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CONSERVING KINSHIP CONCEPTS:

A DEVELOPMENTAL STUDY IN SOCIAL COGNITION

by

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A dissertation submitted to the Graduate
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Abstract

CONSERVING KINSHIP CONCEPTS:

A DEVELOPMENTAL STUDY IN SOCIAL COGNITION

by

Valerie Barnes Jordan

Adviser: Dr. Harry Beilin

Cognitive interpretations of children's understanding of social concepts have received increased attention in recent years. This study examined the development of conservation of social concepts pertaining to kinship, and the effects of certain experimental transformations and subject variables on these concepts. A distinction was made between single and multiple social roles, and three types of transformations, relevant to kinship, were applied to these roles. One type involved temporal transformations in past and future directions, and different time spans. A second type involved inclusive kinship combinations which could logically occur, and exclusive kinship combinations which could not logically occur. A third type involved combinations of male and female kinship roles with conventional and unconventional male and female sex stereotyped social roles. In addition, the relationship between social and physical knowledge was examined by administering a battery of physical conservation tasks. The effects of chronological and mental age, and family characteristics of birth order and family size, on social and physical conservation, were also assessed.

The sample contained 90 middle class, Caucasian children ranging in age from 5- to 7-years-old, with 15 boys and 15 girls at each age level. Each child came from an intact family and lived with both natural parents.

As predicted, the effects of each experimental transformation were significant, and conservation of kinship was found to develop during the preoperational and concrete operational periods. Preoperational acquisitions reflected knowledge of kinship classes, conservation of single roles under near time transformations, and recognition of logically exclusive kinship combinations. Thus, preoperational children understood which kinship combinations could not occur, but acknowledged the permanence of other kinship roles only under certain conditions. Concrete operational acquisitions reflected the knowledge of the permanence of single kinship roles under remote time spans, and an increased, but still incomplete acknowledgement of inclusive kinship, and kinship-social combinations. It appeared that perceptions of age and generational differences between certain kinship and social role combinations precluded conservation of these roles.

Strong evidence was obtained for the presence of convergent validity among social and physical tasks, and of discriminant validity between social and physical tasks. A factor analysis revealed distinct Physical and Social Conservation factors, and physical conservation was strongly associated with chronological age and verbal ability, while social conservation was strongly associated with socialization experiences. Although family characteristics were not related to conservation performance, the unexpected presence of sex differences on social, but not physical conservation, was interpreted as support of the role of differential patterns of socialization experiences in mediating the acquisition of social knowledge. It was proposed that social and physical conservation develop synchronously, and that social knowledge may influence structural reorganization and change of the same kind, and through the same equilibration process that physical knowledge does.

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CHAPTER 1

INTRODUCTION

Cognitive interpretations of children's understanding of social concepts and relationships within a Piagetian framework have received increased attention in recent years. The domain of social, or interpersonal cognition has been defined as the "logical representation of others" (Shantz, 1975), in comparison to physical, or interpersonal cognition which involves knowledge of "person-to-object" relationships (Feffer, 1970). Areas of social cognition which have been explored to-date have involved moral concepts, egocentrism, role-taking and communication skills, so the present study has been undertaken to explore an area of social cognition which has not received systematic investigation: conservation of kinship concepts.

The selection of kinship as a topic of social cognition has been made for several reasons. First, kinship can be considered a cross-product of both cognitive and social development in that it involves both logical and linguistic processes which develop in a social context of familial and cultural experiences. However, although kinship has been studied by anthropologists and linguists, it has not been extensively studied by psychologists as a cognitive or developmental phenomenon. Investigating children's kinship concepts from a Piagetian perspective involves a consideration of the role of Piaget's cognitive structures, since he contends that the acquisition of all knowledge, whether in the physical or social domain, is a consequence of these underlying mental structures. The presence of these structures in children has been inferred by their understanding of the invariance of certain logical properties of physical objects despite physical but logically nonessential

transformations which are performed on them. The emergence of conservation is regarded by Piaget as one of the major features of the concrete operational period. Although the existence of these operational structures is still debated, the role of these operations has been extensively examined vis-a-vis physical cognition, but to a much less extent for social cognition. In fact, the relationship between the acquisition of physical and social knowledge has received little systematic investigation, and the evidence to-date appears equivocal concerning the nature and extent of this relationship (Shantz, 1975). The present study therefore, examines the relationship between physical and social cognition by analyzing kinship concepts within a conservation paradigm, and assessing the effects of experimental transformations performed on both social and physical concepts.

It is also proposed that certain features of the social milieu may influence the development of kinship concepts. Clearly, children learn kinship terms and relationships in the context of their family and other social interactions, so it is conceivable that these experiences may affect the acquisition of their kinship concepts. The issue of the effects of both experimental and naturalistic experiences on the development of physical knowledge has a long history of debate among Piagetian research (see Beilin, 1976 for a recent review of some of these issues). The effects of environmental experiences on the development of social cognition has also been examined with the premise that social knowledge is more likely to be influenced by intra-individual differences, and naturalistic and experimental experiences than is physical knowledge (Bearison, 1975). For example, there is evidence which suggests that social role-taking and communication skills are affected by the degree

of social and verbal isolation of a community, but that physical concepts are not (Hollos, 1975). Other studies have reported moderate relationships between moral concepts, communication and role-taking skills on the one hand, and familial socialization practices and interaction patterns among families and peers on the other hand (Shantz, 1975). Therefore, in the present study, the issue of environmental influences on kinship concepts is addressed in two ways. First, one of the experimental transformations performed on the kinship conservation tasks involves the effects of combining kinship roles with social roles that have culturally acquired values (specifically those of sex stereotyped occupational roles), and it is expected that the value of these roles will influence kinship conservation. Second, the relationship between kinship and physical concepts on the one hand, and familial characteristics of family size and birth order on the other hand, will also be assessed.

In sum, the present study is designed to examine the development of conservation of kinship concepts in relationship to: physical conservation; different types of transformations pertaining to kinship per se; and subject variables pertaining to chronological and mental age, and familial characteristics. The following review is divided into two main sections. The first sections reviews the development of kinship concepts in general according to Piagetian and linguistic componential analyses. The second section reviews the area of conservation of social concepts, and delineates several categories of single and multiple kinship and social roles. The effects of certain methodological and subject variables on kinship conservation are discussed, and then the hypotheses tested in the study are presented at the conclusion of the chapter.

Development of Kinship Concepts

Piagetian Sibling Studies

The analysis of children's understanding of kinship concepts began with Piaget's analysis of sibling concepts. In the course of analyzing errors made by children on the absurd phrase item "I have three brothers, Paul, Ernest and myself" from the Binet-Simon intelligence test, Piaget (1928) distinguished between membership and relational sibling concepts. Concepts of membership were characterized by children's knowledge of themselves as members of the class of siblings so that they recognized themselves as siblings. In contrast, relations were characterized by understanding reciprocity between members of the class, so that children understood that they have N number of siblings and that X was their sibling. Thus, membership or class concepts were expressed by the copula and predicative statements such as "I am a brother (sister)," while relations were expressed by the possessive, such as "I have two brothers (sisters)."

With these distinctions, Piaget delineated five stages through which these membership-relations concepts developed in reference to the Binet item. The initial stage reflected the absence of a differentiation between these concepts, thereby resulting in the absence of the recognition that the child (i.e., myself) was a sibling, or that a reciprocal relationship existed between one's sibling and one's self. In the second stage, children acknowledged that "myself" included one's self as a sibling, but still failed to distinguish between membership and relations. Thus, children at this stage claimed that "we are three brothers and I have two brothers" (Piaget, 1928, p. 77) without recognizing the contradiction. In the third stage, children began to differentiate between

membership and relations, but succeeded in placing only one's self but not one's siblings, in relationship to each other. The fourth stage was exemplified by an incorrect solution of the absurdity in which children contended there were four brothers by adding 'myself' as the fourth brother. Finally, at the fifth stage, children recognized the absurdity of the question because of there ability to distinguish class and relations concepts, so that 'myself' was counted at the third, rather than as an additional sibling.

Piaget (1928) verbally administered his own series of six questions concerning relational (questions #1, 2, 3, 5 and 6 listed in Table 1) and class (question #4 in Table 1) sibling concepts to children ranging in age from 4- to 12-years-old. Using the criterion of at least 75% of the subjects succeeding at each age level, Piaget reported that it was not until 10 years of age that a majority of children passed all six questions. Several replications of Piaget's sibling questions have been undertaken, and Table 1 summarizes the results of these studies. With few exceptions, the results of these studies are similar to those obtained by Piaget, with a tendency for retarded children to pass these questions at older mental ages than normal children.

The results from the replication studies concerning class sibling concepts (i.e., "Are you" and "What is a brother/sister") presented in Table 1, suggest that this concept is not understood by a majority of children until the age of 9 years. Piaget observed three stages in the development of children's class definitions of siblings. In the first stage, children's definitions were restricted simply to naming or describing siblings on the basis of their sex (such as "Johnny" or "a girl"). At the second stage, children recognized the relational necessity of other

Table 1

Summary of Replication Studies of Piaget's Sibling Questions

Study	Age Range	Relational: 1	2	3	5	6	Class: 4
Normal children							
Piaget, 1928	4-12	10[a]	6	8	10	10	9
Elkind, 1962a	5-11	7	6	8	10	10	9
Kooistra, 1963	4-7	-	-	5	-	-	-
McManis, 1969	5-11	6	6	6	7	8	9
Swartz & Hall, 1972[b]	5,7,9,11	9	7	7	*	*	11
Chambers & Tavuchis, 1976	7,9	7	7	-	-	-	-
Retarded children[c]							
Lane & Kinder, 1939	16	12	10	10	10	10	-
McManis, 1969	10-18	7	7	8	*	*	*

[a]These ages indicate the level at which the criterion of 70% of subjects of that age passed each question. An asterisk indicates that criterion was not attained, and a dash indicates that this question was not asked. The relational questions from Piaget (1928) are: 1)How many brothers/sisters do you have? How many does X have? 2)How many brothers/sisters are there in the family? How many all together? 3)There are 3 brothers in a family, A, B & C. How many brothers has A? B? C? 5)X has 3 brothers, W,Y & Z. How many brothers has W? Y? Z? 6)How many brothers are there in this family? The class question is: 4) Are you a brother/sister? What is a brother/sister?

[b]In this study, 60% of the 9- and 11-year-olds passed questions 5 and 6.

[c]For retardates, mental age, rather than chronological age levels, are used as criterion for success.

siblings existing in order for someone to be a sibling, but this recognition was typically limited to some but not all of the siblings. At the third stage, children recognized that in order to be a sibling, one must have a sibling, therefore reflecting an integration of class and relational concepts.

Danziger (1957) administered Piaget's sibling questions to children ranging from 5- to 8-years-old, and also observed three similar stages in children's membership definitions of siblings. The first stage was defined as precategorical since children simply named a person, while the second was defined as categorical in that sibling definitions were based on some concrete property such as sex or size (such as "he's little"). The third stage, defined as relational, was based on either a concrete or abstract explanation of the sibling's relationship to the subject. For example, concrete explanations suggested that the relationship was based on someone who lived with you, while abstract relational definitions were based on an understanding of the consanguinal relationship between siblings. Elkind (1962a) observed similar stages in children's class concepts, with the third stage reflecting an explicit recognition of consanguinity among siblings, such as being born from the same mother or belonging to the same family.

Haviland and Clark (1974) asked children ranging in age from 3½- to 8-years-old to define sibling (and other kinship) terms, and observed four categories of definitions which corresponded to those observed by Piaget and Danziger. The first category, which corresponded to Danziger's precategorical stage, was simply naming people, while the second category, which corresponded to Piaget's first stage and Danziger's categorical stage, was characterized by the use of property features such as sex and age.

The third category, which corresponded to Piaget's second stage, contained definitions which were relational but not reciprocal, while the fourth category, which corresponded to Piaget's and Elkind's third stages and Danziger's relational category, was characterized by sibling definitions which were both relational and reciprocal. In summary then, it appears that children's understanding of class sibling concepts progress through several stages, with initial concepts based primarily on specific persons and concrete attributes, and more mature concepts based on gradually more abstract and relational attributes.

In analyzing the pattern of success on the five relational questions (listed in Table 1), two clusters of questions appear to emerge which are succeeded at two different age levels. The first cluster, represented by questions 1, 2 and 3, is passed by a majority of children between 6- and 7-years-old (with the single exception of Piaget's sample who did not pass question 1 until age 10), while the second cluster, represented by questions 5 and 6, is passed by a majority of children between 9- and 10-years-old. Many items in the first cluster involve questions concerning the subject's own family, while those in the second cluster involve questions concerning a fictitious family. It is possible that familiarity may facilitate an understanding of relational sibling questions which may not generalize to fictitious families.

Componential Analysis of American Kinship Terms

A different approach to the analysis of kinship has been the examination of the conceptual dimensions, or components, which underly the 15 basic consanguinal American kinship terms. Although theoretical and methodological differences exist among these componential models, the results have yielded a general consensus as to the identity of these components.

Several of these componential models are briefly reviewed.

The initial componential analysis of American kinship terms proposed by Wallace and Atkins (1960) contained three components: sex, consisting of male and female terms; generation, consisting of two generations above (+1 and +2) and two below (-1 and -2) ego, whose generational level was '0'; and lineality, consisting of lineal relatives who were descendants and ancestors of ego, colineal relatives who were ego's ancestors, and ablineal relatives who were neither lineal or colineal (such as cousin). The resulting matrix of kinship components had a fixed reference point on ego at the 0 generational level, with parents and grandparents of both sexes one and two generations directly above ego, and with children and grandchildren of both sexes one and two generations directly below ego. Siblings were represented as colineals within the same generation as ego, and aunt, uncle, niece and nephew were one and two generations above and below ego respectively. Cousin, the only American kinship term with no sex distinction, was represented as an ablineal relative without any specific generational level. Thus, the 15 kinship terms in this model were relational only with respect to ego, and not between each other.

An alternative componental model proposed by Romney and D'Andrade (1964) preserved both sex and generation components from Wallace's model, but reduced the lineal component to two dimensions of either direct or collateral relatives. An important addition of Romney's model was the introduction of a reciprocity component, in which reciprocal pairs of relatives were placed in adjacent generational levels, such as mother-daughter, and grandson-grandfather, in contrast to the separation of these terms by generational hierarchies in Wallace's model. The underlying assumption of these reciprocal pairs was that the terms within each pair

were assumed to be (and later validated) psychological closer to each other than neighboring but nonreciprocal terms in Wallace's model, such as mother-grandmother, and daughter-sister. Thus, directly lineal reciprocal pairs of parent-child, and grandparent-grandchild of both sexes were schematically represented at adjacent generation levels of + and -1, and + and -2 respectively. Similarly, collateral reciprocal pairs of uncle-nephew and aunt-niece were schematically represented at both one and two generational levels. Other features of Romney's model were the elimination of ego as a fixed reference point, and the representation of siblings as direct lineals, rather than as colineals as in Wallace's model.

Both Wallace's and Romney's models delineated these kinship components among adolescents and adults, but neither examined differences in difficulty between components, or their respective acquisition by children. Jacobowitz (1975) examined the acquisition of these components among first, third and fifth grade children, and reported that lineal, sex and reciprocity components were the earliest to be consistently recognized by younger children. The generation component emerged last, and was not clearly apparent in children's clustering of kinship terms until the fifth grade. Jacobowitz suggested that the underlying components of children's kinship clusters closely resembled Romney's componential model, while the underlying components of adult's kinship clusters closely resembled Wallace's model.

In contrast to these structural component models, Haviland and Clark (1974) proposed an alternative model based on relational components. Haviland and Clark contended that neither of the above models, as already noted, could account for children's acquisition of kinship terms or for

Piaget's observations concerning the development of class sibling concepts. They also suggested that in both of these models, all components were assigned an equal value so that there was no basis for predicting any levels of complexity for kinship terms, or an order in which these terms might be acquired by children. Because of these shortcomings, Haviland and Clark proposed an alternative model based on relational components between two or more persons. Using a relational system devised by Bierwisch, the basic features of this model were two relational components "X Parent of Y" and "X Child of Y," and one inverse rule which could be applied to all kinship terms. These basic relational components could be combined with other components, such as property features of sex (denoted as Male X or Female X), to yield an entry such as mother = "(X Parent of Y)(Female X)." The advantage of this system was that not only could it compute X's relation to Y, but it could also describe Y's relationship to X by applying the inverse rule to each relational component in the kinship entry. Thus, while the lineality component of the previous models was not directly comparable to this model, the relational model preserved both sex and generation components and at the same time could also account for reciprocal relationships in a manner that was not possible in the foregoing models.

In interpreting Piaget's stages of class sibling concepts according to the relational model, they suggested that stage 1 definitions of siblings represented children's acquisition of property features such as sex, size, clothing, etc. By stage 2, children have acquired some relational components, such as "Child of," but still did not grasp the reciprocal nature of sibling relationships. The third stage was represented by the appropriate use of the inverse rule so that sibling definitions were both

relational and reciprocal, reflecting the understanding that if X if the sibling of Y, then Y is the sibling of X.

To account for the course of kinship acquisition, Haviland and Clark proposed four levels of relational complexity for the 15 consanguinal kinship terms: Level 1, containing terms with only one relational component (either "Parent of" or "Child of"): Level 2, containing kinship terms with only one relational component and recursion of that component, such as grandparents and grandchildren; Level 3, containing kinship terms with two relational components, such as siblings; and Level 4, containing terms with two relational components and recursions of these components, such as aunt, uncle, etc. To evaluate this relational complexity hypothesis, children ranging in age from 3½- to 8-years-old were asked to define the 15 consanguinal terms, and the results provided some support for the predicted order of complexity. A reordering of Levels 2 and 3 with each other yielded the best sequence of complexity levels of kinship terms among children, indicating that the relational model was capable of generating an acquisition model of kinship terms which was also compatable with Piaget's stages of sibling concepts.

Concepts of Age

One of the basic kinship components delineated in the foregoing models is generation, and perhaps one of the most salient feature which distinguishes between generational terms such as parents, grandparents and children, is the recognition of age. It is proposed that children's concepts of age are likely to be related to their understanding of kinship, and perhaps may even account for the relatively later understanding of generational kinship terms, in comparison to other kinship components. A review of the development of age concepts supports this possibility.

