 pairs, except grapes, which require two portions

B. Alternative "Everyday" Solutions. A numerical solution must be given which is consistent with the "real-life" approach taken to the problem. The salient variables must be identified, and an heuristic for attaining the solution must be given.

Step Two: Relativistic Scoring

A. Determining Presence of Relativistic Thinking. The following criteria must be met to achieve a positive score for relativistic thinking:

1. the presence of two or more problem definitions,
2. the presence of a metatheory shift between two or more definitions,
3. the presence of two or more parameters per definition,
4. two or more solutions based upon related definition and reflected in the parameters,
5. the presence of a process/product shift.

B. Determining Presence of Self-Referential Thinking. A statement must be made in which the dyad recognizes and agrees that they are ultimately responsible for defining what is "true," then proceed to solve the problem according to agreed upon "realities."

Step Three: Dialectical Scoring

A dyad will be scored for dialectical processes if they demonstrate the ability to synthesize two or more opposing relativistic solutions into a single dialectical whole. Each relativistic solution must first meet the criteria for relativistic thinking. The solutions must then be synthesized in such a way that a new solution is created which is conceptually beyond either of those described alone.

ability to apply appropriate logical mathematical operations in solving the problem formally, as described in Step 1 below. The two qualitative scores consisted of a score for relativistic operations, and dialectical operations as described in Steps 2 and 3.

Step 1 - formal operational responses. Step one scoring consisted of two possible response types, abstract formal operational, and alternative "everyday" solutions.

A. Abstract formal operational. A dyad was considered "abstract formal operational" on a problem if a correct numerical answer was given, and the subject correctly described how the answer was obtained, which variables were manipulated, and the heuristic used to make exhaustive combinations. If a correct solution was given, the dyad was assigned a "pass" score, or "1," for formal operations on that problem. A "fail" score (or "0") was given for each incorrect solution. Pass/fail scores were assigned based upon the following responses for each problem.

Camp: 15 trips

ABC: 15 pairs

Bedroom: 15 combinations

Power: 9 possible relationships

Vitamin C: 15 pairs, except grapes, which require two portions

B. Alternative "everyday" solutions. Along with the abstract formal solution, participants could also generate alternative solutions from differing view points. For example, the bedroom problem may be solved as an abstract formal problem, with a solution of 15, or as a "real life" problem which involves everyday,

"socially correct," solutions. The real-life solution was scored as a "pass" for formal operations, if a correct logical answer was given in terms of the salient variables identified. A "fail" score was given if the answer given did not correspond to the variables and/or heuristic chosen to solve the problem.

If the participants generated both a formal and an alternative solution, they were credited with a "metatheory shift" in thinking from one perspective to an alternative, which is an indication that relativistic thinking may be present. Presence of relativistic thinking was then scored separately using the following step.

Step 2 - relativistic scoring. Step two consisted of two possible levels of cognitive complexity. The first was relativistic thinking, which identified five criteria to be met. The second was self-referential thinking.

A. Determining presence of relativistic thinking. Relativistic processes include both logical, or formal, operations and "necessary subjectivity" which implies a choice among several possible formal solutions. According to Sinnott (1982) "relativistic operations . . . permit selection of one formal system among many where several could apply" (pg. 13). These two thought processes were operationalized in terms of specific cognitive behaviors which indicated an increased ability to view a problem from multiple perspectives, while generating relevant definitions, boundaries, and parameters for each perspective. The consideration of multiple perspectives then resulted in a subjectively chosen "best" way to

solve the problem. Thus, five specific criteria were identified as being characteristic of relativistic thinking. Each of the five criteria is further clarified below, and an example of scored relativistic cognitions can be found in Table 5.

1) Problem definition. To obtain credit for problem definition, the respondent had to choose to define the problem in a certain way. Some sort of statement had to be made to indicate a decision about how the problem was to be viewed. For example, the participant solving the bedroom problem might consider the importance of having peace in the family, the moral or ethical values, to simply approach a problem mathematically, or any combination of all three. Problem definitions were inferred from the parameters; however, the participants had to recognize, at some point, that they are solving the problem as a math problem or a social problem. In other words, the participant must specify the nature of the problem within a given reality or a priori. "This is the same as the last one" was not scored as a definition. On the score sheet, all problem definitions were listed and counted. One point was assigned for each definition. (Please refer to Table 5, section A for an example of a problem definition.)

2) Metatheory shift. This cognitive behavior demonstrates the consideration of multiple formal systems. To obtain credit for a metatheory shift, the dyad had to identify various a priori's, or beliefs about the realities, or salient issues, underlying the problem, and then choose a "best" or "good" way to solve the problem based upon their chosen reality. For example,

Table 5

Relativistic Reasoning Score Sheet

Relativistic Reasoning Score Sheet

Couple #: 20.1/20.2 Problem: Bedroom Scorer's Initials: ____

Global	Count	Score
Metatheory Shift: yes no (B) (B)	Problem Definition: (A) Social - how to deal with space, relationships, and grandfather Mathematical - run out the permutations Mathematical and social synthesis - within the permutations, these social arrangements could occur, which we would recommend. (A)	Total: 3
Process/Product Shift: yes no (E) (E)	Parameter Setting: (C) -the children will be using sleeping bags, or foutons -I think we're going to sleep on the couch or something. -a single could be one bed, or it could be a double -this is a very foolish thing to do, grandfather has an apartment, they could take turns going to stay with him. -they've assumed grandfather is giving up his apartment. -do we need to make fine distinctions between who gets to sleep with whom? -the parents are in their 40's and have three kids, so they ~~don't need to sleep together.~~ -if they want to have sex, they don't have to do it in the bedroom. -there is also the math, do we want to run out all permutations? -I think the father should work the night shift. -the children would be in school. -the mother can sleep while the kids are in school. -that's how the two can get together. -that's from the practical stand point. We wouldn't want to put all three kids in one bedroom -would you want to sleep with grandfather? -what's wrong with the couch? -if I need to make a recommendation, I'd say put all in one and grandfather in the other. -both parents need quality time with the children, even if it's just at dinner. (C)	Total: 18
SELF- REFERENTIAL THINKING yes no (F) (F)	Multiple Solution: (D) 1) 5 + 1, 4 + 2, 3 + 3, and swap around 2) Father and mother in bedroom, get lots of foutons for the two girls, and put grandfather and boy in small room. 3) Put the whole family in the big room and give grandfather small room. 4) Somebody needs to work the night shift PROBE: -Need to keep the other apartment. (D)	Total: 4

the dyad may have generated both abstract (e.g., math) and/or everyday (e.g., social) realities, then based upon his/her own judgement - choose to solve the problem socially. A score of "1," was given for the presence of a metatheory shift. A score of "0" was assigned if no metatheory shift was given. (Please see Table 5, section B for related examples.)

3) Parameter setting. To obtain credit for parameter setting, the dyad had to name key variables to be combined or made proportional, other than those given in the written demands of the problem. Respondents often identified the variables and/or conditions necessary for solving the problem. For example, if a problem was defined as a social or ethical problem, as might be the case in the "bedroom" problem, sleeping arrangements (who, where, when, how, etc.), or how the solution was to be negotiated between all of the involved parties, was a primary consideration. To be counted as a parameter, the statement must be tied to a related problem definition, and must be reflected in the solutions. Each parameter was scored individually on the score sheet. One point was assigned for each parameter, and a total number entered on the score sheet. (Please see Table 5, section C for related examples.)

4) Multiple solutions. To obtain credit for multiple solutions there had to be a statement that there were many correct solutions, due to the nature of the problem. The dyad may have created solutions. For example, the dyad may have chosen to solve the problem as a social problem, a social/ethical problem, a gender related problem, and/or a comfort/living arrangements problem,

and subsequently identified all appropriate parameters of each solution depending upon the chosen definition. Solutions generated on the worksheets, but not verbalized, were also counted as solutions. If an alternative, everyday solution was given, the participants were scored for "multiple solutions" if each solution was matched with an appropriately specified problem definition and at least two appropriate parameters. Each completed solution was noted on the scoring sheet. One point was assigned for each solution, and a total number of solutions entered on the score sheet. (Please see Table 5, section D for related examples.)

5) Process/product shift. To obtain credit for a process/product shift there had to be a description of a process as one answer and an outcome as another answer. The participant may have applied a process, formula, heuristic, or "rule of thumb" developed in an earlier problem to the current problem, which then led to the solution. The participant viewed the problem as both a process of "finding a good answer" and "finding a good general way to get answers to problems of this type." As with metatheory shift, a score of "1," was given for the presence of a process/product shift. A score of "0" was assigned if no process/product shift was given.

Dyads received a pass score, or "1," for relativistic thinking based upon the presence of the following criteria: (a) the presence of two or more problem definitions, (b) the presence of a metatheory shift between the two problem definitions, (c) the presence of two or more parameters per definition, (d) two or more solutions based upon related definitions and reflected in the

parameters, and (e) a process/product shift. Both partners of the dyad were required to cooperatively generate and agree on all definitions and solutions to receive a score for presence of relativistic thinking. If all of the criteria were not met, couples were said to have "failed," and received a "0" score, indicative of the absence of relativistic thought.

B. Determining presence of self-referential thinking. The second procedure of Step 2 was to determine the presence or absence of self-referential thought. Self-referential thought has been defined as an awareness that "Truth" is a commitment to one of several versions of reality that seem equally correct which we construct with other individuals on an ongoing basis. The dyad had to verbalize an awareness that he or she must be the ultimate judge of which belief system will dominate his/her thinking. A score of "1" was given for the presence of self-referential thinking, and a score of "0" was assigned if no self-referential thinking was demonstrated. Theoretically, it has been suggested that self-referential thought is similar in nature to dialectical thought. Therefore, self-referential thinking was scored separately, as a level of cognition beyond relativistic operations.

Step 3 - dialectical scoring. In a study by Sinnott and Guttmann (1978a), it was suggested that Piagetian and dialectical operations, as defined by Riegel (1976), appeared to share similar underlying elements. Both theoretical approaches seem to rely on contradictions and resolutions as the basis of development of thought. In that study, the dialectical approach was applied to

determine presence or absence of dialectical processes through real-life decision making. Participants had: (a) experienced a recent major life event; (b) applied several of the developmental dimensions suggested by Riegel (1976); that is, biological, psychological, social, financial, and environmental, to the decision making process regarding that event; and (c) described either a conflict, a resolution, or a synthesis as an outcome of the event. Evidence of dialectical processes was conceptualized as the ability to synthesize two or more of the oppositional parts into a more complex whole. According to Riegel (1977) this synthesis is not merely a choice of one antithetical demand over another, but a dialectical combination of thesis and antithesis into a higher stage of truth. In the present study, dialectical cognitions were defined as the ability to synthesize two or more opposing formal solutions into a single dialectical whole. In other words, in the case where several alternative formal solutions were generated, if the dyad went on to synthesize the alternative solutions into a single solution addressing all salient a priori's, they were given a global score for presence of dialectical cognitions.

Frequency counts for all cognitive behaviors, using an appropriate thinking aloud rating sheet, were completed for each of the five problem-solving episodes.

Determining level of thinking within each dyad. A composite yes or no score for relativistic thinking was based upon the presence or absence of each of the five cognitive behaviors described in Step 2. This global score created the dependent

variable which was analyzed relative to marital adjustment and dyadic setting. However, the global score did not allow for the exploration of specific cognitive behaviors which might be most related to the independent variables. Thus, a second scoring schema was developed which resulted in a total score across all five problems for each specific cognitive behavior demonstrated by the dyad. Using the relativistic scoring sheet created in Step 2 (see Table 5), it was possible to determine whether or not the couple generated a single definition and a single related solution (which was scored for a single solution without a relativistic component), or multiple definitions, with a metatheory shift defined as "relativistic light." A multiple definition, with a metatheory shift, and more than one related solution was defined as "relativistic rigorous." The "relativistic rigorous" criterion, plus presence of self-referential thinking, was the fourth level of this hierarchical approach to cognition, and finally, the "relativistic rigorous" criteria, plus a synthesis between two or more of the definitions and solutions, created the score for dialectical operations. (See Table 6 for an overview of this schema.)

Social Behaviors

Social behaviors were operationalized and scored following the coding schemas provided by Pruitt and Rubin (1986) and Sillars (1986). Both members of the dyad received a social behavior score on each of four subscales: (a) avoidance, (b) competition/contention, (c) accommodation/yielding, and (d) cooperation/collaboration. A scoresheet showing the specific verbal and non-verbal behaviors

Table 6

Determining Level of Thinking Within Dyad

Level 1 (Non-Relativistic): Did the dyad generate only one definition and one related solution?
Level 2 (Relativistic Light): Did the dyad generate more than one definition with a metatheory shift?
Level 3 (Relativistic Rigorous): Did the dyad produce more than one definition with a metatheory shift and more than one related solution?
Level 4 (Self-Referential): Did the dyad use self-referential thinking to select one solution as better than one of the others?
Level 5 (Dialectical): Is the final solution a synthesis of two or more generated definitions and solutions?

which contributed to each subscale, can be found in Table 7. Each behavior was assigned a score from 0 (no evidence of that behavior) to 3 (the behavior was frequent and a salient factor in the problem-solving episode). The points were tallied and provided the score for that particular subscale. Each of the five problems was scored separately.

Analyses

Once the data were collected, entered into a file, and verfied, frequencies were run to check for missing values. Responses on the Dyadic Adjustment Scale and demographics questionnaire were checked to ensure that the values were within valid ranges. The demographic variables were used as independent variables in a

Table 7

Social Behavior Score Sheet

Social Behavior Score Sheet

Couple #: _____ Problem: _____ Scorer's Initials: _____
Time: _____

0 None observed	1 Occasional	2	3 Frequent

Verbal: M	Verbal: F		Nonverbal: M	Nonverbal: F	
_____	_____	disclosure of thoughts/feelings	_____	_____	tracking the problem
_____	_____	withdraws	_____	_____	engaged eye movement
_____	_____	speaks abstractly (nonmeaningful)	_____	_____	distant physical or body positioning
_____	_____	noncommittal statements (I don't know)			
_____	_____	making jokes (irrelevant to solution)			
_____	_____	statements which take focus away from problem solving process			
_____	_____	participation (meaningful contributions)			

Verbal: M	Verbal: F		Nonverbal: M	Nonverbal: F	
_____	_____	overly assertive (pushy or demanding)	_____	_____	eye contact which indicates anger
_____	_____	imposing solutions	_____	_____	facial or body expressions which indicate disapproval
_____	_____	finding fault with another			
_____	_____	rejection of another's opinion			
_____	_____	personal criticism			
_____	_____	uncooperative			
_____	_____	asking questions to imply fault or blame			
_____	_____	hostile comments which seek to change partner's behavior			
_____	_____	behaviors which seek to gain compliance from partner			
_____	_____	reversal or negation of partners thought			

M	F	
_____	_____	agreement without critical analysis
_____	_____	passive or unconcerned
_____	_____	overly cooperative (people pleasing)
_____	_____	verbal compromising at expense of his or her own ideas
_____	_____	lower one's aspirations or give up one's own goal to accommodate the ideas of partner

Verbal: M	Verbal: F		Nonverbal: M	Nonverbal: F	
_____	_____	assertive/communicative	_____	_____	assent
_____	_____	validation/approval/support	_____	_____	smiling
_____	_____	nonevaluative & nonblaming	_____	_____	positive physical positioning
_____	_____	disclosure of thoughts & feelings	_____	_____	positive eye movement (toward or direct)
_____	_____	soliciting disclosure from others	_____	_____	involvement
_____	_____	humor			
_____	_____	reflective listening			
_____	_____	willingness to change/flexibility			
_____	_____	soliciting criticism or feedback of one's own thought processes			
_____	_____	attempts to equalize problem understanding			

__Y__ __N__ Was the problem solving basically relegated to, or forfeited by, one partner? Or,
__M__ __F__ Which partner became dominant?
__C__ __P__ __I__ Was this problem solved cooperatively, parallel, or independently?
(m)___ (f)___ Did the couple appear to enjoy each other and/or the problem solving process? Rate.

multiple regression to determine their ability to predict type of cognition and marital adjustment. None of these variables significantly contributed to the variance in these factors. Simple correlations ranged from .19 for marital adjustment and verbal IQ, to .33 for marital adjustment and age. Given the low correlations, these factors did not warrant consideration as covariates in further analyses.

The order of presentation of the problems was evaluated to determine if cognitive behaviors were affected as a result of problem order. No significant differences were detected in the multiple analysis of variance between the counterbalanced orders. Problem order, therefore, did not apear to be significantly related to performance. The different packet orders were collapsed for the remaining analyses.

Four basic analyses were conducted to test the hypotheses of this study.

Analysis 1. Frequencies and cross tabulations were run to determine percentages, means, and standard deviations of overall performance on each problem within the four dyadic settings, i.e., high adjusted married dyads, low adjusted married dyads, high adjusted stranger dyads, and low adjusted stranger dyads.

Analysis 2. To determine whether or not formal and relativistic cognitions varied according to problem type as hypothesized, Cronbach's Coefficient Alpha's were run for the two types of cognitions across the five problems. It was found that for formal operational responses, ABC and Vitamin C were moderately

correlated (r = .55) and, although Power, Bedroom, and Camp were only slightly correlated with each other, they were significantly different from ABC and Vitamin C. When looking at relativistic cognitions, a similar pattern of grouping was found. There was virtually no variance between ABC and Vitamin C, whereas Power, Bedroom, and Camp were relatively highly correlated (r = .61). These results were used to collapse the two problem types into groups which were labeled "math" (ABC and Vitamin C), and "social" (Bedroom, Power, and Camp). These groups were used in further ANOVA's testing marital adjustment and dyadic setting, using a 2 (marital adjustment) x 2 (dyadic setting) x 2 (problem type) factorial model with repeated measures on the last factor. In the results section these are referred to as "within problem" ANOVA's. Tukey's post hoc analyses were used to explore significant main effects and interactions.

Analysis 3. A composite score for relativistic and formal operations was calculated by collapsing cognitive scores across all five problems. Two by two factorial ANOVA's were run to determine the main effects and interactions between marital adjustment and dyadic setting, on overall formal and relativistic cognitive performance.

As suggested earlier, however, the composite score does not allow for the exploration of specific levels of cognitive behaviors demonstrated by each dyad. Thus, additional 2 x 2 factorial anovas were computed, where level of thinking was the dependent variable. In the results sections these are referred to as "across

problem" ANOVA's. Tukey's post hoc analyses were used to explore significant main effects and interactions.

Analysis 4. Social behaviors were analyzed using MANOVA's for each of the independent variables, dyadic setting, marital adjustment, and presence or absence of cognitive behavior. The dependent variables were the composite scores from each of the four social behavior scales. The Wilks' Lambda Criterion was used to test the multivariate null hypotheses. Univariate analyses were used to explore which of the dependent variables contributed to significant main effects or interactions.