Piaget (1969) suggested that children's concepts of age were based on the coordination of two premises. The first was the notion of order of succession, or seriation of births, reflected by the understanding that older people (or any living organisms) were born earlier than, or before younger people, and that this birth succession, rather than any physical attribute, was the basis for ensuing age differences. The second was the concept of conservation of these age differences throughout life, with the assumption that aging was a continuous process which never reached a static, or final state during adulthood. The coordination of these concepts, and the resulting independence from physical features as a determinant of age, was considered a concrete operational acquisition.

Piaget observed two stages prior to an operational understanding of age. The first was characterized by the absence of an understanding of birth succession, so that children at this stage were uncertain as to whether they were born before, after, or at the same time as their siblings or parents. Furthermore, they believed that age was proportional to physical size, so that grownups were older because they were bigger than children. Thus, children could overcome initial age differences, and even surpass other children, by becoming "bigger" than the other person (usually by eating extra portions of food). Since adults were also seen as having reached their final size, children believed that adult ages no longer changed annually, but rather remained at a fixed age.

At the second stage in the development of age concepts, Piaget observed two types of patterns. The most common pattern was an understanding of the seriation of births, but without an accompanying understanding of the conservation of age differences. Thus, while children realized that older

people were born before younger people, they still thought these differences could be overcome with changes in size. The less frequent pattern was the converse of the first, namely the recognition of the permanence of age differences without an understanding of the order of births.

Piaget (1969) and Lovell and Slater (1960) assessed children's age concepts by presenting a series of pictures of apple and pear trees which had unequal rates of growth and were depicted in one year intervals as larger in size and with more fruit. The apple tree was planted two years before the pear tree and was initially larger than the pear tree, but gradually the pear tree exceeded the apple tree in both size and amount of fruit. Children between 5- and 7-years-old had no difficulty in seriating each series of pictures according to each tree's respective age, but until the ages of 7- and 9-years-old, a majority of children incorrectly judged the taller pear tree with more fruit as being older than the smaller apple tree with fewer fruit.

Looft (1971) extended Piaget's age concepts to human stimuli by presenting pairs of drawing of males and females at four age levels (infant, child, adolescent and adult) in two sizes, to children ranging in age from 3- to 9-years-old. The frequency of correct judgments as to which person in each pair was older increased significantly with age, while the frequency of incorrect judgments based on the selection of the larger of the two drawings significantly decreased with age. By 9 years of age, over three quarters of the children made correct age judgments. In contrast, Kratochwill and Goldman (1973) found that by age 7, a majority of children made correct age judgments when realistic photographs, rather than drawings, of males and females at each of the four age levels and two sizes, were used as stimuli.

Summary: The Development of Kinship Concepts

The results from the foregoing studies reveal that kinship concepts emerge gradually during the preoperational and concrete operational periods. Initially, kinship concepts are based on physical properties such as names of persons, size and the sex component. Among older children, kinship concepts become based on inferential and logical properties such as relational components, birth succession and conservation of age, and perhaps at the last point, the recognition of the generation component. The componential analyses complement Piagetian studies by providing models of features which are unique to the kinship system, and some of these components constitute the basis for the transformations that are applied to the kinship conservation tasks designed for the present study.

Conservation of Social Concepts

Conservation is central in Piaget's theory, and has been extensively examined in relation to quantitative, or physical concepts such as number, quantity, weight, length and volume (see Beilin, 1976, for a review of recent conservation research). Conservation refers to the invariance of critical logical properties in spite of one or more transformations that are performed on the stimulus materials. The understanding of the invariance of these logical properties is the hallmark of the concrete operational period. Although substantial research has been conducted on conservation of physical concepts, considerably less attention has been focused on conservation of social concepts, although it is proposed that conservation across both domains relies on common reasoning processes.

The types of social conservation tasks reviewed here have been classified into two general categories: one involving single and one involving

multiple social roles. Conservation of single social roles refers to the recognition of the permanence of a single social role despite transformations that are applied to that role. This category includes conservation of: self, human and generic identity, such as the recognition that one is always the same person across time; gender, such as the recognition that one is always a male or female; and kinship role, such as the recognition that one is always a child or sibling. Conservation of multiple social roles refers to the recognition that two or more roles can exist simultaneously despite transformations that are applied to one or all of these roles. This category includes the recognition that two kinship roles, or a kinship and social role combination, can exist simultaneously, such as a mother and a sister, amd a father and a doctor. It is likely that an understanding of multiple role conservation involves an understanding of both single role conservation and multiple classification. That is, if mother is class A and sister (or doctor) is class B, then children must recognize the inclusive possibility that some people can belong to both classes, but that other combinations are exclusive, such as class A of mothers and class B of brothers. This distinction between inclusive and exclusive combinations is considered one of the relevant transformations pertaining to social conservation, and will be examined in the present study.

The following sections review the development of single roles of human identity, gender and kinship roles; conservation of multiple roles of kinship, kinship-social roles, multiple social roles, and inclusive and exclusive roles. The relationships among social conservation tasks, and between social and physical conservation is examined, and the effects of methodological and subject variables on kinship conservation are also reviewe

Conservation of Single Social Roles

Conservation of human identity. Piaget (1968) suggested that the concept of growth reflects a form of conservation of identity which is irreversible and hence likely to be a preoperational acquisition. Children observed the rapidly accelerated physical growth of a plant, and were asked to draw the plant's growth, as well as their own growth from infancy to the present, in a series of pictures. Three stages were observed in the development of self- and plant-identity. In the first stage children readily understood the permanence of their own identity, but only conserved the plant's identity when differences in the size of the plant were relatively small. When differences between pictures of the plant's size were large, children denied that it was still the same plant. This is reminiscent of children's tendency to equate size with age and deny the permanence of age differences as reviewed earlier (cf. p. 13). In the second stage, the inital responses were the same as the first, but eventually children conserved the plant's identity after repeated comparisons to their own growth. The final stage of initial acceptance of both self- and plant-identity occurred between the ages of 7 and 8 years. The results indicate that conservation of identity is affected by large size differences, and the ability to overlook these large transformations is a concrete operational, rather than preoperational acquisition. In addition, Piaget's juxtaposition of one's past growth with the complete growth cycle of a plant is really not comparable in terms of time span and growth rate, and it is conceivable that children might not have conserved their own self-identity during the preoperational period if confronted with more extreme, or discontinuous temporal and growth spans.

DeVries (1969) examined conservation of both human and animal identity among 3- to 6-year-old children by having the experimenter and a live cat assume masks of other animals. By 5-years-old, approximately three quarters of the children conserved human identity, and more than half conserved animal identity. The precedence of human over animal identity corresponded to some extent to Piaget's findings of earlier conservation of human over plant identity. However, one explanation for the earlier understanding of human identity suggested by DeVries was the facilitating effects of the greater discrepancy between the human's body and animal masks, than between the cat's body and animal masks.

Guardo and Bohan (1971) examined conservation of self-identity by verbally asking children ranging in age from 6- to 9-years-old whether they were the same person from birth, and whether they would be the same person in the near future (i.e., higher grades) and remote future (i.e., when grown up). Over three quarters of the children conserved their self-identity into the near future, while about two thirds conserved their self-identity into the remote future. Thus, for children at all age levels, transformations over a long temporal span were more difficult than those involving a shorter temporal span. However, smaller proportions of children conserved their self-identity from the past, and developmental patterns were observed under the past transformation. It was not until about 8- and 9-years-old that about half the children conserved their identity from the past. One possible explanation for the comparatively later conservation of past self-identity (not considered by the authors) may be the difference in the format of the past and future questions. The past item required children to specify the number of years they were themselves (somewhat ambiguous wording for their actual age), while the future

items simply required an affirmation or denial of the continuation of their self-identity. Thus, these methodological disparities tend to confound the reliability of the age patterns observed for past and future transformations on conservation of self-identity.

Conservation of gender. Gender conservation refers to the recognition of the permanence of one's sexual identity despite certain behavioral, temporal or other transformations. DeVries (1969, 1971) asked separate groups of 3- to 6-year-old boys and 5- to 7-year-old children whether a girl could become a boy if she had a boy's haircut, played male stereotyped games (such as playing with guns), and wore male clothing. By 5- and 6-years-old, more than half the children realized that gender was permanent, although it was not until 1 or 2 years later that most children explicitly verbalized the principle of gender conservation according to DeVries' criterion. Slaby and Frey (1975) asked 2- to 5-year-old children whether they could become opposite-sex children if they wore opposite-sex clothes, played opposite-sex games, or by simply wanting to change their sex. While about half the children acknowledged the permanence of their gender under these transformations, about three quarters recognized gender conservation from their own infancy to the present time. Thus, as with conservation of self-identity, continuity from the past to the present appears to contribute to an earlier recognition of invariance than other types of transformations which highlight perceptual changes.

It appears then, that gender conservation emerges for many children during the preoperational period. One reason for this early development, as compared with other types of social conservation, may be that, notwithstanding current trends towards reducing sex sterotyping, there is much socialization during these young ages promoting gender identification.

It is likely that implicitly (and perhaps explicitly as well) accompanying this gender identification is the recognition of the permanence of ... that identity.

Conservation of kinship role. Conservation of kinship refers to the recognition of the permanence of a given kinship role despite various transformations. Chambers and Tavuchis (1976) examined 7- and 9-year-old children's understanding of kinship roles under two types of transformations. The first type involved changes in the essential, or defining feature of the kinship terms, such as: "If two boys have different parents are they still brothers?" The second type involved future temporal changes such as: "When these two boys grow up are they still brothers?" All questions were accompanied by a photograph of a family, and covered parental, sibling and child kinship terms. For both types of transformations, a majority of the 7-year-olds, and all of the 9-year-olds understood the appropriateness or inappropriateness of the particular kinship terms.

Summary. The results from these studies indicate that conservation of single social roles is primarily a preoperational acquisition, although it is not fully completed until the ages of 7- and 8-years old. These findings are consistent with Piaget's (1968) position that conservation of identity in general (albeit mainly with respect to physical concepts) is a preoperational phenomenon, although it is conceivable that transformations other than those performed to-date might delay the appearance of single role conservation to the concrete operational period.

Conservation of Multiple Social Roles

Conservation of multiple kinship roles. Conservation of multiple kinship roles refers to the recognition that two kinship roles can coexist simultaneously, such as a mother being a sister, or a father being a brother.

Danziger (1957) observed a three stage sequence in the development of multiple kinship role conservation among 5- to 8-year-old children who were asked whether a father could be an uncle, a man could be a brother, and a lady could be a daughter or sister. The first stage was defined as categorical, and children at this stage denied the possibility of being two roles simultaneously. The second stage was defined as isolated (or concrete) relational, and again children denied the possibility of multiple kinship roles, but based this denial on some concrete attribute such as "being grown up" or "too old." The third stage was defined as abstract relational, and now children accepted the logical necessity of multiple kinship roles, and based their explanations in terms of the relationship between the roles, such as "a lady is just a little girl grown up."

Kooistra (1963) examined 4- to 7-year-old children's understanding of conservation of multiple kinship roles by showing children a picture of a family with three sons, and asking boys if the father could be a brother and girls if the mother could be a sister. An analysis of Kooistra's data by this writer on this question indicated that only 36% of the children answered it correctly. In fact, this question was significantly more difficult than both conservation of quantity, and children's understanding of sibling concepts. An analysis of variance on this question indicated that the main effect of age was significant, and planned comparisons between adjacent age levels indicated that a linear trend accounted for the significant age effect.

Thus, the available evidence concerning conservation of multiple kinship roles suggests that it is a fairly difficult concept for preschool age children, and that it is not fully developed until the concrete

operational period. One explanation as to why this form of social conservation depends on concrete operational structures is the necessity of understanding both the invariance of two separate kinship classes, as well as combining these separate classes into a newly formed class. Thus, the union of these separate classes may not occur until each class is independently established, and the ability to combine separate classes is a concrete operational skill.

Conservation of kinship-social roles. Conservation of kinship-social roles refers to the recognition that a kinship and social role, such as mother and teacher, can coexist simultaneously. The earliest research concerning conservation of kinship-social roles was conducted by Hartley (Hartley & Krugman, 1948; Hartley, Rosenbaum & Schwartz, 1948a) who presented 6½- to 10½-year-old children pictures depicting mothers and fathers in both parental and occupational roles. For example, a father was shown in a parental role with a child as well as in two occupational roles, and the children were asked whether the pictured man was still a father when he was working as a postman. No developmental trends were reported, but contingency coefficients indicated that the children responded consistently across the various conservation of role situations. Hartley proposed four possible categories for multiple roles: exclusive roles (A or B); coexisting roles (A and B); one permanent and one temporary coexisting roles (always A and sometimes B); and one permanent or temporary role with one potential role (A with B potential).

Kooistra (1963) presented two sets of four dolls under three kinship-social conditions to 4- to 7-year-old children. The three transformations were: mother-schoolteacher, father-doctor, and boy/girl-schoolchild, corresponding to the subject's sex. One doll from the kinship group was placed in the

social group, and children were asked whether the mother is still a mother when she joins the teacher group. The present analysis of variance of these data revealed a significant main effect of age, and planned comparisons between adjacent age groups revealed a linear trend which accounted for the significant age effect. Interestingly, the mother-schoolteacher question was significantly more difficult than the father-doctor question, while no differences occurred between the child-schoolchild and either parental question. The total score on these conservation of kinship-social role questions did not differ from that on conservation of quantity, and approximately two thirds of the children conserved on both social and physical conservation tasks. In addition, these kinship-social role questions were significantly easier than the multiple kinship role question (i.e., father-brother). Thus, the present analysis of Kooistra's data suggested that conservation of kinship-social roles developed synchronously with conservation of quantity, yet somewhat earlier than conservation of multiple kinship roles.

Sigel, Saltz and Roskind (1967) expanded Kooistra's kinship-social role tasks by assessing the effects of irrelevant temporal and perceptual cues among children ranging in age from 5- to 8-years-old. Temporal cues involved two conditions in which the father either is, or was in the process of becoming (i.e., studied and became) a doctor. The effects of representation were examined by either using the two sets of dolls or simply presenting the questions orally without any accompanying stimuli. The developmental patterns obtained resembled those observed with Kooistra's sample, although the 8-year-old level at which a majority of children conserved was one year later than that reported by Kooistra. The elimination of the dolls resulted in significantly greater number of conserving subjects

(71 versus 42% in no dolls and dolls present conditions), and this facilitating effect of no representation was interpreted as support for Bruner's position concerning the interfering effects of irrelevant perceptual cues on conservation. Under the two temporal conditions, a significantly larger number of subjects conserved under the "is" condition than on the two stage progression of "studied and became" (69 and 39% respectively).

Both Kooistra's and Sigel et al.'s social role transformations involved what Saltz and Hamilton (1968) described as "good-good" changes, in that the shift from kinship to social role involved a positively valued social role (i.e., doctor). Thus, in addition to these good-good conditions, Saltz and Hamilton also included transformations from "good-bad," such as father becoming a drunkard, mother becoming a shoplifter and brother becoming a bully. The stimulus materials were similar to those used by Sigel et al., and each of the "bad" roles had been rated as negative by a separate group of children. Among their 8-year-old sample, significantly more children conserved under the good-good transformation than under the good-bad transformation (78 and 33% respectively). The question which involved the least amount of negative evaluation was found to be the brother-bully question, and significantly more children conserved on this question than on the father-drunkard question. Thus, these results indicated that conservation of kinship-social roles was more difficult for children to understand when one of the role changes involved negative, in contrast to positive, social roles.

In a further extension of these studies, Saltz and Medow (1971) included an additional evaluative transformations of "bad-good" social roles. Saltz proposed a cognitive space theory to account for conservation of

social roles, which contained both attributes for particular concepts as well as a semantic space which represented the linguistic representation of these attributes. Furthermore, Saltz suggested that children's concepts occupy narrow semantic spaces, so that transformations of only a few attributes will cause children to alter their initial concept and no longer accept the original role as a member of that class. Based on this theory, Saltz predicted that good-bad and bad-good transformations were essentially symmetrical, since in both cases, the amount of distance between these evaluative dimensions was the same regardless of the direction of change. Using materials similar to those used previously, three types of transformations were administered to 5-and 8-year-old children: good-good, such as father-doctor; good-bad, such as saleslady-thief; and bad-good, such as drunkard-father. Significantly more conservation responses occurred in the good-good condition in contrast to both the good-bad and bad-good conditions, although as predicted, these last two did not differ from each other. The only significant age differences occurred within the good-good condition, in which 8-year-olds made significantly more conservation responses than 5-year olds. Since the two conditions involving good and bad transformations were equally difficult, it is not clear by what age children conserve on those kinship-social roles.

The possibility that certain types of training experiences might accelerate the acquisition of kinship-social role conservation was investigated by Fink (1974), who administered imaginative play training sessions to 5-year-old children. These play training experiences significantly increased children's understanding of kinship-social roles, but had no effect on children's conservation of physical concepts. While these results support the contention that certain social experiences may

facilitate the development of social conservation, there were limited (if any) theoretical grounds to expect an influence on physical conservation.

The results from these studies reveal clear developmental trends in the increase in conservation of kinship-social roles, but the acquisition of this form of social conservation is mediated by certain factors. Removing all concrete stimuli, using positive, rather than negative social roles, and limiting temporal changes to the present, tend to facilitate the understanding of kinship-social conservation.

Conservation of multiple social roles. Children's understanding that people can simultaneously occupy more than one social role has been examined in relationship to religious (class A, consisting of three subclasses of Jewish, Catholic and Protestant) and nationality groups (class B, consisting of American and other nationalities such as Italian and Irish). In general, it is assumed that subclasses within both A and B are mutally exclusive, so theoretically one could not be both Jewish or Catholic, or American and Irish. However, in reality, the existence of interfaith and interethnic marriages precludes the exclusiveness assumption of some of these subclasses, so that while these studies were based on this assumption, its limits are recognized.

Hartley, Rosenbaum and Schwartz (1948b) asked preschool and elementary school age children whether it was possible to belong to both a religious and nationality group which corresponded to those groups which children identified themselves as belonging to. Before the age of 6½-years-old, much confusion was observed concerning the possibility of multiple roles, and children generally claimed either that it was possible to belong to more than one subclass (such as being Jewish and Catholic), or denied the possibility of belonging to more than one class simultaneously. Recognition

of the possibility of belonging to two classes simultaneously occurred only among the older children.