CHAPTER IV

RESULTS

Formal Operations

Frequencies

Table 8 provides the percentages of dyads using the various types of cognitions in solving each of the problems. It can be seen that across all five problems, approximately 54% of the dyads used formal thinking to solve the problem. When examining the "math" versus "social" problem types, more dyads used formal thinking to solve the math problems than to solve the social problems (79% compared to 38%). High and low maritally adjusted couples

Table 8

Percentage of Dyads Using Formal Operations Across the Five Problems

	Problems					
Dyadic Setting	ABC	Vit C	Camp	Bedm	Powr	Ave.
High Adj Married	80	70	60	0	50	52
High Adj Stranger	90	80	80	20	20	58
Low Adj Married	60	70	60	0	40	46
Low Adj Stranger	80	100	70	10	40	60
Average	78	80	68	08	38	54

appeared to make the same number of formal cognitions, both across all five problems (55% and 53%, respectively), and across the math (32% and 31%, respectively) and social (38% and 36%, respectively) groupings. Across all five problems, stranger dyads appeared to be using formal operations to solve the problems slightly more often than married dyads (59% and 49%, respectively). It is interesting to note that on the individual problems, 80% of the dyads solved the Vitamin C problem formally, whereas only 8% of the dyads solved Bedroom formally.

Analysis of Marital Adjustment and Dyadic Condition Relative to Formal Operations

In a 2 (dyadic composition) by 2 (marital adjustment) ANOVA, where a global score for formal operational thought was the dependent variable, no significant main effects or interactions were found. Neither marital adjustment nor dyadic composition appeared to have an impact on the general pattern of formal operational cognition.

Impact of Problem Type on Formal Operations

A 2 (dyadic composition) by 2 (marital adjustment) by 2, with a within subjects factor of problem type (math versus social), ANOVA was conducted on the presence of formal operations across the two problem types. There was a significant main effect for problem type, $F\,(1, 36) = 63.38$, $p < .01$. Math problems (ABC and Vitamin C) were solved formally significantly more often than were

the social problems (Bedroom, Power, and Camp). The main effect for dyadic composition, F (1, 36) = 2.88, $p < .10$), approached significance suggesting that dyadic composition may contribute to the overall problem-solving effect, regardless of problem type. However, there were no main effects for marital adjustment, nor were there any significant interactions. Mean performance of dyads solving both types of problems is provided in Table 9.

Table 9

Mean Performance of Dyads Solving Math and Social Problems Using Formal Operations

	Problem Type			
	MATH		SOCIAL	
Dyadic Setting	Mean	SD	Mean	SD
High Adjusted Married	1.75	(.35)	1.37	(.25)
High Adjusted Stranger	1.75	(.34)	1.40	(.26)
Low Adjusted Married	1.65	(.41)	1.33	(.27)
Low Adjusted Stranger	1.95	(.16)	1.43	(.27)
Average	1.80	(.34)	1.38	(.26)

Note: The higher the mean, the greater frequency of formal operations. Standard deviations are provided in the parentheses.

Relativistic Operations

Frequencies

Table 10 presents the percentages of subjects using relativisic thinking to solve each of the five problems. Only about 19% of all dyads used relativistic thinking when solving the problems. None of the dyads solved the math problems using relativistic thinking, whereas, 32% of the dyads used relativistic thinking to solve the social problems.

Table 10

Percentage of Dyads Using Relativistic Cognitions Across the Five Problems

	Problems					
Dyadic Setting	ABC	Vit C	Camp	Bedm	Powr	Ave.
High Adj Married	0	0	0	80	50	26
High Adj Stranger	0	0	40	80	40	32
Low Adj Married	0	0	0	40	20	12
Low Adj Stranger	0	0	0	30	0	06
Average	0	0	10	58	28	19

Furthermore, high adjusted couples were much more likely to use relativistic thinking to solve the social problems than were low adjusted couples (48% versus 15%). Stranger and married dyads

performed similarly, with the exception that 40% of the high adjusted stranger dyads demonstrated relativistic cognitions on the camp problem, and were the only group to do so. This anomaly was unexpected, and it is unclear as to whether or not it occurred because of a particular dynamic specific to the type of dyadic setting, or whether it may be due to a variant related to the problem. It would be interesting to explore this in later studies. Also, the comparison between problem types is, again, interesting to note. None of the dyads used relativistic thinking to solve the mathematical problems, whereas 32% of the dyads used relativistic thinking to solve the social problems.

Analysis of Marital Adjustment and Dyadic Setting as Related to Relativistic Operations

When scores for relativistic thinking were collapsed across all five problems in a 2 (dyadic setting) by 2 (marital adjustment) ANOVA, a significant main effect for marital adjustment, F (1,36) = 14.40, $p < .001$, was found. High adjusted stranger and married dyads ($\overline{X}$ = 1.60 and $\overline{X}$ = 1.30, respectively) were using relativistic thinking significantly more often than low adjusted stranger and married dyads ($\overline{X}$ = .30 and $\overline{X}$ = .60, respectively). There were no significant interactions suggesting that stranger and married dyads appeared to be using relativistic operations similarly across all problems. However, as Figure 1 indicates, there is a trend toward a significant interaction between married and stranger dyads which may have reached significance with a larger sample size.

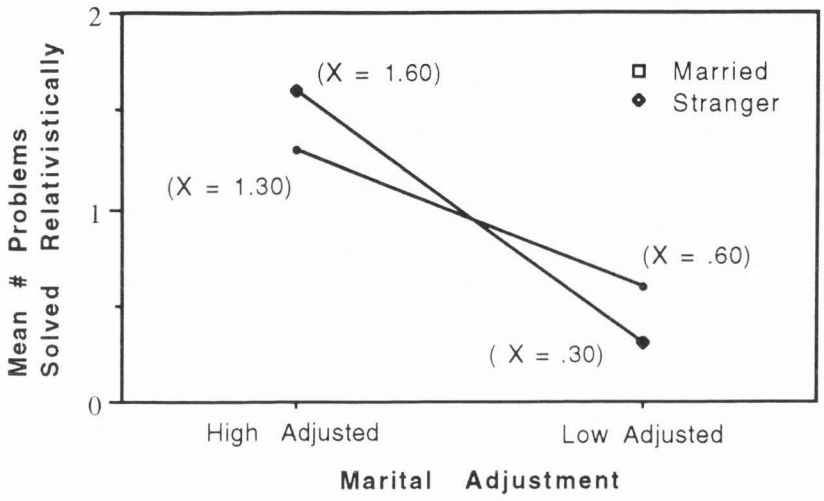

Figure 1. Analysis of marital adjustment and dyadic setting as related to relativistic cognitions.

Impact of Problem Type on Relativistic Operations

A 2 (marital adjustment) x 2 (dyadic setting) x 2 (problem type) analysis of variance with repeated measures on the last factor was conducted on relativistic operations for math versus social problem types. There was a main effect for problem type, F (1, 36) = 2.01, $p < .000$, and a marital adjustment by problem type interaction, F (1, 36) - .56, $p < .001$. Simple effects tests and Tukey's post hoc analyses indicated that not only were math problems not solved relativistically, but that high adjusted couples used relativistic thinking to solve social problems significantly more often ($\overline{X}$ = 1.48) than low adjusted couples ($\overline{X}$ = 1.15), F (1, 38) = 14.67, $p < .01$. There was no significant main effect or interaction involving the dyadic setting.

In a two-factor ANOVA (dyadic setting x marital adjustment) and a within subjects factor of problem type across all five problems, a main effect for dyadic setting approached significance, F (4, 144) = 2.02, $p < .10$ supporting the earlier trend finding. This may suggest that, as with formal operations, dyadic setting is contributing to overall problem solving, regardless of problem type. Stranger dyads appeared to be using relativistic operations slightly more often than married dyads to solve the five problems. The means and standard deviations for relativistic thought for the two problem types can be found in Table 11. Figure 2 portrays the marital adjustment by problem type interaction (on Figure 2 the higher the mean the greater the frequency of relativistic operations).

Table 11

Mean Performance of Dyads Solving Math and Social Problems Using Relativistic Operations

	Problem Type			
	MATH		SOCIAL	
Dyadic Setting	Mean	SD	Mean	SD
High Adjusted Married	1.0	(.00)	1.43	(.27)
High Adjusted Stranger	1.0	(.00)	1.53	(.36)
Low Adjusted Married	1.0	(.00)	1.20	(.28)
Low Adjusted Stranger	1.0	(.00)	1.10	(.16)
Total Mean	1.0	(.00)	1.32	(.32)

Note: The higher the mean, the greater frequency of relativistic operations. Standard deviations are provided in the parentheses.

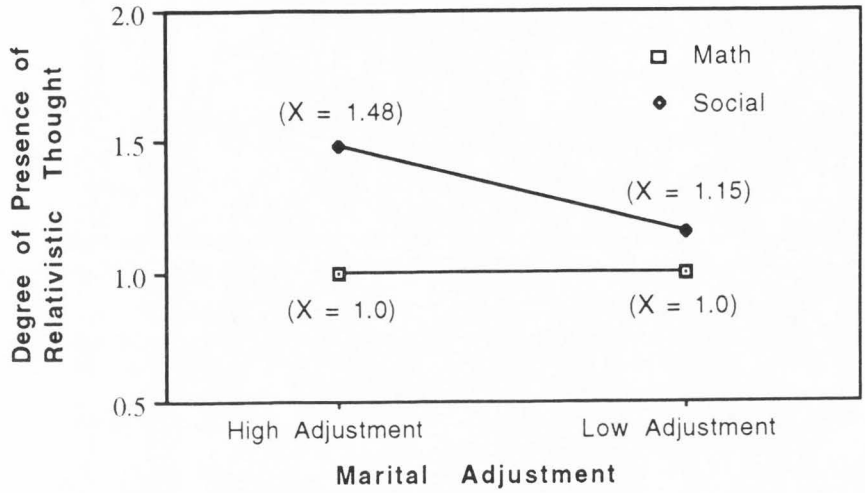

Figure 2. Analysis of marital adjustment and problem types as related to relativistic cognitions.

Analysis of Level of Relativistic Cognitions

When cognitions were broken down into specific levels of performance (i.e., Level 1 = one definition and one solution only, Level 2 = two or more definitions plus a metatheory shift, Level 3 = Level 2 criteria plus multiple related solutions, Level 4 = Level 3 criteria plus self-referential thinking, Level 5 = multiple solution plus dialectical synthesis) significant main effects emerged for marital adjustment on Levels Two, F (1, 36) = 21.54, $p < .000$; Three, F (1, 36) = 16.82, $p < .000$; and Four, F (1, 36) = 21.13, $p < .000$. In all three analyses, high adjusted couples appeared to be using each level of relativistic thinking significantly more often than low adjusted couples. At Level Two, there were no significant

interactions, suggesting that married and stranger dyads are very similar in their performance. However, at Level Three, high adjusted stranger dyads appeared to be using relativistic cognitions slightly, but not significantly, more often than high adjusted married dyads (see Figures 3 and 4, respectively). An examination of Figure 4 suggests a possible marital adjustment by dyadic composition interaction. Again, this trend may have been significant with a larger sample size.

At Level Four, the trend toward greater use of relativistic thinking in high adjusted stranger dyads was significant, in that a marital adjustment by dyadic setting interaction was found for self-referential thought, F (1, 36) = 4.17, $p < .05$. Simple effects tests and Tukey's post hoc analyses showed that high adjusted stranger dyads used self-referential thought significantly more often than low adjusted stranger, or married, dyads, F (3, 36) = 8.78, $p < .01$. Thus, self-referential thought appears to be the only characteristic of relativistic operations which discriminates between dyadic setting groups as well as marital adjustment (see Figure 5).

Dialectical Operations

Table 12 provides the percentages of subjects using dialectical thought to solve problems. As can be seen, dialectical cognitions occur extremely rarely. Because of the level of complexity of thinking required to accurately demonstrate dialectical thought, this finding was not unexpected. Previous studies investigating dialectical thought were designed to elicit these cognitions by using

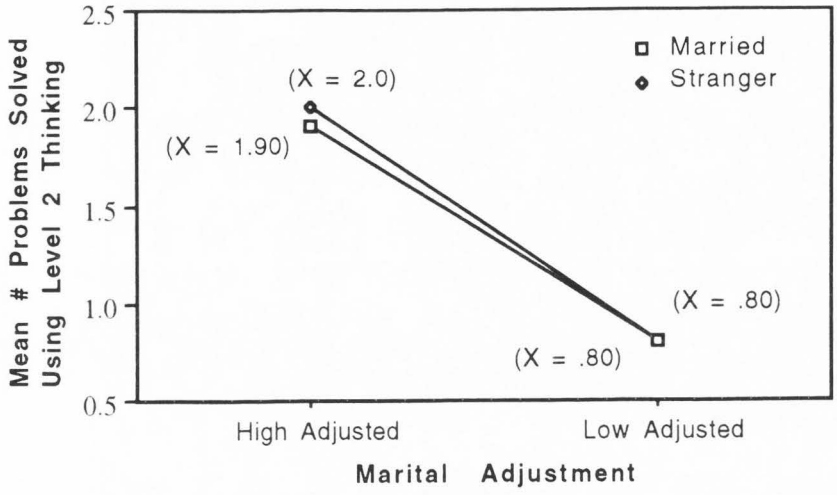

Figure 3. Main effect analysis of Level Two Cognitions for marital adjustment across both married and stranger dyads.

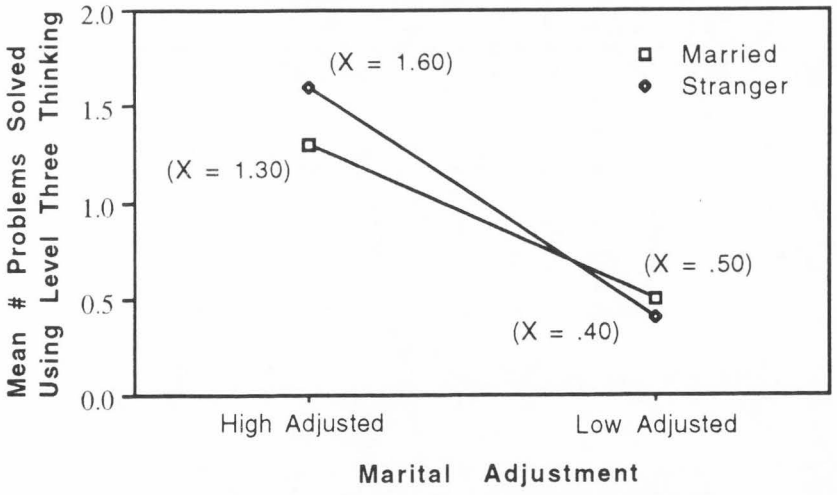

Figure 4. Main effect analysis of Level Three Cognitions for marital adjustment groups across both married and stranger dyads.

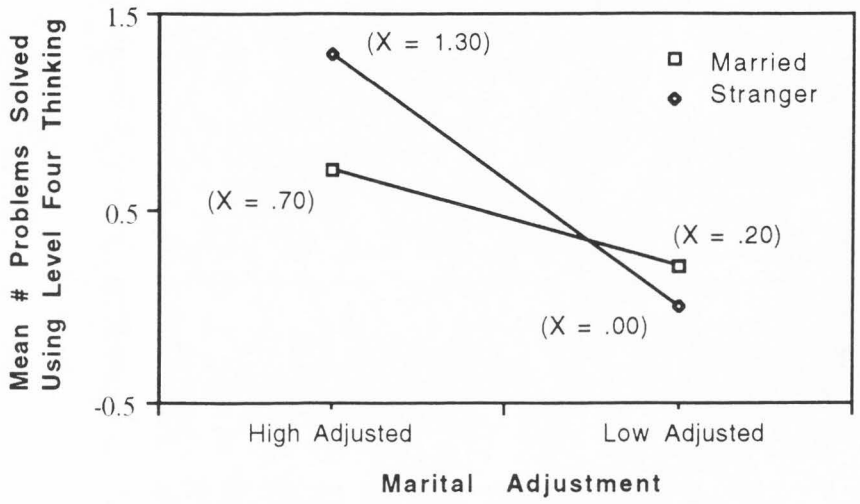

Figure 5. **Analysis of interaction for marital adjustment and dyadic setting as related to Level Four Cognitions.**

Table 12

Percentage of Dyads Using Dialectical Cognitions Across the Five Problems

	Problems					
Dyadic Setting	ABC	Vit C	Camp	Bedm	Powr	Ave.
High Adj Married	0	0	0	10	0	2
High Adj Stranger	0	0	0	10	0	2
Low Adj Married	0	0	0	0	0	0
Low Adj Stranger	0	0	0	0	0	0
Average	0	0	0	5	0	0

questioning, and clarifications, which allowed the researcher to "pull for" dialectical cognitions. This methodology was not used in the present study because of the nature of the problems used, and may have contributed to the low occurrence of dialectical cognitions. Given the infrequent number of dialectical cognitions, it was not possible to conduct further analyses on dialectical problem solving.

Social Behaviors

Multivariate Analysis of Marital Adjustment, Dyadic Setting, and Cognitive Performance

A three-way multivariate analysis of variance was computed to evaluate the main effects and interactions between scores on the social behavior subscales (the dependent variables), marital adjustment, dyadic setting, and presence or absence of cognitive behavior (independent variables), across the five problems. There was no three-way interaction; however, there was a two-way interaction between dyadic setting and relativistic thinking which approached significance, F (4, 29) = 2.51, $p < .10$, by the Wilks' Lambda Criterion. The univariate F tests indicated that subscale two, or the subscale measuring contention/competition, contributed to this borderline interaction, F (1,32) = 6.19, $p < .05$. Simple effects tests and Tukey's post hoc analysis indicated that non-relativistic married dyads demonstrated more contentious or competitive behaviors while solving problems ($\overline{X}$ = 8.9) than non-relativistic stranger dyads ($\overline{X}$ = 2.6), relativistic married dyads ($\overline{X}$ = 1.4), or relativistic stranger dyads ($\overline{X}$ = .69) (see Figure 6).