In a series of studies with children of different religious groups, Elkind (1961, 1962b, 1963) examined Jewish, Catholic and Protestant children's understanding of whether they could be both a member of their respective religious group as well as be an American. Elkind observed three stages in the development of multiple social roles among three groups of children who ranged in age from 5- to 14-years-old. The first stage, designated as global, was characterized by the absence of any multiplicity of roles, so that classes A and B were seen as mutually exclusive. The second stage, designated as concrete, was characterized by a consideration of class A as a subclass of class B. For example, children at this stage would claim that a Jew could be an American because they lived in America. The third stage, designated as abstract, was characterized by a recognition of the genuine multiplicity between class A and B with an understanding of the logical relationship between them.As expected, progress through these stages increased with age, so that a majority of children at the global stage were between 5- and 6-years-old; the majority of children at the concrete stage ranged between 7- and 11-years-old; and a majority of children at the abstract stage ranged between 11- and 14-years-old. With few exceptions, similar developmental patterns occurred for children from each religious group.

Therefore, it appears that conservation of multiple social roles involving religious and nationality groups is not fully developed until most children reach a transitional age between concrete and formal operations. Furthermore, conservation of social roles appears later than conservation of multiple kinship, and kinship-social roles. One explanation

for this difficulty of multiple social conservation may be the greater abstractness and ambiguity of these concepts, in comparison to kinship and other social concepts.

Inclusive and exclusive roles. The foregoing sections have dealt exclusively with combinations of kinship and social roles that were inclusive in the sense that a person could logically assume both roles either simultaneously or successively. For example, in the mother-sister combination, it is logically possible for this pair to occur, but it is also possible to distinguish combinations that are exclusive, such as brother-sister, in which it is not logically possible for that pair to occur. Using this distinction between inclusive and exclusive roles, the development of exclusive roles and its relationship to inclusive roles is reviewed.

This distinction between inclusive and exclusive roles corresponds to some extent to one proposed by Slobin (1966) concerning reversible and nonreversible forms of passive and active sentences. Slobin defined reversible sentences as those in which the subject and object could both serve as either actor or recipient in active and passive sentences. For example, a reversible sentence could be "the dog chases the cat" since either animal can logically serve as subject or object. In contrast, nonreversible sentences were those in which the subject and object could not be interchanged because it would be logically impossible for the actor to also be the recipient as well. Thus, a nonreversible sentence could be "the mother washes the clothes" since it is not possible for clothes to wash the mother.

Slobin reported that among elementary school age children, nonreversible sentences eliminated differences which were typically found between active

and passive sentences when these were expressed in reversible formats. Slobin suggested that nonreversible sentences were easier for children to understand because they reduced the semantic complexity of the sentence by limiting the number of logically feasible subjects and objects to only one instance. While some evidence exists to the contrary, additional research has generally supported the tendency for nonreversible sentences to be somewhat easier than reversible sentences, particularly among preschool age children (Beilin, 1975).

Based on these linguistic findings, a question which arises is whether inclusive and exclusive roles would also follow this pattern observed in conjunction with active and passive sentences. As far as American kinship terms are concerned, the only variable which logically precludes inclusive roles is the sex component, and the only combinations of exclusive kinship roles that have been examined are those pertaining to whether children could become parents of the opposite sex. When this question has been given to different groups of preschool age children (Slaby & Frey, 1975; Thompson & Bentler, 1973), approximately three quarters of the children recognized the impossibility of this combination occurring. Even among 3-year-olds, Thonpson (1975) found that 60% of the children understood several questions concerning the possibility of becoming same- and opposite-sex parents.

When these results concerning exclusive kinship roles are compared to those concerning inclusive kinship roles reviewed earlier, it is apparent that these exclusive roles are understood by larger proportions of comparable age children than are inclusive roles. However, there several problems within these exclusive and inclusive questions which might contribute to the observed precedence of exclusive roles. First, exclusive

questions have involved changes across generations (such as child to parent), as well as across time (such as from the present to the future). In contrast, inclusive questions have involved changes within the same generation (such as parental-sibling, or child-sibling roles), as well as within the present time context. Thus, it may be that children were responding to generational and temporal cues embedded in exclusive questions, rather than to the logical exclusivity per se. Second, exclusive questions have included subjects as one of the referents, while inclusive questions contained people other than the subjects. It is conceivable that the presence or absence of the subject as one of the role may affect performance on that question, particularly among younger, more egocentric children. The present study is designed to examine exclusive and inclusive roles by controlling these temporal, generational and subject variables.

While the foregoing roles have involved kinship combinations, it is also possible to consider social roles in which logical exclusivity might exist. Applying this distinction to social roles is difficult since there is little logical necessity which precluded most combinations of social roles. However, one exclusive social role combination examined in conjunction with children's understanding of religious and nationality groups, as whether animals such as dogs and cats could belong to the same religious group as the subject (Elkind, 1961, 1962a, 1963). The recognition of the impossibility of an animal belonging to a religious group progressed through the same stages, and at similar ages, as that observed for inclusive social roles. In this instance therefore, few differences were observed between exclusive and inclusive concepts.

In sum, the issue of exclusive roles has received little attention to-date, but some evidence indicates that among kinship combinations,

exclusive roles are conserved earlier than inclusive roles. This conclusion is tentative however, in light of methodological problems inherent in questions that have been employed at this time.

Relationship between Social and Physical Conservation

Since it has been suggested that conservation of social and physical concepts have some logical properties in common, it is of interest to consider the extent to which these types of conservation tasks might be correlated. The available correlational data reveals moderate correlations between physical conservation tasks such as number, quantity and length, and: conservation of gender (ranging from .23 to .65, DeVries, 1974; LaVoie & Andrews, 1975): conservation of self-identity (ranging from .37 to .51, DeVries, 1974); and conservation of multiple kinship and kinship-social roles (.44 and .47 respectively, Kooistra, 1963). A related question is whether any evidence of convergent validity exists among social conservation tasks, since Shantz (1975) reported equivocal results concerning convergent validity among other social cognitive tasks such as role-taking and egocentrism. The available correlational data among these social conservation tasks indicates moderately high correlations between: conservation of gender and self-identity (.57 and .76, DeVries, 1969, 1974); and multiple kinship and kinship-social roles (.58, Kooistra, 1963). Thus, these data provide evidence for convergent validity among several social conservation tasks, as well as some support of a relationship with physical conservation tasks. The present study addresses these issues through correlational and factor analytic analyses of social and physical conservation tasks.

Effects of Experimental and Subject Variables

In addition to the theoretical issues examined in the foregoing sections,

it is also possible that social conservation tasks are influenced by certain methodological and subject variables. Some of these variables are discussed below.

Methodological variables. One difference between physical and social conservation tasks, beyond the content domain, is that transformations performed on materials among physical conservation tasks are not permanent, so that the materials can be physically restored to their pre-transformation condition. The transformation-restoration sequence is the standard procedure among physical conservation tasks from which there are few departures. Similarly, some of the foregoing social conservation tasks also involve restorable transformations, such as inclusive kinship roles and certain kinship-social combinations. However, other social conservation tasks involve transformations which are permanent and therefore cannot be returned to their pre-transformation condition. For example, when temporal transformations were applied to conservation of human identity or kinship roles, these temporal changes were considered permanent and nonrestorable. In addition, other nonrestorable transformations are logically impossible, such as exclusive kinship roles and opposite sex gender transformations. It is proposed that nonrestorable transformations may interfere with conservation in both social and physical domains, since children may confuse the impossibility of physically restoring materials with the logical understanding of operational reversibility of either inversion (i.e., A is changed to B but B can be changed back to A) or compensation (B is taller but thinner than A). Thus, one variable which has not been systematically examined is the restorability of the performed transformation, so in order to maximize the methodological comparability between social and physical

conservation tasks, the present study applies both restorable and non-restorable transformations to both content domains.

A second methodological issue which may influence the assessment of social conservation is a familiar one in Piagetian research, namely the presence or absence of concrete stimulus materials. Among physical conservation research, some form of stimulus materials are invariably used, despite controversies concerning particular features of these materials. However, among social conservation research, predominately verbal presentations have been more common than the use of some form of stimulus materials, so many of the results discussed earlier may be confounded by this difference in the mode of representation. For example, in reference to Piaget's sibling questions, with only two exceptions, all studies have administered these questions verbally without any accompanying representation of people or families. When pictures of families were used (Chambers & Tavuchis, 1976; Kooistra, 1963), children's understanding of these sibling concepts occurred approximately two to three years earlier than those of other studies (see Table 1 for a comparison of these results). However, the opposite effect occurred on Sigel et al.'s (1967) kinship-social conservation tasks, in that significantly more conservation responses occurred when no form of stimulus representation was used. These contradictory patterns concerning the facilitating or interfering effects of stimulus materials are somewhat inconclusive since the nature of the tasks per se are so different. However, the present study employs concrete stimulus materials for all social conservation tasks with the assumption that the presence of these materials is more likely to enhance, rather than hinder, conservation performance. In addition, the use of materials for social conservation tasks will

further increase the methodological similarity between physical and social conservation tasks.

Family characteristics. Since many of these social conservation tasks have been concerned with kinship, it is conceivable than children's understanding of these concepts may be influenced by family variables such as family size, sex of siblings and birth order. The possible influence of these variables on kinship conservation has not been assessed, although Slaby and Frey (1975) reported no significant correlations between conservation of gender and family variables of sex of siblings, birth order and family size.

In reference to kinship terms, Haviland and Clark (1974) reported that preschool age children's knowledge of kinship definitions per se was not related to family experiences, although a trend was observed for children to have higher level definitions for same-sex kin terms. Price-Williams and his colleagues (LeVine & Price-Williams, 1974; Price-Williams, Hammond, Walker, Edgerton & Newton, 1974) reported that among Nigerian and Hawaiian children, the acquisition of other-centered, as compared to ego-centered kinship terms, was related to cultural patterns and the size of the family household. Without citing any data, Piaget (1928) claimed on the one hand that results on his sibling questions were "conditioned. . .by the number of the subject's brothers and sisters" (1928, p. 100), and on the other hand reported no differences between only children and those with siblings. Elkind (1962a) suggested that one source of some of the (minor) discrepancies between his and Piaget's results might be accounted for by the smaller family size of his subjects, in contrast to Piaget's subjects who supposedly came from larger families. However, since both Piaget's and Elkind's observations were without empirical foundation, the possible effects of family variables on kinship

concepts remains unresolved. The present study assesses the effects of these variables by comparing children's performance on kinship conservation according to certain family characteristics.

Effects of intelligence. Another variable which may influence the development of social conservation may be children's intelligence and mental age, since these factors have been found to correlate with performance on physical conservation tasks. Several studies (DeVries, 1974; Kooistra, 1963) have reported moderate correlations between psychometric measures of mental age and: conservation of multiple kinship (.59) and kinship-social (.56) roles; and conservation of gender (.31 and .67) and self-identity (.35 and .71). Thus, to assess the effects of mental age on social conservation, an index of mental age is included in the present study.

Summary: The Development of Social Conservation

Several conclusions can be drawn from the studies reviewed in the foregoing sections. First, the development of conservation of single social roles occurs among a majority of children during the preoperational period, and is completed by around the age of seven. In contrast, conservation of multiple social roles emerges among a majority of children during the concrete operational period, with kinship-social roles appearing earlier than multiple kinship roles, and multiple social roles appearing later at the transition to the formal operational period. Clearly, conservation of multiple roles is a more complex acquisition than single roles, since it involves conservation of single roles such as identity, gender and kinship, as well as the coordination of these, and other concepts pertaining to the particular role combinations.

Second, the nature of experimental transformations applied to social

conservation appears to have differential effects on particular content domains. For example, one transformation applicable to kinship is the sex component, as illustrated by the proposed distinction between exclusive and inclusive concepts. It appears that exclusive concepts, based on the impossibility of assuming opposite-sex kinship roles, are understood earlier than inclusive roles, based on same-sex kinship roles. Thus, children learn during the preoperational period which kinship roles cannot coexist, but at the same time they are less certain as to which kinship roles can coexist. The sex component seems to eliminate certain kinship pairs at an early age, but becomes a less salient factor among inclusive kinship pairs.

A second transformation also germane to kinship is time, and results from studies concerning the effects of temporal transformations on social conservation differ according to the direction ot the temporal changes. Transformations into the future, particularly the distant future, increase the difficulty of conservation of self-identity (Guardo & Bohan, 1971) and kinship-social roles (Sigel et al., 1967). In contrast, transformations into the past yield equivocal findings, since they increase the difficulty for self-identity (Guardo & Bohan, 1971) but decrease the difficulty for gender conservation (Slaby & Frey, 1975). The lack of methodological comparability between these studies limits the strength of these findings, although another explanation for this pattern may be the confounding of implicit changes in generational kinship roles in future transformations, with the amount of elapsed time per se, That is, for five-year-old children, changes into the distant future involve a substantial amount of elapsed time (such as 15 to 20 years), as well as the recognition that adulthood is a distinct kinship role from childhood. In contrast, changes

into the past involve a shorter elapsed time span (such as 3- to 4-years), and no obvious change in kinship role, since children generally do not consider infancy a distinct kinship role from childhood, but an extension of their current kinship role. Thus, there seems to be continuity for children between the past and present in both amount of time and past and present kinship roles, but a discontinuity between the present and future in terms of amount of time and present and future kinship roles. It is likely that this perceived discontinuity contributes to the greater difficulty of social conservation under future, as compared to past transformations. However, when conservation of self-identity from the present to the future is accompanied by the recognition of the possibility of occupying multiple social roles, the transition from childhood to adulthood kinship roles (and vice versa) may no longer be perceived as discontinuous. The present study systematically examines the effects of these types of temporal transformations on kinship conservation.

A third type of transformation which influences kinship conservation is the nature of the accompanying social role. It appears that when negatively evaluated social roles (such as thief) accompany kinship roles, children deny the pair can coexist, although at the same time they acknowledge the existence of positive kinship-social combinations. Clearly, the children are denying that parents could (or should) assume these negative roles. The effects of other types of social roles have not been explored, such as the effects of sex stereotyped social (i.e., occupational roles. For example, certain male stereoytped social roles might be conserved with male kinship roles but not with female kinship roles because of the conventional nature of the sex-role stereotype per se. Thus, children may acknowledge that a father can also be a doctor or a mother be a nurse.

This could occur not because of an inability to conserve multiple roles, but because of the power of the stereotype which negates that combination of roles, as did the negatively evaluated roles. This would reflect an example of the influence of social learning on cognitive conservation, since the effects of the stereotyped social roles on kinship combinations would depend on the degree to which children believed those stereotypes to be valid. The present study explores the effects of sex stereotyped social roles as a form of transformation performed on kinship conservation tasks.

These foregoing transformations pertain only to social conservation, but a more general transformational issue concerning the distinction between restorable and nonrestorable transformations applies to both physical and social conservation tasks. It has been suggested that an important but overlooked methodological difference between social and physical conservation tasks was that many of the former tasks involved nonrestorable transformations, while many of the latter tasks did not. The absence of any restorations to pre-transformation conditions may tend to increase the difficulty of conservation, since this absence may be confused with the understanding of logical reversibility which is essential for conservation. The present study is designed to correct this problem by performing both types of transformations in both social and physical domains.

Statement of the Problem

The present study is designed to examine the development of conservation of social concepts pertaining to kinship, and the effects of certain experimental transformations and subject variables on these concepts. The following hypotheses will be tested:

1. The effects of the type of conservation will be significant, so that conservation of social concepts will be more difficult than conservation of corresponding physical concepts.

2. The effects of the type of transformation performed on the physical and social conservation tasks will be significant, so that across content domains, nonrestorable transformations will be more difficult than restorable transformations.

3. Within conservation of single kinship roles, the effects of the type of temporal transformation will be significant, so that conservation under transformations into the future and remote time spans will be more difficult than those into the past and near time spans.

4. Within conservation of multiple kinship roles, the effects of the logical exclusivity of the transformation will be significant, so that inclusive transformations will be more difficult than exclusive ones.

5. Within conservation of kinship-social roles, the effects of the conventionality of the sex stereotyped social role will be significant, so that conservation of kinship-social role combinations containing unconventional social roles will be more difficult than those containing conventional ones.

6. Convergent and discriminant validity are expected to occur among the social and physical conservation tasks, so that social conservation tasks will be positively and more highly correlated among themselves than with physical conservation tasks, and the converse pattern will occur among the physical conservation tasks.

7. Performance on physical and social conservation will be positively related to chronological and mental age.

8. Family characteristics of birth order and family size will be positively related to performance on social, but not physical conservation.

CHAPTER 2

METHOD

Design

The experimental design of the study was a 3 x 2 x 2 x 2 x 2 repeated measures factorial design, consisting of three between, and two within subject factors. The three between subject factors were: chronological age (CA), with three levels (5-, 6-, and 7-year-olds); sex, with two levels (male and female); and form of social conservation items (same or opposite sex). The two within subject factors were: type of conservation, with two levels (physical and social); and type of transformation, with two levels (restorable and non-restorable). Among the social conservation tasks only, a separate within subject factor was type of transformation, with three levels: (temporal, logical exclusivity and social roles). A summary of the design is presented in Table 2.

Subjects

The sample contained 90 Caucasian children ranging in age from 5- to 7-years-old, with 15 boys and 15 girls at each age level. Each child came from an intact family and was living with both natural parents. Of the total sample, 43 subjects were interviewed individually at the Calhoun School, a private coeducational school located in Manhattan, and the remaining 47 subjects were interviewed individually in their homes in the NewYork metropolitan area. Information concerning the age, sex and number of siblings, was obtained from each subject, while information concerning parental occupations was obtained either from school records or the parents themselves. The size of the subject's families ranged from 1 to 6 children, with 18% of the

Table 2

Experimental Design by Type of Conservation Task

Factors	Number of levels	Description of levels
Physical and social conservation		
Between subjects:		
Chronological age	3	5-, 6-, 7-year-old
Sex	2	Male and female
Form of social conservation tasks	2	Same- and opposite-sex
Within subjects:		
Type of conservation	2	Physical and social
Type of transformatio-	2	Restorable and non-restorable
Social conservation		
Between subjects:		
Chronological age	3	5-, 6-, 7-year-old
Sex	2	Male and female
Form of social conservation tasks	2	Same- and opposite-sex
Within subjects:		
Type of transformation	3	Temporal, logical exclusivity, sex stereotyped social roles

subjects coming from families with one child, 62% with two children, 14% with three children, and 5% with four or five children. The ordinal positions of the subjects ranged from 1 to 5, and 58% were first-borns, 33% were second-borns, 6% were third-borns, and the remaining 3% were fourth- or fifth-borns. The socioeconomic level of the sample was middle- and upper-middle income, since the father's occupations ranged within managerial, business, and professional categories. Of the 85 subjects for whom information was available, 45 had working mothers and 40 had nonworking mothers.