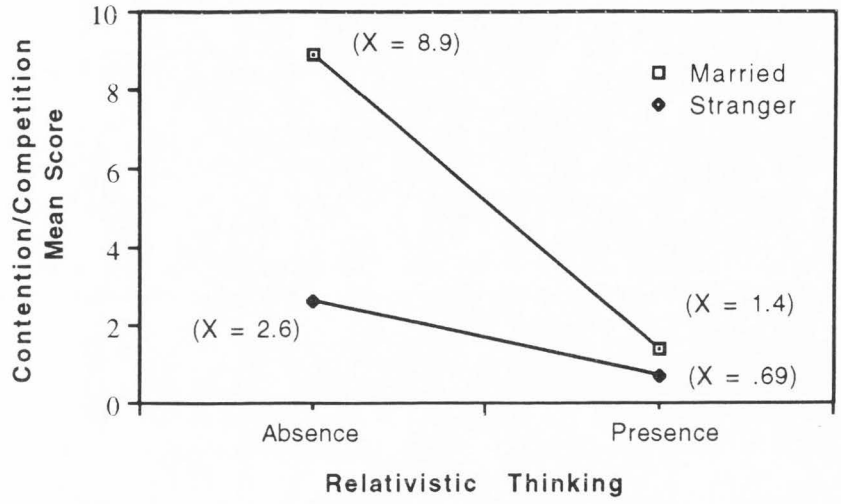

Figure 6. Analysis of relativistic thinking and dyadic setting as related to Social Behavior Subscale Two.

questioning, and clarifications, which allowed the researcher to "pull for" dialectical cognitions. This methodology was not used in the

There were also two significant main effects, and a third main effect approached significance. The first significant main effect was for relativistic thinking, F (4, 29) = 4.623, $p < .01$, by the Wilks' Lambda Criterion. The univariate F tests indicated significant main effects on three of the four subscales. Subscale one, or avoidance, approached significance, F (1, 32) = 3.10, $p < .10$, indicating that those dyads who demonstrated higher levels of avoidant behavior (subscale one) were less likely to also demonstrate relativistic thinking. Similarly, dyads which demonstrated higher rates of contentious/competitive behaviors (subscale two) were

significantly less likely to demonstrate relativistic thinking F (1, 32) 16.92, $p < .000$. Finally, those who demonstrated less cooperative behaviors (subscale four) were significantly less likely to demonstrate relativistic cognitions, F (1, 32) = 4.00, $p < .054$. These results together indicate that three of the four types of social behaviors measured (avoidance, contention, and cooperation) are related to the use of relativistic cognitions.

There was also a significant main effect for dyadic setting, F (4, 29) = 2.73, $p < .05$, by the Wilks' Lambda Criterion. Univariate F tests indicated that subscale two, or the subscale measuring contention/ competition, contributed to this significant F. Married dyads demonstrated significantly more contentious or competitive behaviors ($\overline{X}$ = 4.21) while solving problems than stranger dyads ($\overline{X}$ = 1.71).

The borderline multivariate main effect was for marital adjustment, F (4, 29) = 2.32, $p < .10$, by the Wilks' Lambda Criterion. Upon examination of the univariate F tests, it was found that subscale four, or cooperation, F (1, 38) = 16.45, $p < .000$, was the scale contributing to the borderline univariate main effect. High adjusted dyads, overall, demonstrated significantly more cooperative behaviors ($\overline{X}$ = 27.32) than low adjusted dyads ($\overline{X}$ = 21.28).

The lack of strongly significant findings in the three-way MANOVA is most likely a function of the small sample size. Support for this conclusion comes from the results of a two-way (cognitive behavior by dyadic composition) MANOVA and one-way MANOVA's on each of the independent factors. The two-way multivariate

analysis for dyadic setting by cognitive behaviors showed a significant interaction between the two factors, F (4, 33) = 2.66, p = .05, according to the Wilk's Lambda Criterion, with the univariate F significant for subscale two, or contention/competition, F (1, 36) = 9.36, $p < .01$.

Similarly, the one-way MANOVA's confirmed the significant multivariate effects for relativistic thinking, dyadic setting, and marital adjustment. The relativistic multivariate main effect was F (4, 35) = 7.70, $p < .000$, with significant univariate effects on social behavior scales one ($\overline{X}$ = 1.8 and $\overline{X}$ = 4.0, for presence and absence of relativistic thinking, respectively), two ($\overline{X}$ = 1.0 and $\overline{X}$ = 5.8, for presence and absence of relativistic thinking, respectively), and four ($\overline{X}$ = 27.3, and $\overline{X}$ = 19.6, for presence and absence of relativistic thinking, respectively). The multivariate main effect for dyadic setting was F (4, 75) = 4.21, $p < .01$, with the univariate F significant on subscale two, F (1, 78) = 8.11, $p < .01$ ($\overline{X}$ = 4.2 and $\overline{X}$ = 1.7, for married and stranger dyads, respectively). The one-way MANOVA for marital adjustment not only showed a significant main effect F (4, 35) = 4.02, $p < .01$, with a significant univariate F on social subscale four ($\overline{X}$ = 28.1 and $\overline{X}$ = 20.4 for high and low marital adjustment groups, respectively), but a significant univariate F also emerged for subscale one, or avoidance, F (1, 38) = 6.94, $p < .05$, as well ($\overline{X}$ = 1.8 and $\overline{X}$ = 3.6, for high and low marital adjustment groups, respectively). This subscale suggests that high adjusted dyads demonstrated significantly fewer avoidance behaviors than low adjusted couples.

Multivariate Analysis of Level of Relativistic Cognitions

Finally, each of the five levels of relativistic cognitions was used in two-way MANOVA's to determine whether or not specific components of relativistic thinking might be most related to social behavior. Although a significant multivariate main effect was not found F (4, 35) = 1.85, $p < .15$, level four cognitions, or self-referential thinking, did yield significant univariate main effects for subscale one, or avoidance, F (1, 38) = 5.03, $p < .05$ ($\bar{X}$ = 1.17 and $\bar{X}$ = 3.30, for presence and absence of self-referential thinking, respectively); and subscale four, or cooperation, F (1,38) = 6.32, $p < .05$ ($\bar{X}$ = 27.47 and $\bar{X}$ = 22.1, for presence and absence of self-referential thinking, respectively). These main effects suggest that dyads which demonstrated less avoidance and increased cooperation were also significantly more likely to demonstrate self-referential thinking. These results are similar to those found for overall relativistic thinking on the same subscales, and suggest a trend toward the increased use of complex relativistic cognitions in social settings which facilitate problem exploration through supportive, cooperative, communication styles. There were no other significant main effects or interactions.

CHAPTER V
DISCUSSION AND CONCLUSION

Discussion

Formal Operations Versus Relativistic Cognitions

The first hypothesis, that the interactive process would allow for creative problem solving (i.e., formal and postformal operations), was partially supported in that across all five problems, slightly more than half of the dyads solved the problems using formal operations. These results are similar to those reported by Hooper, Hooper, and Colbert (1984), and Sinnott (1975), in which formal operational ability was demonstrated on the problems between 47% and 84%, and 11% to 100%, of the time, respectively, depending upon the nature of the tasks. Of the present sample, 80% of the dyads demonstrated formal operations on the Vitamin C problem, a "formal/logical" task. Similar performance was demonstrated for the ABC task. However, only 8% of the dyads were able to demonstrate formal operations on the bedroom problem, and only 38% demonstrated formal operations on the power problem, both "formal/everyday" tasks, with a social component. These percentages appear to be similar to those in which individuals solved problems alone.

There are two possible explanations for the lower than expected formal operational performance on the bedroom and

power problems. First, either these two "formal/everyday" problems were too difficult to solve using logical mathematic processes, which would indicate a lack of mastery at the formal operational level, or second, because of the implicit "nature" of the problems, the dyads chose to use cognitive behaviors very different from those described by formal operations. The second possibility is somewhat supported in that, upon examination, it was determined that the bedroom problem was solved relativistically by 58% of the total sample. Furthermore, the bedroom problem was the only problem in which dyads generated dialectical cognitions. No relativistic cognitions appeared on either the ABC or the Vitamin C problems.

The above differences in cognitive behavior between the Vitamin C problem and the bedroom problem were supported by the significant main effects for "math" versus "social" problem types, in which math problems were solved formally significantly more often than were the social problems. Yet just the reverse was true for relativistic cognitions, which were demonstrated most often on social problems. It may be that in everyday problem-solving adults tend to adjust their problem-solving style according to the type of problem and the social context.

These findings support the recent work of many researchers and theorists who have suggested that when solving "everyday" problems which are "open-ended" and defined by the context in which they are embedded, adult styles of thinking are qualitatively different from those espoused by Piagetian theory. More

specifically, adults tend to demonstrate postformal, or relativistic, cognitions when responding to problems with an interpersonal component.

Cognitive and Social Behaviors as Related to Marital Adjustment

Hypothesis two suggested that high adjusted dyads would demonstrate higher level cognitive behaviors as evidenced by (a) mastery of formal operations, (b) mastery of relativistic cognitions, and (c) demonstration of facilitative social behaviors relative to the problem-solving process. Hypothesis three predicted just the opposite for low adjusted couples, that is, they would evidence (a) less mastery of formal operations, (b) less mastery of relativistic cognitions, and (c) less facilitative social behaviors during the problem-solving process. Hypotheses three through six suggested the same cognitive and social behaviors would differentiate between well and low adjusted married and stranger dyads.

Part (a) of hypotheses two through six dealing with formal operations was partially supported in that formal operations were demonstrated by the majority of the sample. However, differences across the marital adjustment groups, and across the dyadic setting groups did not emerge. The ability to solve problems at the formal operational level was not significantly influenced by the nature of the marital relationship, as suggested by part (a) of hypotheses two and three, or the dyadic setting, as suggested by part (a) of hypotheses four, five, and six.

In examining relativistic thinking, or part (b) of hypotheses two and three dealing with high adjusted versus low adjusted couples, there were significant differences in performance with respect to marital adjustment. High adjusted married and stranger dyads demonstrated relativistic cognitions significantly more often than low adjusted married and stranger dyads. This difference between marital adjustment groups was found in the analysis examining a global score for relativistic cognitions across all five problems, as well as the analysis examining math versus social problem types.

The above hypotheses were further supported by the analyses relative to level of cognitions demonstrated by maritally well and low adjusted dyads. It was hypothesized that not only would the presence or absence of relativistic thinking discriminate between the marital adjustment groups, but that the two groups would also be different at each level of increasing cognitive complexity. Analyses of the data were consistent with these hypotheses. High adjusted dyads were significantly more likely to generate more than one definition of the problem, along with multiple related solutions, and to use self-referential thinking to order and select as "most true" one of the multiple solutions.