Materials, Procedure and Scoring

The tasks included in the study are presented in Table 3, and the specific materials, procedure and scoring for each task are described separately below. All subjects were asked to make a conservation judgment and an explanation of that judgment on 36 conservation items. The responses initially received two scores; a judgment score of either 1 or 0, indicating a conservation or nonconservation response (i.e., same or different); and an explanation score of 1 or 0, indicating whether the explanation reflected an understanding of conservation. If a subject did not make either a judgment or explanation, the response was scored as 0. The criteria for the explanations are described separately below for each task, and reliability of the classifications of explanation responses was assessed by calculating the percent of inter-rater agreement. After the author classified all the explanations, a second judge (a doctoral student in psychology) independently classified 90 responses of subjects randomly selected from the total sample. The inter-rater agreement on these items was 91%, and the few discrepancies were discussed and resolved.

Table 3

Summary of Experimental Tasks

Restorable		N Items	Nonrestorable	N Items
Social conservation				
Inclusive kinship roles		6	Exclusive kinship roles	6
Kinship-social roles:			Temporal changes	6
Conventional:		3		
Unconventional:		3		
Total social:		12		12
Physical conservation				
Mass	Clay balls	3	Crushed shells and sugar cubes	3
Weight	Containers	3	Dissolution of sugar	3
Total physical:		6		6
Kinship measures				
Kinship definitions		6		NA
Kinship identification		2		NA
Kinship permanence		2		NA

Social Conservation

Four conservation of kinship tasks were given, each differing in the type of transformation performed. The logically inclusive kinship pairs and the sex stereotyped kinship-social pairs contained restorable transformations, and the logically exclusive kinship pairs and temporal transformations contained nonrestorable transformations.

Restorable transformations. These tasks involved restorable transformations in that either the transformation was logically possible, or once it was performed, the materials were restored to their original condition.

Inclusive kinship pairs: This task assessed the understanding that an individual can occupy two kinship roles which can logically co-exist simultaneously, while still retaining membership in both roles, such as being a father and a brother, or a mother and a daughter. The inclusive set of combinations contained six items, including all pairwise combinations of male and female parental, child and sibling kinship terms. These items were designed so that each kinship term appeared twice, each in a within- and across-generation pair, and once as the subject and once as the object of the pair. These items appear in Appendix A.

Materials: Eight cardboard stick figure dolls, each 5" high and 3¼" wide at the arms. The figures were intentionally ambiguous as to sex so that no cues would exist in the materials as to the sex of a particular kinship role.

Procedure: Following Kooistra's (1963) procedure, the figures were divided into two groups of four dolls, with each group representing

one of the two kinship roles. One doll was moved from the first group (A) to the second (B), and subjects were asked: "This doll (A) wants to join the other group (B). Can (A) also be a (B) and still be (A) at the same time?" or "Is he/she still a (A) if he/she is also a (B)?" After the subject responded yes or no, they were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 6. The categories of explanations which received 1 point scores were:

1. Kinship relationship explained: These responses recognized the appropriate kinship relationship between the pairs. For example, a brother can also be a son because they have the same parents and siblings.

2. Multiple roles possible: These reponses indicated an understanding that it is possible for a person to occupy two or more roles simultaneously. For example, you can be a brother and a son at the same time.

3. Names person in both roles: These responses gave examples of someone, primarily the subjects themselves or family members, who were both roles. For example, I am a brother and a son, or my mother is a sister and a mother.

4. Recognition of similarity: These responses indicated that the two roles were similar in some way, usually on the basis of sex. For example, a brother can be a son because they are both boys.

The categories for explanations which received 0 point scores were:

1. Inappropriate age - too young: These responses indicated that the two roles could not co-exist because one was too young (or small) to also be the other. For example, a sister cannot be a mother

because the sister is too young.

2. Inappropriate age - too old: These responses indicated that the two roles could not co-exist because one was too old (or big) to also be the other role. For example, a father cannot be a brother because he is too old to be a brother.

3. Multiple roles not possible: These responses indicated that a person cannot be more than one role at a time. For example, a mother cannot be a sister because she cannot be two things at the same time.

Sex stereotyped kinship-social pairs: This task assessed the understanding that an individual can occupy a kinship and social role simultaneously. The social roles were conventional and unconventional male and female sex stereotyped occupational roles (adapted from Bacon & Lerner, 1975), which were paired with male and female kinship terms. For example, a conventional male kinship-social pair was "father and doctor," and a conventional female pair was "mother and nurse." The unconventional pairs were the converse of the conventional ones, such as "father and nurse" and "mother and doctor." The conventional and unconventional sets each contained three parental-, sibling-, and child-social pairs, and to reduce the number of items given to each subject, separate forms using male and female kinship terms were used. Thus, each form contained six kinship-social pairs, three conventional and three unconventional pairs of either male or female kinship-social combinations. These items appear in Appendix A.

Materials: Same as those used for inclusive kinship pairs.

Procedure: Same as that for inclusive kinship pairs.

Scoring: The number of possible conservation judgments ranged from 0 to 6. The categories for explanations which received 1 point scores were:

1. Anyone can occupy social role: These responses recognized that any person could occupy the particular social role. For example, a son can be a teacher because anyone who wants to be a teacher can do so.

2. Multiple roles possible: These responses indicated an understanding that it is possible for a person to occupy two roles simultaneously. For example, a mother is still a mother when she is a doctor.

3. Names person in both roles: These responses gave examples of someone who occupied both kinship and social roles. For example, a mother can be a doctor because the subject goes to a doctor who is also a mother.

4. Appropriate sex combination: These responses indicated that the kinship-social role combination could occur because the kinship role was the appropriate sex for the social role. For example, a father can be a doctor because he is a man, and men are doctors.

The categories for explanations which received 0 point scores were:

1. Inappropriate age: These responses indicated that the two roles could not co-exist because the kinship role was too young to also occupy the particular social role. For example, a son cannot be a pilot because the son is too young (or too little or too inexperienced) to be a pilot. These responses denied that the combination could exist at the present time, but indicated that it might be possible for them to

exist in the future when the age of the kinship role was older.

2. Inappropriate sex: These responses indicated that the combination could not occur because the kinship role was not the appropriate sex for the social role. For example, a mother cannot be a doctor because only men are doctors.

3. Multiple roles not possible: These responses indicated that a person cannot be more than one role simultaneously. For example, a father cannot be a doctor because then he would not be a father anymore.

Nonrestorable transformations. These social conservation tasks involved nonrestorable transformations in that either the transformation was logically impossible, or permanent once it was performed.

Exclusive kinship pairs: This task assessed the understanding that an individual cannot occupy two kinship roles which were logically exclusive on the basis of the particular sex combination, such as "a mother and a son," or "a father and a daughter." The exclusive set of kinship combinations contained six items, including all pairwise combinations of male and female parental, sibling and child kinship terms. These items were designed so that within each set, each term appeared twice, each in a within- and across-generation pair, and once as the subject and once as the object of the pair. These items appear in Appendix B.

Materials: Same as those used for inclusive kinship pairs.

Procedure: Same as that used for inclusive kinsip pairs.

Scoring: The number of possible conservation judgments ranged from 0 to 6. The categories of explanations which received 1 point scores were:

1. Inappropriate sex: These responses recognized that the roles were exclusive because of sex. For example, a mother cannot be a son because she is female and a son is male.

2. Recognition of differences: These responses recognized that the roles were exclusive because of some difference between them. For example, a mother cannot be a son because they are different things.

The categories of explanations which received 0 point scores were:

1. Inappropriate age: These responses indicated that the roles could not occur because one was either too young (or small) or too old (or big) to also be the other role.

2. Multiple roles not possible: These responses indicated that a person cannot be more than thing at a time.

Temporal transformations. This task (hereafter referred to as time conservation) assessed the understanding of the invariance of child kinship roles despite temporal transformations in two directions, past and future, and ranging in amount of elapsed time, near, intermediate and remote time spans.

Materials: Four male and four female plastic, freestanding 1½" dolls (Fisher-Price people) of different colors; the "birthday squares" game described below.

Procedure: This task was presented to subjects as a "birthday" game in which children became older or younger by moving forward or backward a certain number of squares. The board contained 29 adjacent squares in a "S" shaped pattern, each with a birthday cake numbered consecutively from 1 to 29. The board was 21" by 19", and each square was 2¼ by 2½". Adjacent to the squares at two or three year intervals were commercially prepared black and white drawings (from Letraset

transfer sheets) of infants, preschool, preadolescent, adolescent and adult males and females. The past and future changes were performed by moving one of the plastic dolls backward or forward, and the amount of elapsed time was represented by the number of squares moved, with 1 square for near, 4 squares for intermediate, and 10 squares for remote time spans. Since the ages on the board ranged from infancy to adulthood, the actual ages selected for the pretransformation positions were designed to include preschool, preadolescent and adolescent aged children. There were six items on this task, including all combinations of time directions and spans performed on either a male or female form of child kinship roles. These items appear in Appendix B.

The experimenter described the game to the subjects, and to assess their understanding, each subject was asked to identify the square which represented their present age and age on their next birthday. The experimenter then placed one of the figures on the appropriate numbered square and said:"Here is X who is 17(18) years old (figure placed on square 17 or 18). Is he/she still a son/daughter on his/her birthday 10 years from now when he/she is 27/28 (figure is moved to square 27/28)?" Following the conservation judgment response of yes or no, subjects were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 6. The categories of explanations which received 1 point scores were:

1. Permanence of kinship relationship: These explanations recognized that child kinship roles remained permanent because they will always have the same parents. For example, the child will always be a child to their parents because they will always have their parents.

2. Permanence despite age changes: These explanations recognized that child kinship roles remained permanent regardless of the child's age. For example, a child would still be a child no matter how old they are.

3. Appropriate age for child role: These explanations indicated that the child could still occupy child kinship roles because they were still within an appropriate age range. For example, a child would still be a child at a certain age because they are still not too old or too young to be a child.

The categories of explanations which received 0 point scores were:

1. Inappropriate age - too old: These explanations indicated that a child would no longer be a child because they would be too old for that role. For example, a child cannot be a child when they reached a certain age (somewhere around 20 years old) because then they would become a grown up.

2. Inappropriate age - too young: These explanations indicated that a child would no longer be a child because they were too young for that role. For example, a child cannot be a child when they were very young (or little) because then they were an infant.

3. Multiple roles not possible: These explanations indicated that a person could not be more than one kinship role at a time. For example, a child cannot be a child when they reached a certain age because they could not be both a child and grown up (or infant) at the same time.

Item order for social conservation. Since the inclusive, exclusive and kinship-social tasks involved common materials and procedures, these tasks were combined into a randomized list of 18 items. Pretesting indicated that an uninterupted presentation of all these items was

somewhat monotonous, so the full list was divided into two equal subscales (A and B), each containing a randomized list of 9 items which appears in Appendix C. Thus, the item order across all social conservation tasks consisted of inital presentation of either subscale A or B, followed by the six time conservation items, and then the remaining subscale A or B. The order of presentation for subscales A and B was counterbalanced across all subjects.

Same- and opposite-sex forms. Since there were separate male and female forms on the kinship-social and time conservation tasks, half the subjects received same-sex forms and half received opposite-sex forms.

Physical Conservation

The physical conservation tasks were mass and weight, performed under restorable and nonrestorable conditions. All 12 physical conservation items involved conservation of equalities, but subjects were also given one conservation of inequality item on the mass task. Since all subjects passed the inequality item, it was not included in the data analysis. Prior to the administration of the physical conservation tasks, subjects were pretested in their understanding of the terms more, less, same, different, heavier and lighter, following Griffiths, Shantz and Sigel's (1967) procedure. All subjects understood all these terms.

Restorable transformations. These tasks involved the standard procedure of altering the materials in some nonpermanent and logically nonessential manner, and then restoring them to their original appearance. The six items designed for these tasks appear in Appendix D.

Conservation of mass:

Materials: 2 clay balls of different colors.

Procedure: Three transformations and restorations were performed on the clay balls in the following order: one was changed into a hotdog; one into a pancake/hamburger, and one into eight pieces. After each transformation, subjects were asked: "Is there the same amount or a different amount," and following their judgments of same or different, they were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 3. The categories of explanations which received 1 point scores were:

1. Identity operation: These explanations indicated that the materials were the same amount because nothing was added or removed during the transformation. Therefore, the transformation per se did not affect the amount of clay. For example, the clay balls are the same because none of the clay was lost when it was changed from one form to another.

2. Compensation: These explanations indicated that the materials were the same because a transformation on one dimension was compensated on another dimension. For example, the clay balls are the same because one is longer but thinner, so it is the same amount.

3. Inversion: These explanations indicated that the materials were the same because if the transformed one was restored to its original condition, it would be the same as the standard. For example, if the hotdog is restored to a ball, it will be the same as the standard.

The categories of explanations which received 0 points scores were:

1. Qualitative identity. These explanations did not define the property which accounted for the material's equivalence. For example, the clay balls are the same as they were before the change.

2. Size of transformed materials greater than standard: These explanations indicated that the transformed materials were larger than the standard materials. For example, the hotdog is more because it is longer than the ball.

3. Number of transformed materials greater than standard: These explanations indicated that the transformed materials contained more than the standard materials. For example, the amount of clay is more because there are more pieces in the transformed than in the standard.

4. Size of standard greater than transformed: These explanations indicated that the size of the standard was greater than the transformed materials. For example, the standard ball is more than the pancake because it is bigger.

Conservation of weight:

Materials: One O'Haus (School balance 1200) doublepan balance scale; green and yellow split peas; 2 standard size clear plastic containers 4" high and 3¼" diameter (A & B); one tall and narrow clear plastic container 6¼" high and 2¼" diameter (C); one short and wide clear plastic container 3¼" high and 4½" diameter (D); 5 miniature clear plastic containers 1½" high and 1½" diameter (E).

Procedure: All subjects were instructed in the use of the balance scale prior to the tasks. Three transformations and restorations were performed with the containers of split peas in the following order: the green peas in A were poured into C; the yellow peas in B were poured into D; and the green peas in A were poured into E.

After each transformation subjects were asked: "Does this jar weigh the same amount or a different amount as this jar," and following their judgments of same or different, they were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 3. The categories of explanations which received either 1 or 0 point scores were the same as those described above for conservation of mass.

Nonrestorable transformations. In contrast to the foregoing restorable tasks, the materials selected for the nonrestorable tasks could not be returned to their original condition once the transformation was performed. The nature of the transformations was such that they altered the appearance of the materials in a permanent but logically nonessential manner. These tasks were designed to correpond in format, procedure, items and scoring to the restorable tasks, and these six items appear in Appendix D.

Conservation of mass:

Materials: Sugar cubes, macaroni shells, plastic bags, mallet and chisel.

Procedure: Three transformations were performed in the following order. On the first trial, two plastic bags each containing three macaroni shells were presented, and after their equivalence was established, the experimenter crushed one bag into finely ground pieces with the mallet. On the second trial, two plastic bags each containing one sugar cube were presented, and after establishing their equivalence, the experimenter sliced one cube in half with the chisel. On the third trial, two new plastic bags each containing one sugar cube were presented, and after establishing their equivalence, the experimenter

sliced one cube into four pieces. All of the materials remained in the bags while the transformations were performed. On each trial subjects were asked: "Is there the same amount or a different amount," and following their judgments of same or different, they were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 3. The categories of explanations which received either 1 or 0 point scores were the same as those described above for restorable conservation of mass.

Conservation of weight: This task was a modification of Inhelder's (1968) dissolution of sugar task in which a sugar cube was dissolved in water and comparisons made between the dissolved sugar and its predissolution state. However, in Inhelder's procedure, a standard intact cube was not present as a basis for a conservation comparison to the dissolved cube, so the present task was designed to provide a standard intact cube to compare with the dissolving cube.

Materials: One O'Haus doublepan balance scale; two 9-ounce clear plastic containers partially filled with equal amounts of water; 4 sugar cubes; one 2-minute egg timer.

Procedure: Three transformations were performed in the following order. The initial equality of the two jars of water was established, and with the standard jar remaining on the scale, the jar with the dissolving cubes was removed from the scale and placed in front of the subjects. Two cubes were placed next to the standard jar on the scale, while two cubes were inserted into the second jar. The first comparison between the two jars occurred immediately after the cubes were inserted into the water, the second after one 2-minute

interval, and the third after a subsequent 2-minute interval. After the first 2-minute interval the cubes were partially dissolved, and after the second 2-minute interval the cubes were almost always completely dissolved. If the cubes were not completely dissolved at the end of the last trial, subjects were requested to stir and crush them until they were completely dissolved. This procedure guaranteed that the cubes were always completely dissolved after the last trial for all subjects. On each trial subjects were asked: "Does this jar weigh the same amount or a different amount as this jar," and following their judgments of same or different, they were asked for an explanation.

Scoring: The number of possible conservation judgments ranged from 0 to 3. The categories of explanations which received either 1 or 0 point scores were the same as those described above for restorable conservation of mass.

Item order for physical conservation. Within each physical conservation task, items were presented in the order described above. Four possible order combinations of restorable and nonrestorable conservation of mass and weight were counterbalanced across all subjects.

Task orders for physical and social conservation. In addition to counterbalancing items independently within the physical and social conservation batteries, the order of the total physical and social batteries was counterbalanced across all subjects. Thus, there were a total of four different task orders that were counterbalanced across all subjects.

Kinship Measures

Since the social conservation tasks were based on kinship roles, three additional tasks were included to assess various aspects of

kinship terms and concepts.

Kinship definitions. Following the final conservation task, subjects were asked: "What is a mother, father, daughter, son, sister and brother" respectively. A modification of Haviland and Clark's (1974) four levels of kinship definitions was used to score the responses:

1. Precategorical: These definitions named a person or gave an irrelevant definition, such as a sister is someone who goes to school.

2. Use of property features: These definitions were based on property features of sex, age (or size), occupation or caretaking role associated with the kinship term. For example, a brother is a boy, a father is someone who is big, or a mother is someone who takes care of you.

3. Relational: These definitions were based on the recognition of the relational aspect of kinship roles, but were not generalized to include all kinship possiblities or reciprocal roles. For example, a parent (or child or sibling) is someone in your family or who lives with you, or a parent is someone who has a boy or girl (but not general class of children).

4. Reciprocal: These definitions reflected the understanding of the reciporcal nature of kinship roles, such as a daughter is the child of both a mother and father, a sibling is someone who has a sibling, or a parent is someone with a child.

Ifsubjects did not make a response or not know the term, they were assigned a score of 0. For each kinship definition, a score from 0 to 4 was possible, and across all six definitions, scores ranged from 0 to 24.

Kinship identification. Following the kinship definitions, subjects were asked whether they were a brother, sister, son or daughter. The

responses were scored as correct or incorrect, and the number of possible correct judgments ranged from 0 to 2.

Kinship permanence. Following the kinship identification items, subjects were asked whether they would always remain in the sibling and child roles previously identified. The responses were scored according to whether permanence was acknowledged or denied, and the number of possible kinship permanence judgments ranged from 0 to 2. If subjects denied kinship permanence, they were asked for an explanation. There were 22 subjects without siblings, so these subjects were not given the sibling permanence question and were eliminated from the analysis of the sibling permanence item and the total kinship permanence score.

Mental Age

To assess each subject's mental age, the Vocabulary subscale from the WISC was given during the two 2-minute intervals of the non-restorable conservation of weight task. This subscale was selected because of its high correlations with the total verbal and total IQ scale among children of this age range. The scale was administered and scored according to the instructions in the WISC manual.

CHAPTER 3

RESULTS

The results are organized into two main sections. The first reports findings concerning several methodological issues and subject characteristics, and the second reports findingd pertaining to each of the eight hypotheses presented in Chapter 1.

Methodological Issues

Judgment and Explanation Scores

Each response on physical and social conservation was scored in two ways: a judgment of conservation or no conservation received a score of 1 or 0, and an explanation of that judgment received a score of 1 or 0. To assess the extent of concordance between judgment and explanation responses, phi coefficients were obtained between these scores. For the 12 physical items, these correlations ranged from .71 to .98, with a mean correlation of .93. For the 24 social items, these correlations ranged from .32 to 1.00, with a mean correlation of .74. The lower mean social correlation was accounted for by 7 items on which correlations were below .6 . Examination of these items revealed that these were the easiest ones, succeeded by all but several children. Thus, the lower correlations on these items reflected atypical explanations made by several children on items which otherwise reached ceiling performance. Excluding these items, the mean social correlation was .88, which did not differ significantly from the mean physical correlation ($t(87) = 1.86$, ns, 2-tailed test). Thus, on the basis of this analysis, only judgment scores were used in the subsequent data analysis.

Effect of Form on Social Conservation

Two forms containing either male or female kinship terms were used in the kinship-social and time conservation tasks. To assess the effects of these forms, two 3-way ANOVAs (with form, group and sex as between subject factors) were performed on judgment scores on kinship-social and time conservation tasks. There were no significant main effects

for form (F (1,86) = .02 and .38 respectively), or interactions between form and group or sex. Thus, the effect of receiving same- or opposite-sex forms on these tasks was not significant.

Effect of Task Order

There were four task orders counterbalanced across all subjects: within physical conservation, restorable or nonrestorable tasks first and mass or weight tasks first; within social conservation, subscales A or B first; and across all physical and social tasks, the complete social or physical battery first. For the first three task orders, there were no significant main effects for order (F (1,78) = .90, .46 and .00 respectively), or any significant interactions between order and group or sex. The only significant order effect involved receiving the social or physical conservation battery first, and this order affected performance on the total social conservation, but not physical conservation judgment scores. A 3-way ANOVA (with order, group and sex as between subject factors) performed on the total social conservation score found no significant main effect for order (F (1,78) = 1.04), but did obtain a significant order by sex interaction (F (1,78) = 6.78, $p < .05$). Tests for simple effects on this interaction revealed that within task order, females who received the social battery first performed significantly higher on social conservation than males who received the social battery first (means for females and males were 19.14 and 14.76 respectively, F (1,78) = 16.43, $p < .01$). Tests for simple effects within sex indicated that for males, those who received the physical conservation battery first performed significantly higher on social conservation than males who received the social conservation battery first (means for physical and social batteries first were

17.79 and 14.76 respectively, $F(1,78) = 7.30$, $p < .01$). There were no differences between females on social conservation according to the order of the physical and social conservation batteries. These sex by task order interactions will be discussed in greater detail in conjunction with the results of each of the social conservation tasks.

Test Location

As described in Chapter 2, 47 children were tested at home and 43 at school. To assess whether there were any differences on conservation performance between these groups, two 3-way ANOVAs (with group, sex and test location as between subjects factors) were performed on the total physical and social conservation scores. There were no significant main effects for test location on either score ($F(1,78) = .94$ and .47 respectively), or any interactions between test location and group or sex. Thus, the two samples did not differ in their respective conservation performance.

Subject Characteristics

The mean chronological and mental ages, and WISC Vocabulary scores by group and sex are presented in Table 4. The main effect of group was significant on both WISC Vocabulary and MA ($F(2,84) = 25.27$ and 26.15 respectively, $p < .001$), and Scheffe comparisons ($p < .05$) revealed that 7-year-olds were significantly higher than both 5- and 6-year-olds on both variables, while the latter two groups did not differ from each other. The main effect of sex, or age by sex interactions were not significant on any of these variables.

Tests of Hypotheses

Hypothesis 1: Effects of Type of Conservation

It was predicted that across all tasks, social conservation would be more difficult than physical conservation. The mean number of

Table 4

Summary Statistics on WISC Vocabulary, Chronological and Mental Age, by Group and Sex

Age Level	Sex	N	WISC Vocabulary[a]	Chronological Age[b]	Mental Age[b]
5	Males	15	22.60	65.73	91.33
	Females	15	24.33	65.47	97.47
	Total	30	23.50	65.60	94.40
6	Males	15	26.47	78.47	104.93
	Females	15	24.73	77.20	99.33
	Total	30	25.60	77.80	102.10
7	Males	15	31.00	88.47	119.60
	Females	15	32.67	89.80	125.20
	Total	30	31.80	89.10	122.40
Total males		45	26.69	77.50	105.29
Total females		45	27.24	77.50	107.33
Total subjects		90	27.00	77.50	106.30
SD			5.89	10.26	19.39
Range			17-41	60-95	70-154
			F Tests		
Age $F(2,84)$:			25.27***	340.62***	26.15***
Sex $F(1,84)$:			.31	.01	.39
Age x sex $F(2,84)$:			1.31	1.05	1.37

[a] WISC Vocabulary scores are raw scores.

[b] Chronological and mental ages are in months.

***$p < .001$

conservation judgments on physical and social conservation tasks are presented in Tables 5 and 6 respectively, and illustrated in Figure 1. To test this prediction, a MANOVA followed by a step-down procedure (Bock, 1975) was performed on the number of conservation judgments on each battery (eliminating the exclusive social conservation task because of ceiling performance). The results revealed that the type of conservation was significant ($F(1,88) = 26.12$, $p < .001$), with scores on the total social conservation battery being significantly higher than scores on the total physical conservation battery. This finding does not support the hypothesis in the predicted direction, but does suggest that the type of conservation per se was significant, and that physical conservation was more difficult than social conservation.

While no specific predictions were made concerning the effects of conservation task within the social and physical batteries, the relative difficulty of each task was also assessed. Among physical conservation tasks, performance on restorable and nonrestorable mass was compared to performance on restorable and nonrestorable weight. The results of a MANOVA analysis revealed that the main effect of task was significant ($F(1,88) = 5.06$, $p < .05$), and scores on conservation of mass were significantly higher than those on conservation of weight. Among social conservation, scores on exclusive kinship reached ceiling performance, and were significantly higher than those on all other social tasks. The results of a MANOVA analysis revealed that scores on time conservation were significantly higher than both inclusive and kinship-social tasks ($F(1,88) = 74.35$, $p < .001$), but no differences occurred between the latter tasks ($F(1,85) = .72$).

While no specific predictions were made concerning differences

Table 5

Summary Statistics on Physical Conservation Judgments by Task, Age Level and Sex

Age Level	Sex	N	Restorable: Mass	Weight	Total	Nonrestorable: Mass	Weight	Total	Total
5	Males	15	.73	.93	1.67	.60	.67	1.27	2.93
	Females	15	.87	.80	1.67	.60	.53	1.13	2.80
	Total	30	.80	.87	1.67	.60	.60	1.20	2.87
6	Males	15	1.73	2.00	3.93	1.47	1.27	2.73	6.67
	Females	15	1.93	2.33	4.27	1.67	1.13	2.80	7.07
	Total	30	1.83	2.27	4.10	1.57	1.20	2.77	6.87
7	Males	15	2.60	2.33	4.93	2.40	1.33	3.73	8.67
	Females	15	2.80	2.20	5.00	3.00	1.53	4.53	9.53
	Total	30	2.70	2.27	4.97	2.70	1.43	4.13	9.10
Total males		45	1.69	1.82	3.51	1.49	1.09	2.58	6.09
Total females		45	1.87	1.78	3.64	1.76	1.07	2.82	6.47
Total subjects		90	1.78	1.80	3.58	1.62	1.08	2.70	6.28
SD			1.40	1.24	2.35	1.45	.99	2.07	4.09
Range			0-3	0-3	0-6	0-3	0-3	0-6	0-12
				F Tests					
Age $F(2,84)$:			18.92**	16.66**	23.38**	23.62**	6.06*	22.01**	28.35**
Sex $F(1,84)$:			.45	.04	.10	1.14	.12	.46	.30
Age x sex $F(2,84)$:			.01	.15	.06	.70	.28	1.81	.18

*$p < .01$

**$p < .001$

Table 6

Summary Statistics on Social Conservation Judgments by Task, Age Level and Sex

Age Level	Sex	N	Restorable: Kinship-social: Conventional	Restorable: Kinship-social: Unconventional	Restorable: Kinship-social: Total	Restorable: Inclusive	Restorable: Total	Nonrestorable: Exclusive	Nonrestorable: Time	Nonrestorable: Total	Total Social
5	Males	15	1.60	.93	2.53	2.07	4.60	5.93	4.00	9.93	14.53
	Females	15	1.73	1.27	3.00	3.00	6.00	6.00	4.47	10.47	16.47
	Total	30	1.67	1.10	2.77	2.53	5.30	5.96	4.27	10.20	15.50
6	Males	15	1.40	1.20	2.60	2.60	5.20	5.80	4.87	10.67	15.87
	Females	15	1.47	1.47	2.93	3.40	6.33	6.00	5.40	11.40	17.73
	Total	30	1.43	1.33	2.77	3.00	5.77	5.90	5.13	11.03	16.80
7	Males	15	1.73	1.87	3.60	3.80	7.40	6.00	5.27	11.27	18.67
	Females	15	2.27	2.33	4.60	4.73	9.33	6.00	6.00	12.00	21.33
	Total	30	2.00	2.10	4.10	4.27	8.37	6.00	5.63	11.63	20.00
Total	males	45	1.58	1.33	2.91	2.82	5.73	5.91	4.73	10.64	16.38
Total	females	45	1.82	1.69	3.51	3.71	7.22	6.00	5.29	11.29	18.51
Total	subjects	90	1.70	1.51	3.21	3.27	6.46	5.96	5.01	10.97	17.44
SD			.92	1.11	1.87	1.94	3.42	.21	1.31	1.34	4.20
Range			0-3	0-3	0-6	0-6	0-12	5-6	1-6	7-12	8-24
			F-tests								
Age $F(2,84)$:			3.02*	7.57***	5.58**	7.52***	8.33***	1.96	10.31***	10.22***	11.63**
Sex $F(1.84)$:			1.67	2.64	2.54	5.54*	5.07*	4.48*	4.99*	6.45**	7.45**
Age x sex $F(2,84)$:			.59	.07	.29	.04	.13	1.06	.15	.12	.12

*$p < .05$; **$p < .01$; ***$p < .001$

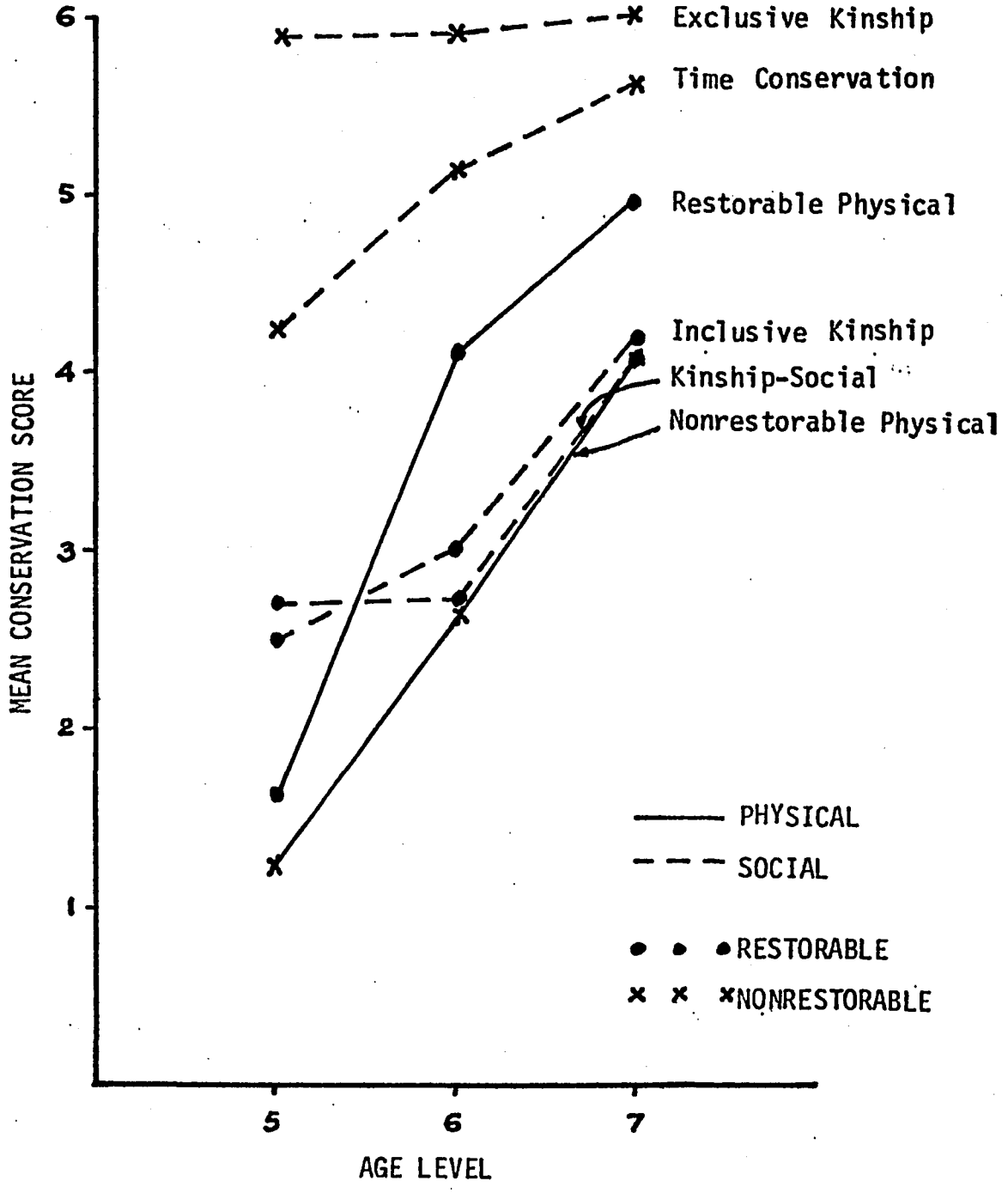

Figure 1. Mean Physical and Social Conservation Scores by Type of Task and Age Level.

between pairs of social and physical conservation tasks, comparisons were also made between combinations of mean scores reported in Tables 5 and 6. Scores were significantly higher on time conservation than on both restorable and nonrestorable physical conservation ($t(89)$ = 6.17 and 10.40 respectively, $p < .01$, 2-tailed test), while scores on inclusive kinship conservation were significantly higher than nonrestorable physical conservation ($t(89) = 2.22, p < .05$, 2-tailed test)) but not restorable physical conservation ($t(89) = 1.23$, ns). There were no differences bteween scores on kinship-social conservation and either restorable or nonrestorable physical conservation ($t(89)$ = 1.40 and 1.99 respectively, ns).

Hypothesis 2: Effects of Type of Transformation

It was predicted that across conservation tasks, nonrestorable transformations would be more difficult than restorable transformations. Initial inspection of social conservation scores reported in Table 6 indicated that ceiling performance was reached by the youngest children on nonrestorable exclusive kinship, and by the oldest children on nonrestorable time conservation. In contrast, performance on nonrestorable physical conservation did not approach ceiling performance at any age level. Therefore, because of the opposite direction of scores according to type of transformation, it was decided to not combine restorable and nonrestorable tasks across content domains, but rather to assess the effects of transformations separately within each conservation battery.

The effects of restorable and nonrestorable transformation on social conservation was assessed by comparing performance on the restorable inclusive and kinship-social tasks to a transformed score on the nonrestorable time conservation task (since the nonrestorable exclusive task

was eliminated). The results of a MANOVA analysis revealed that the effect of transformation was significant ($F(1,88) = 74.35$, $p < .001$), and scores on nonrestorable tasks were significantly higher than those on restorable tasks. The effect of type of transformation on physical conservation was assessed by comparing performance on restorable mass and weight to nonrestorable mass and weight, and the results of a MANOVA analysis revealed that the effect of transformation was not significant ($F(1,87) = 1.58$). Thus, the hypothesis concerning the effects of type of transformation was not confirmed in the predicted direction, since type of transformation did not affect physical conservation, but was associated with higher performance on nonrestorable, as compared to restorable social conservation.