The results for both parts (a) and (b) of hypotheses two and three which relate formal and postformal operations with marital adjustment are not particularly surprising when viewed in terms of the literature discussed earlier. First, maritally high adjusted and low adjusted couples would be equally likely to demonstrate formal

operations, in that formal operations are characteristic of adult cognitive development overall (Piaget & Inhelder, 1969). Second, as suggested by both Kramer (1989) and Basseches (1984b), formal operations would be particularly characteristic of the types of cognitions demonstrated by low adjusted couples, and postformal cognitions would be more characteristic of high adjusted couples. Formal operations are characterized by the manipulation of multiple variables relative to one truth system. Relativistic cognitions are characterized by the manipulation of variables relative to multiple truth systems. Low adjusted dyads typically have difficulty dealing with conflicts which arise from multiple perspectives, thus, it is less likely multiple truth systems would be explored in the problem-solving process.

Part (c) of hypotheses two and three suggested that well versus low adjusted dyads would demonstrate social behaviors which would facilitate or inhibit effective cognitive problem solving. This hypothesis was supported in that specific social behaviors were related not only to marital adjustment, but to the types of cognitions produced during problem solving. Low adjusted dyads demonstrated significantly more avoidant or contentious behaviors and less cooperative behaviors than high adjusted dyads. Furthermore, those dyads who demonstrated higher rates of avoidant or contentious behaviors, or who demonstrated lower rates of cooperative behaviors, were also less likely to demonstrate relativistic thinking. Social behavior, marital adjustment, and relativistic thinking were also related in that nonrelativistic

married dyads demonstrated more contentious behaviors than any of the other groups, and the use of self-referential thinking was significantly related to fewer avoidance behaviors, and greater cooperation within the dyads. In other words, relativistic and self-referential thinking were most likely to occur in social settings which were conducive to, and supportive of, such cognitions.

Together, results supporting parts (a), (b), and (c) of hypotheses two and three provide strong evidence for the theoretical suppositions that cognitive behaviors do not occur in a social vaccum (Meacham & Emont, 1989). Similarly, in support of Fitzpatrick's work (1988), cognitive behavior is as central to understanding the nature of marital adjustment as is social behavior. In the present study, dyads which supported open, cooperative, and creative exploration of multiple solutions during the problem-solving process, were also significantly more likely to demonstrate relativistic thinking. As suggested by Sinnott (1982), relativistic cognitions in an interpersonal interaction are characterized by the exploration, toleration, and consensus of multiple and opposing perspectives, as well as the ability to cooperatively select a set of rules for interpreting the problem depending upon the context, then ultimately the choice of a solution based upon a self-referential knowledge system. In other words, a critical characteristic of relativistic thinking is the awareness that all knowledge is necessarily subjective and requires a choice among several possible formal solutions. In the present study, high adjusted dyads demonstrated the cognitive behaviors at each level

just described, whereas, similar cognitive behaviors were not only missing from the problem solving of low adjusted dyads, but the types of social behaviors observed for low adjusted dyads served to inhibit the occurrence of such cognitions.

Cognitive and Social Behaviors as Related to Dyadic Setting and Marital Adjustment

Hypotheses four, five, and six dealt with the cognitive and social behaviors of married versus stranger well and low adjusted dyads. Hypothesis four (b) suggested that high adjusted married dyads would demonstrate more relativistic cognitions than high adjusted stranger dyads. Based upon the results, this hypothesis would not be supported in that significant main effects or interactions for dyadic composition and relativistic thinking were generally not found. Furthermore, throughout all of the analyses examining relativistic thinking, stranger dyads appeared to be using relativistic cognitions more often than high adjusted married dyads. From an inspection of Figure 2, it can be seen that there is a trend toward a significant interaction between marital adjustment and dyadic setting as related to relativistic thinking. It is possible the trend might have reached significance with a larger sample size.

The same trend can also be found in the analyses examining dyadic composition at each level of relativistic cognitions. It was particularly obvious for level three cognitions, or "relativistic rigorous" (see Figure 5), and was significant at the level four cognitions, or the use of self-referential thinking (see Figure 6).

This finding suggests that in the interaction between high adjusted strangers there is a greater tendency to express self-referential "truth" systems or a priori's in the process of solving the problem than observed with high adjusted married dyads. It may be that this particular cognitive behavior is required more often between strangers, as they define and construct multiple formal systems, than might be necessary between individuals who are known to one another and have already reached some level of intracouple identity.

Hypothesis four (c) suggested that high adjusted married dyads would demonstrate more facilitative social behaviors than high adjusted stranger dyads. This hypothesis was also not supported in that high adjusted stranger and married dyads appeared to perform similarly across the four social behavior subscales.

Hypothesis five (b), that high adjusted stranger dyads would show more relativistic thinking than low adjusted stranger dyads, was supported by the significant main effects for marital adjustment. Both high adjusted stranger and high adjusted married dyads showed significantly more relativistic thinking than low adjusted stranger and married dyads. The same main effects for marital adjustment were also found across the levels of relativistic thinking. These results are similar to those discussed relative to hypotheses two and three comparing the cognitive and social behaviors of well versus low adjusted married dyads. Similarly, hypothesis five (c) was also supported in that high adjusted

stranger dyads did evidence more facilitative social behaviors in the problem-solving process than did low adjusted stranger dyads.

Hypothesis six (b) suggested that stranger dyads, well and low adjusted, would be more effective problem solvers than low adjusted married dyads. This hypothesis was not supported by any of the analyses related to formal or relativistic thinking. Hypothesis six (c) was not supported, with the exception that, as suggested by the interaction between dyadic setting and relativistic thinking for social behavior subscale two, nonrelativistic stranger dyads demonstrated higher rates of contentious or competitive behaviors than relativistic stranger dyads, but significantly fewer than non-relativistic married dyads (see Figure 6). Thus, although typically low adjusted dyads demonstrate more contentious or competitive behaviors than high adjusted dyads, stranger dyads do not appear to evidence these behaviors to the same extent as low adjusted married dyads.

Conclusion

The purpose of this study was to examine the cognitive behaviors of individuals as they work cooperatively, or un-cooperatively, with another person to solve logical problems. The vast majority of problem-solving studies have examined the cognitive behaviors of individuals solving problems in isolation, yet as Meacham and Emont (1989) pointed out, in the real world, it is rare that a person operates alone as a problem solver. Other individuals are ever present in our lives to help construct and

define the problem, the appropriate truth systems, and the solutions. Vygotsky (1978) argued that all cognitive abilities arise from social interaction. It would make sense, then, that the problem-solving process would be influenced by and through interaction with others. This study has shown this to be true. Furthermore, these results help explicate a necessary link between cognitive processes, social behaviors, and marital adjustment, which until now has been largely theoretical.

Logical problem solving was examined in settings which varied according to marital adjustment and dyadic composition, with the use of problems which approximated the "ill-structuredness" of everyday life, as well as problems which lended themselves to the cognitive processes described by Piaget. Several findings emerged. First, the results provided evidence for the presence of both formal operational thinking, as well as postformal, or relativistic thought in adult cognitive processes. Furthermore, the type of cognition demonstrated differed with the structure of the problem. Problems requiring logical manipulation of relationships between variables, such as the combinatorial mathematic problems, were typically solved formally. Problems which were "ill-structured," that is, contained both mathematic and social properties, were solved either formally or relativistically. Second, the use of relativistic thinking varied with marital adjustment. Those who were high adjusted were much more likely to use postformal operations than those who were not high adjusted in the marriage. This finding held true for both married and

and stranger dyads. Third, those dyads, both married and stranger, who most often demonstrated relativistic thinking, also demonstrated much more facilitative and supportive social behaviors.

The hypotheses which suggested differences between stranger and married dyads were not supported in that, for the most part, high adjusted stranger and married dyads performed similarly. There was some indication that high adjusted stranger dyads demonstrated relativistic cognitions more often than high adjusted married dyads, but the evidence was not strong. A possible explanation for the lack of differences between married and stranger dyads is that it may not necessarily be the composition of the dyad that contributes to the differences found in cognitive and social behaviors, as much as perhaps the skills which are necessary for the management of any relationship.

Postformal cognitions are characterized by the ability to deal with problems in a non-absolute manner, an acceptance of the existence of contradiction as a part of everyday reality, and an approach to thinking which allows for the integration of multiple frames of reference (Kramer, 1983). Several theoreticians, including Piaget and Klaus Riegel, have suggested that the process of tolerating contradiction through reciprocal interchange, and permitting consensus between opposing perspectives, serves as the impetus for personal growth and development. Interpersonal relations are no exception, in that individuals "co-create" on a "moment-to-moment basis" the nature of their relationship as they

define the relationship. In the current study, high adjusted dyads approached conflict in a positive and supportive way as they struggled to understand each others perspectives and to find common "a priori's." As this process continued a transformation began to occur which incorporated the cognitive strategies of both partners and allowed for the generation of multiple solutions, any one of which might apply. For the low adjusted dyads, conflicts were often viewed as the result of opposing frames of reference to which only one correct solution or perspective could apply. Thus, either multiple solutions were generated as the individuals creatively and cooperatively shared in the content of the problem, or, as in the latter case, a single solution emerged from the process as the individuals became immersed in the one-way thinking which prohibited consideration and consensus of alternative perspectives. The first was characteristic of postformal thinking, and resulted in a richness of cognitive creativity not otherwise observed. The latter case was characteristic of formal thinking, and resulted in constricted, less creative cognitive behavior. In a marital relationship, this would likely result in conflict between the partners and an inhibition of growth, individually, as well as within the relationship.