Performance on Physical Conservation

While no specific predictions were made concerning each type of physical conservation task, performance on each task was analyzed to assess the effects of age, sex, type of task and explanations given for conservation and nonconservation. It has already been seen that the effect of transformation was not significant, but that the effect of task was significant, with scores on conservation of mass being significantly higher than those on weight. Comparisons between mean scores reported in Table 5 indicated that scores on nonrestorable weight were significantlylower than each of the three other tasks ($t(89) = 4.74$, 5.93 and 3.73, $p < .01$, 2-tailed tests for restorable mass and weight, and nonrestorable mass respectively), while the remaining three tasks did not differ from each other. These mean conservation scores are illustrated in Figure 2.

The effects of age and sex on physical conservation were assessed by performing separate 2-way ANOVAs (with group and sex as between subject

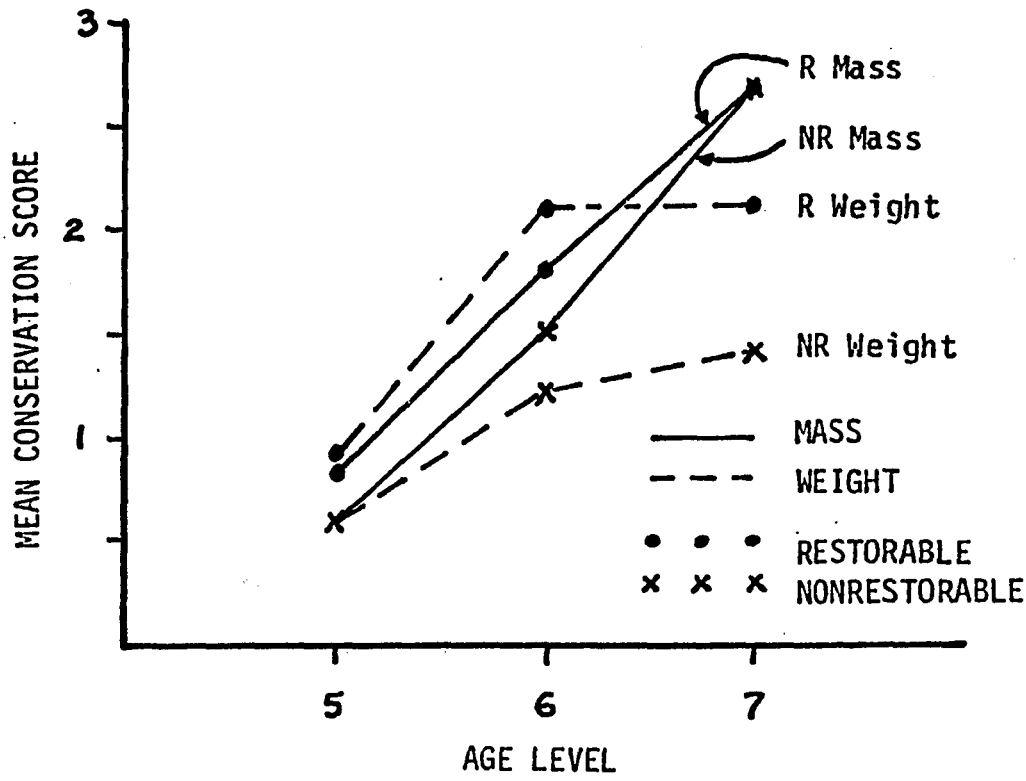

Figure 2. Mean Physical Conservation Scores by Age Level.

factors) on each task. The main effect of age was significant on each task, subtotal and total score (see Table 5 for F values). Scheffe comparisons ($p < .05$) revealed that 7-year-old scores were significantly higher than 5-year-old scores on all tasks, and higher than 6-year-old scores on all tasks except nonrestorable mass. The 6-year-old scores were significantly higher than 5-year-old scores on all tasks except nonrestorable weight. The main effect of sex, and the sex by age interaction, were not significant on any task.

The proportion of conservation judgments on each physical conservation item by age group is presented in Table 7 (the data were pooled across sex because of the absence of any sex effects). Inspection of these distributions illustrates the linear age patterns, as well as the greater difficulty of nonrestorable weight, in comparison to the other tasks. Across all subjects, only one quarter of the responses on nonrestorable weight were conservation judgments, in contrast to a range of conservation judgments from one half to two thirds on the remaining items. The distribution of conservation and nonconservation explanations presented in Table 8, illustrate the kinds of explanations given on these items. The most frequent conservation explanation across all tasks was the identity operation, while among the restorable tasks and nonrestorable mass, the most frequent nonconservation explanation was that the transformed stimulus was either bigger in size or quantity than the standard stimulus. On nonrestorable weight, most of the nonconservation explanations indicated that the standard, intact cubes were bigger in size or quantity than the transformed, dissolving cubes. It appeared that the dissolution of the cubes was considered equivalent to their disappearance, rather than being considered in a different state from

Table 7

Proportion of Conservation Judgments on Physical Conservation Items by Task and Group

Items	Age level: 5	6	7	Total
Restorable				
Mass (clay balls):				
Hotdog	27	60	90	59
Pancake	23	60	90	58
Pieces	30	63	90	61
Weight (jars):				
Tall jar	33	73	89	62
Wide jar	27	67	67	53
Small jars	27	87	80	64
Nonrestorable				
Mass (crushed):				
Shells crushed	17	53	87	52
Sugar sliced	20	50	93	54
Sugar crushed	23	53	90	56
Weight(dissolving sugar):				
Intact in water	50	80	73	68
1 2-minute interval	3	20	37	20
2 2-minute interval	7	20	33	20
N	30	30	30	90

Table 8

Proportion of Conservation and Nonconservation Explanations on Physical Conservation Items

Item	Conservation explanations: Identity operation	Compensation	Inversion	Nonconservation explanations: Qualitative identity	Transformed bigger	Transformed more	Standard bigger	Other
Restorable								
Mass:								
Hotdog	50	8	0	0	39	0	2	1
Pancake	46	10	1	1	33	0	8	1
Pieces	39	10	9	1	3	30	6	2
Weight:								
Tall jar	49	9	0	1	32	0	6	3
Wide jar	44	8	0	0	23	0	21	4
Small jars	44	17	2	1	1	19	13	3
Nonrestorable								
Mass								
Shells crushed	42	1	9	1	19	24	2	2
Sugar sliced	36	4	13	0	9	34	2	0
Sugar crushed	32	7	16	0	4	37	3	1
Weight:								
Intact in water	52	0	0	6	0	13	16	12
1 2-minute interval	15	0	1	2	0	10	63	8
2 2-minute interval	11	0	3	1	2	4	71	7

their pre-dissolution appearance.

Hypothesis 3: Effect of Temporal Transformations on Single Kinship Roles

It was predicted that the type of temporal transformation performed on single kinship roles would have a significant effect on conservation of these roles. The mean number of conservation judgments according to direction of time change and amount of elapsed time are presented in Table 9. It was predicted that conservation would be more difficult when the direction of time change occurred into the future, as compared to the past. A comparison of the mean number of conservation judgments on future and past items revealed that conservations scores on these items did not differ from each other ($t(89) = 1.22$, ns). It was also predicted that the amount of elapsed time would be significant, with changes into remote time spans being more difficult than those into near or intermediate time spans. A comparison of the mean number of conservation judgments on near, intermediate and remote time spans revealed that conservation scores on remote items were significantly lower than those on both near and intermediate items ($t(89) = 5.44$ and 5.21 respectively, $p < .001$, 2-tailed test), while scores on near and intermediate items did not differ from each other ($t(89) = 1.39$, ns). Thus, the hypothesis concerning the type of temporal transformation was partially confirmed, since conservation was most difficult on items involving remote time spans, although the direction of time change per se was not significant.

The effects of age and sex on each type of temporal transformation were assessed by performing separate 2-way ANOVAs (with group and sex as between subject factors) for each time conservation subtask listed in Table 9. As shown in Table 9, the main effect of age was significant on both future and past time directions ($F(2,84) = 10.73$ and 7.07

Table 9

Summary Statistics on Time Conservation Judgments, by Type of Transformation and Group

	Direction:		Amount of elapsed time:			
Group	Past	Future	Near	Inter-mediate	Remote	Total
5-year-olds	2.20	2.05	1.83	1.67	.77	4.27
6-year-olds	2.57	2.57	1.97	1.90	1.27	5.13
7-year-olds	2.87	2.77	1.97	1.97	1.70	5.63
Males	2.40	2.33	1.89	1.80	1.04	4.73
Females	2.69	2.60	1.96	1.89	1.44	5.29
Total subjects	2.54	2.47	1.92	1.84	1.24	5.01
SD	.74	.67	.31	.42	.90	1.31
Range	0-3	0-3	0-2	0-2	0-2	0-6
			F-tests			
Age $F(2,84)$:	7.07**	10.73***	1.87	4.43*	9.93**	10.31***
Sex $F(1,84)$:	3.97*	4.40*	1.05	1.06	5.46*	4.99*
Age x sex F (2,84):	.02	.64	.00	.06	.46	.15

*$p < .05$

**$p < .01$

***$p < .001$

respectively, $p < .01$), and across intermediate and remote time spans ($F(2,84) = 4.43$ and 9.93 respectively, $p < .05$ and .01). Scheffe comparisons ($p < .05$) revealed that on future time changes, 6- and 7-year-old scores were both significantly higher than 5-year-old scores while these two groups did not differ from each other. On past, intermediate and remote time changes, 7-year-old scores were significantly higher than 5-year-old scores, while 5- and 6-year-old scores, and 6- and 7-year-old scores did not differ from each other. As shown in Table 9, the main effect of sex was significant on past, future and remote time items ($F(1,84) = 3.97$, 4.40 and 5.46 respectively, $p < .05$), and female scores were higher than male scores in all instances. The male and female scores on the total time conservation task are shown in Figure 3. There were no significant age by sex interactions.

The effects of age and sex on the total time conservation task were assessed by performing a 2-way ANOVA on the total score. As seen in Table 9, the main effect of age was significant ($F(2,84) = 10.31$, $p < .001$), and Scheffe comparisons revealed that 6- and 7-year-old scores were significantly higher than 5-year-old scores, although they did not differ from each other. The main effect of sex was also significant ($F(1,84) = 4.99$, $p < .05$), and female scores were higher than male scores. Finally, the main effect of task order was marginally significant ($F(1,78) = 3.92$, $p < .05$), with subjects receiving the physical conservation battery first performing higher than those receiving the social conservation battery first (means were 5.25 and 4.74 respectively, N = 48 and 42 respectively).

The greater difficulty of remote time span items is illustrated by examining the proportion of conservation judgments on each time

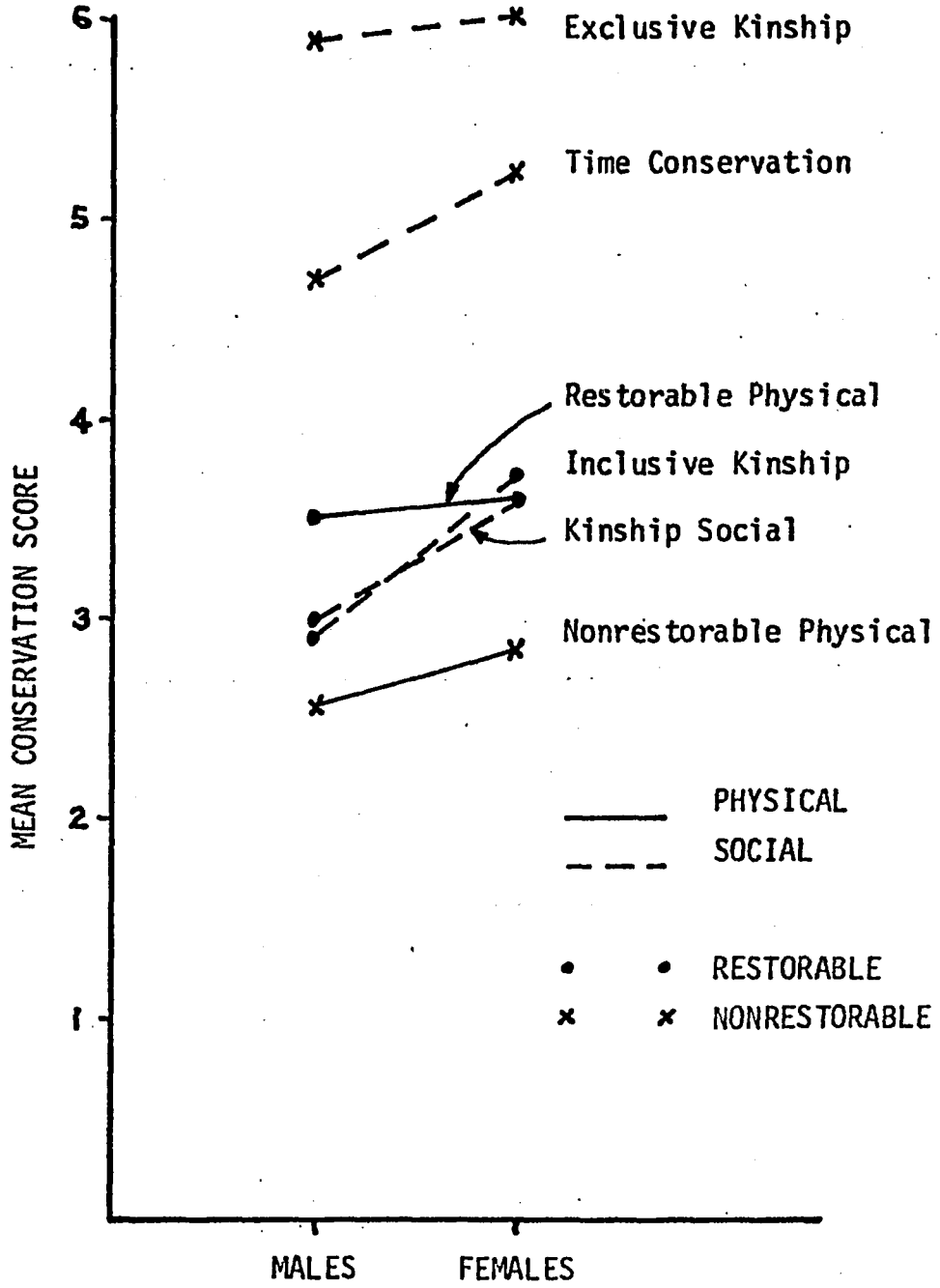

Figure 3. Mean Physical and Social Conservation Scores by Type of Task and Sex.

conservation item presented in Table 10. Across all subjects, over 90% of the responses on near and intermediate time span items in both time directions were conservation judgments. In contrast, approximately two thirds of the responses on the remote-past item, and slightly more than half on the remote-future item, were conservation judgments. The proportion of conservation and nonconservation explanations on each time conservation item appear in Table 11. The explanations associated with nonconservation judgments on remote time span items provide some insight as to why many children denied the permanence of child kinship roles under this transformation. On both remote-past and future items, almost all nonconservation explanations indicated that the person would be too old to still occupy a child kinship role, since once a person reached a certain chronological age (usually around the age of 20), they became a grown up. For these children, a grown up role was considered incompatable with simultaneously occupying a child kinship role. In contrast to nonconservation explanations, conservation explanations reflected a recognition of the permanence of the kinship role despite age changes, or because the kinship relationship between parent and child remained permanent despite changes in the age of the child. Conservation explanations on near and intermediate time span items were evenly distributed among the three types of explanations.

Hypothesis 4: Effect of Logical Exclusivity on Multiple Kinship Roles

It was predicted that inclusive kinship combinations that were logically possible would be more difficult to conserve than exclusive kinship combinations that were logically impossible. This hypothesis was confirmed, since with the exception of three children (one 5-year-old and two 6-year-olds), all children gave conservation judgments on all

Table 10

Proportion of Conservation Judgments on Time Conservation Items by Group

Group	Near: Past	Near: Future	Intermediate: Past	Intermediate: Future	Remote: Past	Remote: Future
5-year-olds	90	93	77	90	53	23
6-year-olds	97	100	93	97	67	60
7-year-olds	100	97	100	97	87	83
Males	93	96	87	93	60	44
Females	98	98	93	96	78	67
Total subjects	96	97	90	94	69	56

Table 11

Proportion of Conservation and Nonconservation Explanations on Time Conservation Items

Explanation	Time conservation items: Near-past	Near-future	Intermediate-past	Intermediate-future	Remote-past	Remote-future
Conservation explanations						
Permanence of kinship relationship	24	26	26	28	27	28
Role permanence despite age change	33	31	30	30	28	26
Appropriate age for kinship role	32	34	30	31	10	0
Nonconservation explanations						
Inappropriate age-too old	2	0	1	3	27	43
Inappropriate age-too young	0	2	7	0	0	0
Multiple roles not possible	0	0	1	0	1	1
Other	8	7	5	8	8	2

exclusive items. In contrast, performance on inclusive kinship was significantly lower than the exclusive task at all age levels, and did not reach ceiling performance among the oldest children.

The effects of age and sex on inclusive kinship were assessed by performing a 2-way ANOVA (with group and sex as between subject factors) on the mean inclusive scores listed in Table 6. The main effect of age was significant ($F(2,84) = 7.52$, $p < .001$), and Scheffe comparisons ($p < .05$) revealed that 7-year-old scores were significantly higher than both 5- and 6-year-old scores, while the 5- and 6-year-olds did not differ from each other. The main effect of sex was also significant ($F(1,84) = 5.54$, $p < .05$), indicating that female scores were higher than male scores (see Figure 3). The sex by age interaction was not significant.

In light of the significant main effect of sex, a further analysis of inclusive items was done by obtaining the mean number of conservation judgments made by males and females on the three male and three female inclusive items (see Table 12 for a list of these items). On the female kinship items, females had significantly higher scores than males (means for females and males were 1.93 and 1.40 respectively, $F(1,84) = 7.24$, $p < .001$), while there was no difference between female and male scores on the male kinship items (means for females and males were 1.78 and 1.42 respectively, $F(1,84) = 3.04$, ns). Thus, it appeared that the higher performance by females on inclusive kinship could be partially attributed to their higher scores on female kinship items, although males did not perform higher than females on male kinship items.

A second factor related to the observed sex difference on this task was the significant sex by task order interaction reported earlier in

conjunction with the total social conservation battery (cf p.61). A 3-way ANOVA (with task order, group and sex as between subject factors) performed on inclusive kinship revealed a significant sex by task order interaction ($F(1,78) = 5.37$ $p < .05$). Tests for simple effects revealed that among subjects who received social conservation before physical conservation, females had significantly higher inclusive scores than males (means for females and males were 3.95 and 2.14 respectively, $F(1,78) = 11.15$, $p < .01$). In contrast, among subjects who received social conservation after physical conservation, there were no differences between females and males (means for females and males were 3.50 and 3.42 respectively, $F(1,78) = .04$). Thus, the lower performance of males occurred primarily among those male subjects who received inclusive kinship before the total physical conservation battery.

The distribution of conservation judgments on each inclusive and exclusive item is presented in Table 12. Inspection of Table 12 reveals that across all subjects, over 80% of the responses on the two inclusive items containing within-generation child and sibling kinship pairs pairs (i.e., brother-son and daughter-sister) were conservation judgments. In contrast, the proportion of conservation judgments on the four items containing across-generation parental-child or sibling kinship pairs ranged from 36 to 44% across all subjects. These differences in the number of conservation judgments between across- and within-generation items were all significant ($t(89)$ ranged from 3.98 to 4.99, $p < .01$, 2-tailed test).

The distribution of conservation and nonconservation explanations made on each inclusive item, presented in Table 13, provides some clues as to the source of the relative difficulty of across-generation pairs.

Table 12

Proportion of Conservation Judgments on Inclusive and Exclusive Kinship Items by Group

Items	Group: 5	6	7	Males	Females	Total
Inclusive kinship						
Brother-son	73	90	90	80	89	84
Daughter-sister	77	80	93	69	98	83
Sister-mother	30	27	60	29	49	39
Father-brother	23	33	63	33	47	40
Son-father	17	33	57	29	42	36
Mother-daughter	33	37	63	42	47	44
Exclusive kinship						
Brother-daughter	100	100	100	100	100	100
Sister-son	100	93	100	96	100	98
Father-sister	100	97	100	98	100	99
Mother-brother	100	100	100	100	100	100
Daughter-father	100	100	100	100	100	100
Son-mother	97	100	100	98	100	99

Table 13

Proportion of Conservation and Nonconservation Explanations on Inclusive Kinship Items

Explanation	Inclusive kinship items: Brother-Son	Daughter-Sister	Sister-Mother	Father-Brother	Son-Father	Mother-Daughter
Conservation explanations						
Correct kinship relationship	30	26	20	20	26	29
Recognition of similarity	39	46	7	6	6	9
Names person in both roles	6	6	8	11	1	4
Multiple roles possible	4	6	3	2	1	3
Nonconservation explanations						
Inappropriate age-too young	3	3	50	8	50	10
Inappropriate age-too old	4	6	6	44	10	37
Multiple roles not possible	3	1	2	4	2	4
Other	11	6	4	5	4	4

On these items, almost all of the nonconservation explanations reflected the perception of one of the kinship pair as being an inappropriate age (i.e., either too young or too old), thereby preventing them from occupying both kinship roles simultaneously. Inspection of these frequencies of these responses indicates that the explanation of inappropriate age was based primarily on the kinship role named first, which appeared as the subject of the sentence. For example, on the 'sister-mother' and 'son-father' pairs, most of the nonconservation explanations indicated that the sister or son were considered too young to be either a mother or father respectively (both 50%). Conversely, on the 'father-brother' and 'mother-daughter' pairs, most of the nonconservation indicated that the mother and father were considered too old to be either a brother or daughter respectively (44 and 37%). Thus, it appeared that the perception of age differences between across-generation kinship pairs interfered with the recognition of the logical possibility of these kinship pairs existing simultaneously. However, explanations for conservation judgments on these items reflected an understanding of the correct kinship relationship between these across-generation pairs, since this was the most frequent type of conservation explanation.

Inspection of conservation explanations on within-generation pairs indicated that the recognition of the similarity of sex was the most common justification for their co-existence (39 and 46%). Approximately one quarter of other conservation explanations reflected an understanding of the correct kinship relationship between the pairs (26 and 30%), while small proportions cited specific persons who occupied both kinship roles (6%). On exclusive items, over 90% of the conservation explanations reflected a recognition of the sex differences between the exclusive pairs.

Hypothesis 5: Effects of Conventionality of Social Roles on Multiple Kinship Roles

It was predicted that kinship-social pairs containing unconventional social roles would be more difficult to conserve than pairs containing conventional social roles. The mean number of conservation judgments on conventional kinship-social pairs (M = 1.70) was significantly higher than the mean number of conservation judgments on unconventional pairs (M = 1.51, $t(89) = 2.22$, $p < .05$, 2-tailed test). Thus, the hypothesis was supported, since conservation on unconventional pairs was lower than that on conventional pairs.

The effects of age and sex on conventional and unconventional kinship-social pairs were assessed by performing 2-way ANOVAs (with group and sex as between subject factors) on each task (means are reported in Table 6). The main effect of age approached significance on conventional items ($F(2,84) = 2.84$, $p < .053$), while the main effect of sex was not significant ($F(1,84) = 1.67$). The main effect of age was significant on unconventional items ($F(2,84) = 7.57$, $p < .001$), and Scheffe comparisons ($p < .05$) indicated that 7-year-old scores were significantly higher than both 5- and 6-year-old scores, while the latter groups did not differ from each other. The main effect of sex was not significant on unconventional items, nor were age by sex interactions for either conventional or unconventional items.

The effects of age, sex and task order on the total kinship-social task, combining conventional and unconventional items, were also assessed. The main effect of age was significant ($F(2,84) = 5.58$, $p < .01$), and Scheffe comparisons indicated that 7-year-old scores were significantly higher than both 5- and 6-year-old scores, while the latter two groups did not differ from each other. The main effect of sex, or a sex by age

interaction were not significant, but the sex by task order interaction was significant ($F(1,78) = 5.37$, $p < .05$). Tests for simple effects revealed that among subjects who received social conservation before physical conservation, females had significantly higher kinship-social scores than males (means for females and males were 4.00 and 2.43 respectively, $F(1,78) = 28.90$, $p < .01$). In contrast, there were no differences between females and males who received social conservation after physical conservation (means for females and males were 3.08 and 3.33 respectively, $F(1,78) = .78$). Within sex, females who received social conservation before physical conservation had significantly higher kinship-social scores than females who received physical conservation first (means for social and physical conservation first were 4.00 and 3.08 respectively, $F(1,78) = 18.95$, $p < .01$), while there were no differences between males who received social or physical conservation first (means for social and physical conservation first were 2.43 and 3.33 respectively, $F(1,78) = 1.21$). Thus, it appeared that receiving social conservation before physical conservation was related to higher performance by females in comparison to males who also received social conservation first, and to females who received social conservation second.

The proportion of conservation judgments on each conventional and unconventional item is presented in Table 14. The influence of the unconventional transformation appeared to be highest on parental-social pairs, since a significantly larger proportion of conservation judgments occurred on the conventional 'father-doctor' or 'mother-nurse' pairs than on the unconventional 'father-nurse' or 'mother-doctor' pairs (97 and 67% respectively, $t(89) = 3.00$, $p < .001$, 2-tailed test). However, there were no differences in the frequency of conservation

Table 14

Proportion of Conservation Judgments on Conventional and Unconventional Kinship-social Items by Group

Items	Group: 5	6	7	Males	Females	Total
Conventional						
Father-doctor/ mother-nurse	97	93	100	96	98	97
Brother-mechanic/ sister-librarian	40	30	57	36	49	42
Son-pilot/ daughter-teacher	30	20	43	27	36	31
Unconventional						
Father-nurse/ mother-doctor	53	60	87	56	78	67
Brother-librarian/ sister-mechanic	37	40	70	47	51	49
Son-teacher/ daughter-pilot	20	33	53	31	40	36

Note. The male and female kinship terms represent the male and female forms on this task.

judgments between conventional and unconventional sibling- and child-social pairs, with the proportion of judgments ranging from 31 to 49% on these items.

Examination of the proportions in Table 14 indicates that across conventional and unconventional items, more conservation responses occurred on parental-social pairs than on sibling- or child-social pairs. To assess the effect of the type of kinship term associated with social roles on conservation, these items were also analyzed according to categories of kinship terms, and the results are reported in Table 15. This observation was confirmed, since the mean number of conservation judgments on parental-social items was significantly higher than that for both sibling- and child-social items ($t(89) = 7.72$ and 11.09 respectively, $p < .001$, 2-tailed test). Furthermore, the mean number of conservation responses on sibling-social items was significantly higher than those on child-social items ($t(89) = 3.62$, $p < .001$, 2-tailed test). Thus, conservation on kinship-social pairs was also influenced by the type of kinship term associated with different social roles, with the highest amount of conservation occurring on parental-social items, and the lowest amount on child-social items. The main effect of age was significant on parental- and sibling-social items but not for child-social items (see Table 15), suggesting that even by the oldest age level, conservation of child-social pairs did not improve. The main effect of sex was significant on parental-social items, with females making more conservation judgments than males.

The distribution of conservation and nonconservation explanations for each conventional and unconventional item, presented in Table 16, provides some clues as to the relative difficulty of child- and sibling-social pairs. The largest type of nonconservation explanation

Table 15

Summary Statistics on Kinship-social Conservation Judgments, by Type of Kinship Role and Group

	Type of kinship role		
Group	Parental	Sibling	Child
5-year-olds	1.50	.78	.50
6-year-olds	1.53	.70	.53
7-year-olds	1.87	1.27	.97
Males	1.51	.82	.58
Females	1.76	1.00	.76
Total subjects	1.63	.91	.67
SD	.56	.89	.83
Range	0-2	0-2	0-2
	F-tests		
Age *F*(2,84):	4.49*	3.78*	3.00
Sex *F*(1,84):	4.89*	.93	1.05
Age x sex *F*(2,84):	.04	.41	.14

*$p < .05$

Table 16

Proportion of Conservation and Nonconservation Explanations on Conventional and Unconventional Kinship-social Items

Explanation	Conventional pairs: Father-doctor/ mother-nurse	Brother-mechanic/ sister-librarian	Son-pilot/ daughter-teacher	Unconventional pairs: Father-nurse/ mother-doctor	Brother-librarian/ sister-mechanic	Son-teacher/ daughter-pilot
Conservation explanations						
Anyone can do it	54	24	18	47	24	24
Correct sex for role	17	2	3	2	2	1
Names person in both roles	8	2	2	8	2	2
Multiple roles possible	11	9	3	7	9	4
Nonconservation explanations						
Inappropriate age	1	52	61	0	47	54
Inappropriate sex	0	0	0	30	2	9
Multiple roles not possible	1	2	3	2	3	1
Other	8	9	10	4	11	3

Note. The male and female kinship terms represent the male and female forms on this task.

on these items indicated that these kinship roles were considered an inapproporiate age, not sex, for the accompanying social role. That is, child and sibling roles were judged as being too young to perform what were perceived as adult social roles, so the barriers preventing multiple roles were not sex, but youth and inexperience. However, the explanation of inappropriate sex was the most frequently cited explanation as to why parental kinship roles could not occupy unconventional social roles. Thus, when age was no longer an obstacle, sex became the reason why someone could not occupy an unconventional social role.

Inspection of the type of conservation explanations listed in Table 16 indicated that the most frequent type across all items was the recognition that any person, regardless of sex, could occupy a particular social role. Occasionally a recognition of the conventional nature of the social role was cited, mainly in conjunction with the 'father-doctor' item, while in a few instances, examples of persons who occupied both kinship and social roles were cited. However, the overall nature of the explanations to these items was that of general acceptance of mutliple roles and the possibility of becoming whatever role one would like, with the major obstacle, albeit temporary, being that of age for child and sibling roles.

Hypothesis 6: Convergent and Discriminant Validity among Social and Physical Conservation

It was predicted that convergent and discriminant validity would exist among social and physical conservation tasks, with intercorrelations among the tasks being positive and higher than those between tasks. To assess these relationships, zero-order and partial correlations were obtained on all conservation measures, and a factor analysis was performed on composite physical and social conservation, as well as other

kinship tasks.

The zero-order and partial correlations among physical conservation tasks are reported in Table 17. Because of the significant zero-order correlations between physical conservation with CA and MA, second-order partial correlations, eliminating the combined effects of CA and MA on physical conservation, were also obtained. The convention of reporting the zero-order and partial correlations respectively, separated by a slash (/), has been adopted in reporting these results.

Several patterns emerge from the intercorrelations among physical conservation tasks reported in Table 17. Tasks with the highest correlations were restorable and nonrestorable mass ($\underline{r}$ = .74/.58), while restorable and nonrestorable weight were only moderately correlated ($\underline{r}$ = .37/25). Intercorrelations among the four tasks ranged from .36 to .74/.21 to .58, with a mean intercorrelation of .50/.34. The effect of eliminating the combined effects of CA and MA was to lower all of the correlations, although in most instances the residual correlations remained significant.

The zero-order and partial correlations among social conservation tasks are reported in Table 18. Because of the significant zero-order correlations between social conservation and CA, MA and sex, all possible combinations of first, second, and third order partial correlations among social tasks with these variables eliminated, were performed. Since there were few differences between the three separate first-order partial correlational analyses, third-order correlations, eliminating the cumulative effects of CA, MA and sex, are reported in Table 18.

Inspection of Table 18 reveals that the social tasks with the highest

Table 17

Zero-order and Partial Correlations Among Physical Conservation Tasks

Tasks	1	2	3	4	5	6	7	8	9
1. Restorable mass		.39**	.84**	.58**	.21*	.52**	.73**	NA	NA
2. Restorable weight	.57**		.83**	.35**	.25*	.38**	.70**	NA	NA
3. Total restorable	.90**	.87**		.56**	.26**	.54**	.89**	NA	NA
4. Nonrestorable mass	.74**	.55**	.74**		.28**	.84**	.79**	NA	NA
5. Nonrestorable weight	.36**	.37**	.41**	.41**		.76**	.58**	NA	NA
6. Total nonrestorable	.69**	.57**	.72**	.90**	.77**		.87**	NA	NA
7. Total physical	.87**	.79**	.94**	.88**	.63**	.92**		NA	NA
8. CA	.56**	.52**	.61**	.59**	.33**	.57**	.64**		NA
9. MA	.55**	.36**	.52**	.53**	.25**	.49**	.55**	.62**	
10. Sex	.06	-.02	.03	.09	-.01	.06	.05	.00	.05

Note. The partial correlations are second-order correlations, eliminating CA and MA, and appear above the diagonal, while the zero-order correlations appear below the diagonal.

*$p < .05$, 2-tailed test

**$p < .01$, 2-tailed test

Table 18

Zero-order and Partial Correlations Among Social Conservation Tasks

Tasks	1	2	3	4	5	6	7	8	9
1. Inclusive		.52**	.87**	-.10	.34**	.32***	.85**	NA	NA
2. Kinship-social	.54**		.87**	-.15	.19	.16	.80	NA	NA
3. Total restorable	.90**	.89**		-.15	.31**	.27**	.95**	NA	NA
4. Exclusive	-.03	-.09	-.06		.03	.21*	-.06	NA	NA
5. Time	.50**	.35**	.47**	.06		.98**	.59**	NA	NA
6. Total nonrestorable	.48**	.32**	.45**	.24*	.99**		.56**	NA	NA
7. Total social	.89**	.83**	.96**	.02	.70**	.96**		NA	NA
8. CA	.38**	.31**	.39**	.16	.43**	.43**	.45**		NA
9. MA	.38**	.36**	.41**	.05	.38**	.38**	.46**	.62	
10. Sex	.23*	.16	.22*	.22*	.21*	.24*	.26**	.00	.05

Note. The partial correlations are third-order correlations, eliminating CA, MA and sex, and appear above the diagonal, while the zero-order correlations appear below the diagonal.

*$p < .05$, 2-tailed test

**$p < .01$, 2-tailed test

correlations were inclusive and kinship-social tasks (r = .54/.52), and inclusive and time conservation tasks (r = .50/.34). None of the correlations between exclusive kinship and the three other social tasks were significant, a pattern that would be expected on the basis of the ceiling performance on this task. Intercorrelations among the three remaining tasks ranged from .35 to .54/.19 to .52, with a mean intercorrelation of .46/.35. As was observed for physical tasks, many of the correlations were lowered when the cumulative effects of CA, MA and sex were eliminated, although most of the residual correlations remained significant. A comparison of the mean physical and social intercorrelations indicates that the intercorrelations within each domain were highly similar (.50/.45 and .46/.35 respectively).

The zero-order and partial corelations between social and physical conservation are presented in Table 19. Because of the significant zero-order correlations between CA and MA with both physical and social conservation, and between sex and social conservation, third-order partial correlations between physical and social tasks, eliminating the cumulative effects of CA, MA and sex, are reported in Table 19.

Inspection of Table 19 reveals that the highest correlations between physical and social conservation occurred between restorable mass on the one hand, and inclusive, kinship-social and time conservation on the other hand (r = .41, .37 and .36). Because of restricted ranges on exclusive kinship and nonrestorable weight, none of the correlations between these and other tasks were significant. Overall, correlations between physical and social conservation ranged from .24 to .39/.02 to .17, with a mean correlation of .32/.09. The correlation between total social and physical conservation was .42, although this relationship was substantially reduced when the combined effects of CA, MA and sex were

Table 19

Zero-order and Partial Correlations between Physical and Social Conservation

Social Conservation	Physical conservation: Restorable: Mass	Weight	Total	Nonrestorable: Mass	Weight	Total	Total Physical
Inclusive	.41**	.29**	.39**	.33**	.09	.27**	.36**
	.17	.11	.17	.07	-.06	.02	.11
Kinship-social	.37**	.19	.32**	.23*	.16	.24*	.31**
	.19	.02	.13	-.01	.06	.03	.09
Time	.36**	.33**	.39**	.34**	.10	.29**	.37**
	.10	.14	.14	.06	-.06	.01	.09
Exclusive	.16	-.03	.07	.13	.02	.10	.09
	.17	-.05	.07	.12	.01	.09	.09
Total restorable	.42**	.27**	.40**	.37**	.14	.29**	.37**
	.21	.08	.17	.04	.00	.03	.12
Total nonrestorable	.37**	.32**	.39**	.35**	.10	.30**	.37**
	.12	.12	.15	.08	-.05	.03	.10
Total social	.46**	.32**	.45**	.37**	.14	.33**	.42**
	.22*	.11	.20*	.06	-.02	.03	.13

Note. The partial correlations are third-order correlations eliminating CA, MA and sex, and appear below the zero-order correlations.