Future Directions

This study has discussed, and provided evidence to support, many of the hypotheses regarding the relation between more complex cognitive development, social development, and the

development of a healthy marital relationship, which have emerged from the literature. Several researchers have suggested that cognitive development may foster marital adjustment through the ability to tolerate and negotiate change, to maintain open and supportive communication patterns, and to cooperatively work together to resolve conflict. It is important at this point to begin to clarify specifically how this process occurs. It may be helpful in future studies to increase the sample size and to alter the methodology in such a way that dialectical cognitions, as they occur between individuals as they solve problems together, might be explored. Furthermore, with a larger sample size, differences between married and stranger dyads may begin to emerge. Finally, the present study showed strong evidence for the relation between cognitions and cooperative versus non-cooperative and avoidant social behaviors. However, it would also be helpful to explore other social characteristics which might be related to problem solving styles, such as the use of power and interpersonal influencing styles, or gender differences in cognitions as well as response to problem type.

This study has shown evidence that there is an exciting new arena for the empirical investigation of adult logical cognitive problem solving as related to marital and social adjustment.

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APPENDICES

APPENDIX A. Dyadic Adjustment Scale

Most persons have disagreements in their relationships. Please indicate below the approximate extent of agreement or disagreement between you and your partner for each item on the following list.

	Always Agree	Almost Always Agree	Occasionally Disagree	Frequently Disagree	Almost Always Disagree	Always Disagree
1. Handling family finances	5	4	3	2	1	0
2. Matters of recreation	5	4	3	2	1	0
3. Religious matters	5	4	3	2	1	0
4. Demonstrations of affection	5	4	3	2	1	0
5. Friends	5	4	3	2	1	0
6. Sex relations	5	4	3	2	1	0
7. Conventionality (correct or proper behavior)	5	4	3	2	1	0
8. Philosophy of life	5	4	3	2	1	0
9. Ways of dealing with parents or in-laws	5	4	3	2	1	0
10. Aims, goals, and things believed important	5	4	3	2	1	0
11. Amount of time spent together	5	4	3	2	1	0
12. Making major decisions	5	4	3	2	1	0
13. Household tasks	5	4	3	2	1	0
14. Leisure time interests and activities	5	4	3	2	1	0
15. Career decisions	5	4	3	2	1	0

	All the time	Most of the time	More often than not	Occasionally	Rarely	Never
16. How often do you discuss or have you considered divorce, separation, or terminating your relationship?	0	1	2	3	4	5
17. How often do you or your mate leave the house after a fight?	0	1	2	3	4	5
18. In general, how often do you think that things between you and your partner are going well?	5	4	3	2	1	0
19. Do you confide in your mate?	5	4	3	2	1	0
20. Do you ever regret that you married? (or lived together)	0	1	2	3	4	5
21. How often do you and your partner quarrel?	0	1	2	3	4	5
22. How often do you and your mate "get on each other's nerves?"	0	1	2	3	4	5

	Every Day	Almost Every Day	Occasionally	Rarely	Never
23. Do you kiss your mate?	4	3	2	1	0

	All of them	Most of them	Some of them	Very few of them	None of them
24. Do you and your mate engage in outside interests together?	4	3	2	1	0

How often would you say the following events occur between you and your mate?

	Never	Less than once a month	Once or twice a month	Once or twice a week	Once a day	More often
25. Have a stimulating exchange of ideas	0	1	2	3	4	5
26. Laugh together	0	1	2	3	4	5
27. Calmly discuss something	0	1	2	3	4	5
28. Work together on a project	0	1	2	3	4	5

These are some things about which couples sometimes agree and sometimes disagree. Indicate if either item below caused differences of opinions or were problems in your relationship during the past few weeks. (Check yes or no)

	Yes	No	
29.	0	1	Being too tired for sex.
30.	0	1	Not showing love.

31. The dots on the following line represent different degrees of happiness in your relationship. The middle point, "happy," represents the degree of happiness of most relationships. Please circle the dot which best describes the degree of happiness, all things considered, of your relationship.

0	1	2	3	4	5	6
Extremely Unhappy	Fairly Unhappy	A Little Unhappy	Happy	Very Happy	Extremely Happy	Perfect

32. Which of the following statements best describes how you feel about the future of your relationship?

5 I want desperately for my relationship to succeed, and would go to almost any length to see that it does.

4 I want very much for my relationship to succeed, and will do all I can to see that it does.

APPENDIX B. Demographics Questionnaire

Confidential Demographics Questionnaire

Subject Number _____
Couple Number _____
Dyad Number _____

Today's Date _____
Age _____
Date of Birth _____
Race _____

Marital Status (check as appropriate):

Married & Live Together ____ Separated ___ Years in Present Marriage _____

Were you married before? Yes __ No __ If yes, please answser the following:

Date(s) of Preview Marriage(s) _____

Date(s) Previous Marriage(s) Ended _____

Is your current relationship better or worse than the previous one?

5	4	3	2	1
much better	better	same	worse	much worse

Can you identify three reasons why this relationship might be better or worse?

_____

_____

_____

Education (check as appropriate):

Grade school _____
High school _____
Trade school _____

College: 1-3 yrs. _____
Associate Degree____
Bachelor Degree_____
Masters Degree_____
Doctorate_____

Health:

Do you take any medications or substances which make you drowsy or not fully alert?

Yes No

Are any of these medications or substances influencing your performance right now?

Yes No

If you answered "yes" for the above two questions, please disqualify yourself from this study now. Give the interviewer your questionnaire

APPENDIX C. Problems

TOL PROBLEMS

POWER: A family consisting of a father in his 40's and a 15-year-old child live in the suburbs. They learn that a 70-year-old grandmother (the father's mother) will need to live with them due to her failing health. Right now the family members have this "POWER RELATIONSHIP": The father runs the house and the child follows his rules (father-dominant: child-dominated). The grandmother has made it clear that when she comes, she may not want anyone, including the father, telling her what to do. If the grandmother moves in, what are <u>all</u> the possible "POWER RELATIONSHIPS" that might develop among pairs of individuals in the household? (The possible power relationships are 1) DOMINANT-DOMINATED; OR 2)EQUAL-EQUAL).

VITAMIN C: Six foods appear on the list below. All six are good sources of vitamin C. Your doctor asked you to eat two different foods which are good sources of vitamin C every day. 1.) How many <u>different</u> pairs of goods must you eat when you make <u>all possible pairs</u> of the six foods? In other words, how many possible pairs are there? 2.) In each pair you make, how many portions of each food must you eat to get at least 2 units of vitamin C from that pair?

<u>VITAMIN C SOURCES</u>

1 PORTION	NO. OF UNITS OF VITAMIN C IN PORTION
1 ORANGE	1 UNIT
1 GRAPEFRUIT	2 UNITS
8 oz. TOMATO JUICE	1 UNIT
1/2 CUP CABBAGE	1 UNIT
20 GRAPES	1/2 UNIT
1 CUP GREENS	1 UNIT

<u>FIND:</u>

1.) _____ Possible pairs of different foods.

2.) In each pair, how many portions of each to get at least 2 units of vitamin C?

TOL PROBLEMS

CAMP: You have six children who love to go camping. You have patience enough to take two children, but no more, with you on each trip. Each child wants a chance to camp with each of the other brothers and sisters during the summer. How many trips would be necessary to give each child a chance to camp with every brother and sister if you take only two children each trip? How do you know?

ABC: Six of the twenty-six letters of the alphabet appear below. Imagine that you are making pairs of the letters, writing down all of the possible ways of putting two <u>different</u> letters together. How many pairs will you have when you make all possible pairs of the six letters? (Remember, although any letter will appear several times in <u>different</u> pairs, the same letter should not appear twice in the same pair:(BB BC BD).) Use these letters: A B C D E F .

BEDROOM: A family consisting of a mother in her 40's, a father in his 40's, a ten-year-old girl, a 12-year-old girl and a 15-year-old boy live in a small two-bedroom house in Detroit. One of the bedrooms is large and well-decorated, and has a single bed; the other bedroom also has a single bed. This summer the family learns that a grandfather who lives alone in a one-bedroom apartment two blocks away can no longer live alone. <u>What are all the possible ways</u> that the six persons can use the two bedrooms in the house?

APPENDIX D. Standardized Instructions and Probes

ADMINISTRATION GUIDELINES

Counterbalancing

For purposes of counterbalancing, the problems will be administered in one of three orders.

Administration of the QT

Impart these instructions upon the testee, "This is a kind of picture game. I am going to show you some pictures and read some words. You point to the best pictures for the words. Some of the words will be very easy and some of the words will be hard. You won't know all the words. If I read a word that you don't know, just tell me that you don't know, and I will go on to another word." Give two or three easy words so the testee gets an idea of how the testing will proceed. Also give the testee two or three hard words so they understand to signal that they "don't know." This will help ensure that guessing does not occur during the testing process. Start the testing at the likely ability of the testee. You don't need to give the testee all the words in every section. If they pass one or two words in the beginning sessions, go on to more difficult sections. If they fail a word in any section, test down until they pass a word and then proceed forward. If any Easy word is failed, give them all. Testing proceeds until there have been six consecutive passes and six consecutive fails. If any Hard word needs to be given to obtain six consecutive fails, give all the Hard words. Record plus signs to the left of the word to indicate correct responses and record minus signs in the same position to indicate incorrect responses. Record sheets should not be shown to the testee, but a special cardboard with the word lists upon it can be given to the testee before the start of testing in case the testee is unsure about spelling.

Administration of the Dyadic Adjustment Scale

The Dyadic Adjustment Scale is self-administering.

Administration of the Problems

In the notebook in front of you are five problems. Please do not read the problems until you are told to do so.

Your main tasks are to solve the problems and to do so while thinking out loud. Pencil and paper may be used, but no other aids may be used. Many persons find thinking out loud difficult, but it is the only way we can gather data to begin to understand how people solve problems. IT IS IMPORTANT TO SAY EVERYTHING THAT GOES THROUGH YOUR MIND AS YOU SOLVE A PROBLEM, EVEN THOSE IDEAS THAT APPEAR TO BE "JUST DISTRACTIONS." Even "silly" digressions of thought are helpful and informative.

Any questions about the task or the problems that occur to you during the test must be resolved between you. To help you get started I will ask you to begin by reading the questions out loud. You may decide between you who or how you will read the questions. Do you have any questions?

Please indicate to me when you feel you have completed the problem to the extent you think is appropriate. I will then ask you some questions about the problem solving process.

You may begin when you are ready. And remember, please say everything that comes to your mind out loud.

Thinking Out Loud Probes - Dyadic Problem Solving

1. Did you agree on the answer to this problem? (If respondent's answer yes) how did you agree on this answer? (If respondent's answer no - ask each respondent..) what do you think the answer should be? How did you select the answer you gave?

2. What was your main goal in solving the problem?

3. Have you ever experienced a problem like this before?

4. How did you solve that problem in the past?

5. Can you think of any other possible goals for solving the problem?

6. Is there any other process through which you could have gotten the same answer?

7. Is there any other solution?

8. Did you find yourself daydreaming or your mind wandering while you were thinking about this problem? How?

General Probes at end of interview:

1. Given all five problems, (allow interviewee to see all problems in writing at once) which one got your attention the most?

2. Which problem caused you to feel the most emotion? (negative, positive, or neither). What types of emotions did you feel? (Have them name the emotions.)

3. Which problem caused you to daydream or your mind to wander most?

APPENDIX E. Informed Consent

Informed Consent Form
for
Dyadic Problem Solving Study

The Center for the Study of Adult Development & Aging at Towson State University and Utah State University, Logan, Utah are cooperatively conducting a study on the affects of dyadic setting and marital adjustment on problem solving. We are interested in having adults (ages 35-50) who have been married between 5 and 30 years participate in five cooperative problem solving tasks.

Testing will take place in one session. The first part of the session is for screening purposes wherein you will be asked to complete a couples adjustment questionnaire and a measure of verbal intelligence, as well as a background questionnaire. If you are chosen for the testing, in the second part of the session you will be asked to solve problems in cooperation with a partner (either your marital partner or a partner assigned to you randomly). You will be asked to think out loud, to say whatever is going through your mind as you solve the problems, and you will be videotaped during this process. As you solve each problem, you will be asked a few questions to help us clarify information needed for the study. The videotapes will be used strictly for the purpose of data analysis. Testing for the entire session will take approximately 90 to 120 minutes. At the end of the testing session, you will be given the opportunity to make a one hour appointment to receive feedback about the results of your tests as well as information on your marital adjustment and problem solving strategies.

All information will remain strictly confidential. Although findings may be published, at no time will your name or any other personally identifying information be used. Testing poses no risk to you. You are at liberty to withdraw your consent to the experiment and discontinue participation at any time without prejudice. If you have any questions after today, please feel free to call Donna Rogers 830-3877 or ask for Dr. Jan Sinnott at 830-2184 or contact Lynn Johnson-Dean, Chairperson of the Institutional Review Board for the Protection of Human Subjects of Towson State University at 830-2236.

I, _____, affirm that I have read and understand the above statement and have had all of my questions answered.

Date: _____

Signature: _____

Witness: _____

CURRICULUM VITAE

CURRICULUM VITAE

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EDUCATION

Ph.D. **Psychology**, Utah State University, Logan, UT 84321
Major Emphasis: Developmental Psychology
Minor Emphasis: Clinical Research
Completion date: May, 1992

M. S. **Family and Human Development**,
Utah State University, Logan, UT.
Major Emphasis: Marriage and Family Therapy.
GPA: 3.76 Completion date: June, 1987

B. A. **Psychology**, Weber State University, Ogden, Utah.
Minor: Sociology
Completion date: June, 1980.

ACADEMIC EXPERIENCE

Senior Lecturer, Towson State University, Towson, MD, 1988 to 1991.
Psychology 350/550 - Personality Theory
Psychology 203 - Human Development
Psychology 101 - Introductory Psychology

Lecturer, Essex Community College, Essex, MD, 1989 to 1991.
Sociology 101 - Introductory Sociology
Psychology 101 - Introductory Psychology

Lecturer, Community College of Baltimore, Baltimore, MD, 1988.
Sociology 101 - Introductory Sociology
Sociology 103 - Marriage and the Family

Lecturer, Utah State University, Logan, Utah, 1988.
Sociology 238 - Sex Roles and the American Society.

Research Associate, Center for the Study of Adult Development and Aging, Towson State University, 1990 to present.

Assisted in conducting research studies in the following areas:
-gender differences in cognition and problem solving
-influence of age, dyad status, and goal clarity on spacial task performance
-emotion in relativistic postformal operations
-effect of gender and dyad status on relativistic and dialectical thought

Supervised undergraduate research interns.

Research Analyst, University of Maryland School of Medicine/State of Maryland, Department of Health and Mental Hygiene, Developmental Disabilities Administration, 1988 - 1990.

Graduate Assistant, Women and Gender Research Institute. Utah State University, 1986 - 1988.

Graduate Research Assistant, Home Economics and Consumer Education. Utah State University, 1986 - 1987. Housing and Locational Decisions of the Maturing Population: Opportunities of the Western Region.

COUNSELING EXPERIENCE

Counseling Internship, Community Counseling and Resource Center, Cockeysville, MD. 1989 - 1990. (Internship in substance abuse and dual diagnostics).

Cinical Experience, Psychologist Associate. Private practice under the supervision of Jacqueline M. Little, Ph.D., Maryland Psychological Center, 1989 to 1991.

Certifications (Counseling)

1990 - 1992 Certified Professional Counselor, State of MD.

1990 - 1992 Board Approved Psychologist Associate, State of MD

1990 - 1993 Board Eligible National Certified Counselor.

1983 Certified Guardian Ad Litem (for abused children) in Utah.

Donna R. B. Rogers

RESEARCH

A. Thesis

PMS: Bi-phasic Differences in Personality and Marital Relations Among a Clinical Sample.

B. Dissertation

The Effect of Dyad Composition and Marital Adjustment on Cognitive Performance in Everyday Logical Problem Solving.

C. Publications and Presentations

Adams, G. R., Day, T., Dyk, P. A. H., Frede, E. & Rogers, D. R. B. (1991). A dialectical theory of physical appearance: Understanding the association between pubescence and psychosocial development. Journal of Early Adolescence (In Press).

Sinnott, J. D., Bochenek, K., Rogers, D. R. B., Walters, C. & Gallagher, R. (1991). Cognitive Styles of Dyads and Singles: Are Two Heads Better Than One? Symposium on Lifespan Cooperative Cognition, J. Sinnott, Chair, American Psychological Association, San Fransisco, CA, September, 1991.

Rogers, D. R. B., Sinnott, J. D., & Van Dusen, L. Marital Adjustment and Social Cognitive Performance in Everyday Logical Problem Solving. Sixth Adult Development Symposium, Society for Research in Adult Development, Suffolk University, Boston, MA, July, 1991.

Rogers, D. R. B. & Van Dusen, L. Premenstrual Syndrome: A Psychosocial Perspective (In Review - Journal of Clinical and Social Psychology).

Rogers, D. R. B., Miller, B. & Keye, W. (1988). PMS and the Marital Adjustment of Husbands and Wives. Southwestern Society for Research in Human Development, March, 1988.

Rogers, D. R. B., Miller, B. & Keye, W. (1988). PMS: Bi-Phasic Changes in Personality and Marital Relations Among a Clinical Sample. National Conference on Family Relations, November, 1988.

D. Invited Symposia

Rogers, D. R. B. (1990). Premenstrual Syndrome: Current Status of Diagnosis and Management. Paper presented to the Division of Social Services, Church of Jesus Christ of Latter Day Saints.

Sinnott, J. D. & Rogers, D. R. B. (1991). Invited Guest Co-leader. Scoring Protocols for Self-Referential Relativistic Postformal Thought. Sixth Adult Development Symposium, Society for Research in Adult Development, Suffolk University, Boston, MA, July, 1991.

AWARDS

Nominated for Who's Who in America, 1990, 1991.

Research Associate Award - Women's Educational Equity Act (awarded to an outstanding student in gender research). December, 1986 to June, 1987; October, 1987 to March, 1988.

100% tuition waiver, academic year 1984-1985, Department of Psychology, Utah State University.

Dean's list for academic achievement 1984-1987.

PROFESSIONAL ORGANIZATIONS

American Psychological Association, Student Affiliate

National Council on Family Relations

Society for Research in Adult Development

American Psychological Society

Jean Piaget Society: For the Study of Knowledge and Development

REFERENCES

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Dr. Brent C. Miller, Professor, Family and Human Development, Utah State University, Logan, UT 84321-2905, (801) 750-1544.

Dr. Jacqueline M. Little, Clinical Psychologist, Maryland Psychological Center, Patuxent Place, 659A Main Street, Laurel, MD 20707, (301) 490-0550.

Dr. Jan Sinnott, Professor, Department of Psychology, Towson State University, Towson, MD 21204-7097, (410) 830-2184.