*$p < .05$, 2-tailed test

**$p < .01$, 2-tailed test

eliminated (r = .13). Thus, in contrast to the patterns observed within physical and social tasks, residual correlations between physical and social tasks which remained after the combined effects of CA, MA and sex were removed, were substantially reduced and in all but one instance, became nonsignificant. It would appear then, that a large proportion of the relationship between physical and social conservation could be attributed to their shared relationship with CA and MA, and when these covariates were eliminated, the relationship between physical and social conservation became negligible.

These results support the prediction of convergent validity, since intercorrelations among physical and social conservation were nearly identical and remained significant after the combined effects of CA and MA were eliminated. Support for the existence of discriminant validity was also found in the absence of a significant relationship between social and physical conservation once their mutual relationship with CA and MA was removed. This latter finding suggested that these domains might reflect independent cognitive skills, so to further explore the nature of the relationship among and between physical and social conservation, a varimax factor analysis, rotated to obtain terminal orthogonal factors, was performed. The tasks included in the factor analysis were restorable and nonrestorable physical conservation; inclusive, kinship-social and time social conservation tasks; kinship permanence and definitions; WISC Vocabulary raw scores and CA. The factors which resulted from this analysis are listed in Table 20 and illustrated in Figure 4. For interpretation of the factor loadings, the conventional criterion of .30 loadings has been adopted.

Examination of Table 20 reveals that two factors emerged from rotation, and the loadings on these factors clearly revealed the identity

Table 20

Varimax Rotated Factor Matrix

Tasks	Factor 1	Factor 2
Restorable physical conservation	.79	.26
Nonrestorable physical conservation	.82	.11
Inclusive kinship	.17	.81
Kinship-social	.11	.78
Time conservation	.28	.70
Kinship permanence	.26	.64
Kinship definitions	.65	.08
WISC Vocabulary	.70	.33
CA	.74	.38

LEGEND:

1 - Vocabulary
2 - Restorable Physical
3 - Nonrestorable Physical
4 - Inclusive Kinship
5 - Kinship-Social
6 - Time Conservation
7 - Kinship Definitions
8 - Chronological Age
9 - Kinship Permanence

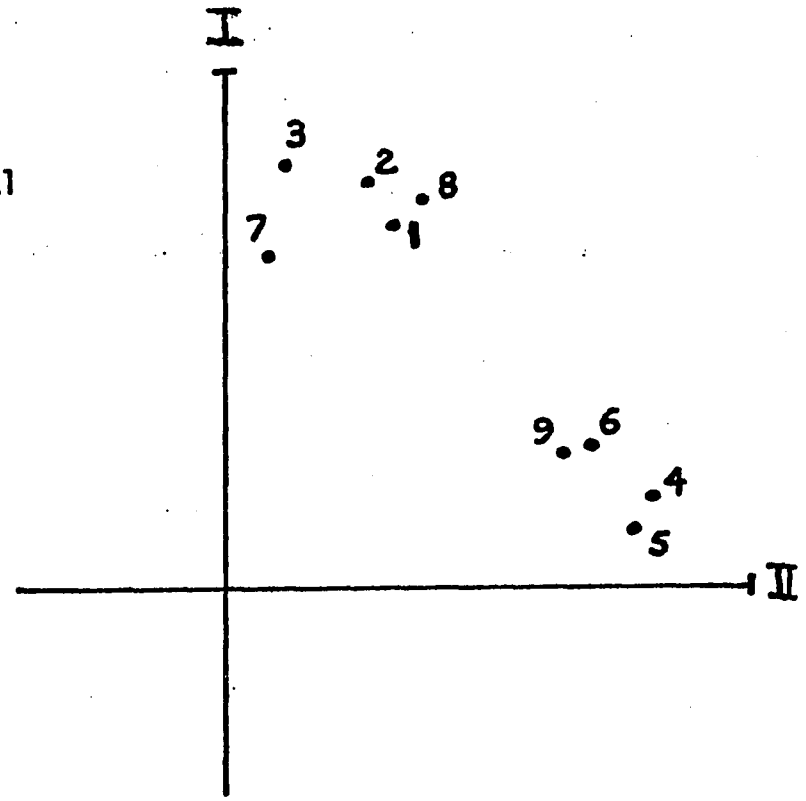

Figure 4. Physical (I) and Social (II) Factors.

of these factors. The first factor contained CA, and both physical conservation and vocabulary tasks, with loadings for these tasks ranging from .65 to .82. Because of the high loadings for physical conservation and vocabulary, this factor was identified as a Physical Conservation and Verbal Ability factor. The second factor contained the three social conservation tasks and kinship permanence, with loadings on these tasks ranging from .64 to .81, and marginal loadings for CA and WISC vocabulary of .38 and .33 respectively. Since the loadings for CA and WISC vocabulary were secondary in size to their primary loadings on the first factor, the second factor was identified primarily as a Social Conservation factor. Inspection of Figure 4 illustrates how the physical and social tasks cluster among themselves, thereby providing additional support for the pattern of convergent validity previously observed in conjunction with the intercorrelations. Furthermore, the distinct Physical and Social Conservation factors lend additional support for the pattern of discriminant valdity between these tasks, since these separate factors suggest that independent cognitive skills were represented by the physical and social conservation batteries. Finally, the higher loadings of CA and WISC vocabulary with physical, in contrast to social conservation, suggest that performance on physical conservation was more influenced by age and verbal ability than was social conservation, an issue which is further examined in the next section.

Hypothesis 7: Effects of CA and MA on Physical and Social Conservation

It was predicted that performance on social and physical conservation would be positively related to CA and MA. The zero-order correlations between total physical conservation and CA and MA (reported in Table 17) were .64 and .45 respectively, while the correlations between total social

conservation and CA and MA (reported in Table 18) were .45 and .46 respectively. Clearly, all of these correlations were positive and significant, thus supporting the prediction concerning their relationships.

While CA and MA were both significantly related to conservation, it is possible that the relative strengths of these relationship differed for social and physical conservation. In fact, the correlation between CA and physical conservation (r = .64) was significantly higher than that between CA and social conservation (r = .45, $t(89)$ = 2.21, $p < .05$, 2-tailed test). On the other hand, the respective correlations between MA with physical and social conservation were not significantly different (r = .55 and .46 respectively, $t(89)$ = .98). Furthermore, while no predictions concerning the relationship between sex and conservation were made, it was found that sex was significantly correlated with social, but not physical conservation (r = .26 and .05 respectively). To assess the relative contributions of these three independent variables, stepwise multiple regression analyses were performed for each predictor on the total physical and social conservation scores, and the results from these analyses are reported in Table 21.

Inspection of Table 21 reveals that the combination of CA and MA accounted for 45% of the variance in physical conservation. Moreover, based on the size of their standardized beta weights, the contribution of CA was almost twice as large as that of MA (.48 and .25 respectively). As expected, the contribution of sex to physical conservation was negligible (.03). In contrast, the cumulative combination of CA, MA and sex accounted for 31% of the variance in social conservation, and the relative contribution of each varaible was similar, since their respective beta weights ranged between .24 and .29. Thus, it appeared that the

Table 21

Multiple Regression Results Predicting Social and Physical Conservation from CA, MA and Sex

Predictors	Multiple R	R^2	R^2 increase	Zero-order r	Beta
		Physical conservation			
CA	.64**	.41**	.41	.64**	.48**
MA	.67**	.45**	.04	.55**	.25*
Sex	.67**	.45**	.00	.05	.03
		Social conservation			
CA	.45**	.20	.20	.45**	.29*
MA	.50**	.26	05	.46**	.27*
Sex	.56**	.31	.06	.26*	.24*

*$p < .05$

**$p < .01$

contributions of CA, MA and sex differed for social and physical conservation, with these measures making relatively equivalent contributions to social conservation, but disproportionate contributions to physical conservation.

Hypothesis 8: Effects of Family Characteristics on Conservation

It was predicted that family characteristics of ordinal position and birth order would be positively related to performance on social, but not physical conservation. Inspection of the correlations between these variables, reported in Table 22, reveals that none of these family variables were related to either type of conservation. Correlations were also obtained between family variables and each social conservation item. Of a total of 48 correlations, only 3 were significant, and these occurred between ordinal position and: 'father-brother' inclusive pair ($r = -.23, p < .05$), and 'father-doctor' or 'mother-nurse' conventional kinship-social pair ($r = .26, p < .05$); and between family size and 'father-doctor' or 'mother-nurse' conventional kinship-social pair ($r = .28, p < .01$). Since the majority (94%) of the correlations between family variables and social conservation items were not significant, the prediction concerning the relationship between these variables was not supported.

Effects of Kinship Measures on Conservation

Three measures involving kinship terms and concepts were administered in this study: knowledge of kinship defintions, self-identification of child and sibling kinship roles, and knowledge of the permanence of these roles. No specific predictions were made concerning these variables, but intuitively it might be expected that these measures would be related to social conservation because of their similar contents. The zero-order and partial correlations between these three kinship measures, and social and

Table 22

Zero-order and Partial Correlations of Family and Kinship Measures with Social and Physical Conservation

Tasks	Kinship measures: Definitions	Identification	Permanance	Family measures: Ordinal position	Family size
Social conservation					
Inclusive	.22* .02	.11 -.06	.36** .22	.14	.04
Kinship-social	.17 -.02	-.05 .13	.34** .24	-.02	-.09
Exclusive	-.10 -.15	.39** .38**	-.12 -.15	-.19	-.11
Time	.25* .05	.24* .20	.51** .38**	-.15	-.13
Total restorable	.22* .00	.04 .04	.39** .26*	.07	.00
Total nonrestorable	.23* .02	.29** .26*	.50** .37**	-.17	-.14
Total social	.25* .01	.12 -.05	.47** .33**	.00	-.05
Physical conservation					
Restorable mass	.28** -.02	.04 .08	.33** .07	-.12	-.11
Restorable weight	.38** .19	.18 -.15	.28* .01	.07	.02
Nonrestorable mass	.35** .07	.14 -.06	.29* -.03	-.09	-.09
Nonrestorable weight	.22* .08	.06 -.02	.11 -.07	.00	-.04
Total restorable	.37** .10	.12 -.04	.33** .04	-.04	-.05
Total nonrestorable	.35* .10	.12 -.06	.26* -.05	-.06	-.08

Table 22 Cont.

Total physical	.39** .11	.13 -.05	.32** .00	-.05	-.07
CA	.42**	.09	.52**	-.02	-.04
MA	.45**	.19	.29*	.05	-.05
Sex	.06	.17	.26*	.06	.04

Note. The partial correlations of kinship measures with social and physical conservation are second-order correlations eliminating CA and MA, and appear below the zero-order correlations.

*$p < .05$, 2-tailed test

**$p < .01$, 2-tailed test

physical conservation are reported in Table 22. Since kinship definitions and permanence were significantly correlated with CA and MA, second-order partial correlations, eliminating the combined effects of CA and MA, are also reported in Table 22. The intercorrelations among the three kinship tasks were not significant, and ranged from .14 to .21.

Inspection of the correlations between kinship defintions and conservation reveals that the level of kinship definitions was significantly related to performance on social (r = .25) and physical (r = .39) conservation. However, when the combined effects of CA and MA were removed, residual correlations between these variables became nonsignificant, indicating that much of the relationship between kinship definitions and conservation was due to their mutual relationship with CA and MA. As observed in conjunction with the factor analysis (cf Table 20), kinship definitions were strongly associated with the Physical Conservation and Verbal Ability factor, and not associated with the Social Conservation factor. Thus, it appeared that kinship definitions reflected a general verbal ability, and did not contribute to social conservation per se.

Inspection of correlations between kinship identification and conservation in Table 22 reveals that kinship identification was not related to physical conservation or restorable social conservation, but was related to performance on both nonrestorable social conservation tasks of exclusive kinship (r = .39) and time (r = .24) conservation. Moreover, the strength of these relationships was maintained after the combined effects of CA and MA were removed. Since all of these tasks reached near ceiling performance, it is not surprising that they would be significantly correlated among each other.

Inspection of correlations between kinship permanence and conservation in Table 22 reveals that knowledge of the permanence of one's own kinship roles was significantly related to both social (r = .47) and physical (r = .32) conservation. Kinship permanence was significantly related to three of the four physical conservation tasks, but these relationships became nonsignificant after the combined effects of CA and MA were removed. In contrast, kinship permanence was significantly related to three of the four social conservation tasks, and these relationships remained significant in two instances (time conservation and total social conservation) after the combined effects of CA and MA were removed. The highest correlations occurred between kinship permanence and time (r = .51/.38), a finding that it not unexpected in light of the similarity of these tasks. These correlations corroborate the results of the factor analysis reported in Table 20, which revealed that kinship permanence was strongly associated with the Social, but not Physical Conservation factor. Thus, of the three kinship measures, kinship permanence was strongly associated with performance on social conservation, kinship identification was strongly associated with nonrestorable social tasks which reached ceiling performance, and kinship definitions were strongly associated with physical conservation and verbal ability.

The mean scores on kinship definitions, identification and permanence are reported in Table 23. Inspection of this Table reveals that performance on kinship identification approached ceiling performance. In fact, with the exception of three children (all males, one at each age level), all children correctly identified themselves as a brother, sister, only child, son and daughter. In contrast, recognition of the permanence

Table 23

Summary Statistics on Kinship Definitions, Identification and Permanence Tasks, by Group

Group	N	Definitions	Identification	Permanence:[a] Sibling	Permanence:[a] Child	Permanence:[a] Total
5-year-olds	15	11.63	1.93	.53	.35	.81
6-year-olds	15	16.57	1.97	.86	.69	1.64
7-year-olds	15	16.90	1.97	.96	.80	1.80
Males	45	14.73	1.91	.66	.56	1.22
Females	45	15.30	2.00	.92	.68	1.64
Total subjects	90	15.03	1.96	.79	.62	1.44
SD		5.50	.26	.41	.49	.80
Range		0-24	0-2	0-1	0-1	0-2
			F-tests			
Age $F(2,84)$:		10.25***	.17	10.78***	11.21***	14.56***
Sex $F(1,84)$:		.32	2.67	10.60***	2.35	6.92**
Age x sex $F(2,84)$:		.48	.17	4.55*	.01	1.19

[a]For kinship permanence, $N = 68$, with 2,62 df for age, and 1,62 df for sex.

*$p < .05$

**$p < .01$

***$p < .001$

of both these kinship roles did not reach ceiling performance. The main effect of age was significant for each permanence item and the total permanence score (see Table 23 for F values), and Scheffe comparisons ($p < .05$) revealed that on each item, 5-year-old scores were significantly lower than both 6- and 7-year-old scores, while the latter two groups did not differ from each other. The main effect of sex was significant ($F(1,62) = 6.92$, $p < .01$), and this was due primarily to the significantly higher performance of 5-year-old females on the sibling permanence item.

The mean score on sibling permanence was significantly higher than that on child permanence (means were .79 and .62 respectively, $t(67) = 3.06$, $p < .01$, 2-tailed test). Those children who denied the permanence of these roles indicated that when they became older, these child and sibling roles would change into those of a parent or grown up. These explanations were identical to those given on the remote-future time conservation item (cf Table 11), and further support the finding that becoming a grown up was considered incompatable with child, and to a somewhat lesser extent, sibling kinship roles.

Inspection of the mean level of kinship definitions reported in Table 23 indicates that the main effect of age was significant ($F(2,84) = 10.25$, $p < .001$), and Scheffe comparisons revealed that 5-year-old definitions were significantly lower than both 6- and 7-year-old definitions, while the latter two groups did not differ from each other. The main effect of sex, and the age by sex interaction, were not significant. The mean level of kinship definitions for each kinship term and different categories of kinship terms, are reported in Table 24. The level of kinship definitions on each item made by 5-year-olds was significantly lower than those of both 6- and 7-year-olds, while the latter

Table 24

Mean Level of Kinship Definitions, by Kinship Term and Age

Terms	Age level: 5	6	7	Total	SD	Range
Mother	2.23	2.83	2.93	2.67	1.09	0-4
Father	2.23	2.80	2.80	2.61	1.12	0-4
Daughter	1.83	2.70	2.87	2.47	1.18	0-4
Son	1.77	2.80	2.93	2.50	1.13	0-4
Sister	1.87	2.73	2.63	2.41	1.08	0-4
Brother	1.70	2.70	2.73	2.38	1.14	0-4
Parental terms	4.47	5.63	5.73	5.28	2.16	0-8
Child terms	3.60	5.50	5.80	4.97	2.25	0-8
Sibling terms	3.57	5.54	5.37	4.79	2.16	0-8
Male terms	5.70	8.30	8.46	7.49	2.83	0-12
Female terms	5.93	8.27	8.43	7.54	2.75	0-12

two groups did not differ from each other. Most of the 5-year-olds gave either irrelavent definitions, or definitions based primarily on property features of kinship terms, while most of the 6- and 7-year-olds gave either relational, or relational and reciprocal definitions. The six kinship terms were also combined into five different categories of terms, and parental definitions were significantly higher than sibling definitions ($t(89) = 2.21$, $p < .05$, 2-tailed test), although there were no differences between parental and child, child and sibling, or male and female kinship terms ($t(89) = 1.33$, .93 and .57 respectively).

Contingency Relationship between Physical and Social Conservation

While no specific predictions were made concerning a contingency relationship between physical and social conservation, this relationship was examined by obtaining the number of subjects who passed or failed the total physical, and total social conservation batteries. These data are reported in Table 25, and as can be seen in this Table, a majority of subjects either consistently passed (N = 13) or failed (N = 42) both tasks, and that the number of subjects who passed physical conservation was similar to those who passed social conservation (N = 33 and 28 respectively). McNemar's chi square test for marginal homogeneity ($\chi^2 = .46$, ns, 2-tailed test) was not significant, indicating that there was no difference between the number of subjects who passed physical but not social conservation (N = 20), and those who passed social but not physical conservation (N = 15). Thus, these data indicate that physical and social conservation develop synchronously, and that while most children's performance on both tasks was in the same direction, there were some whose performance was in the opposite direction.

Table 25

Number of Subjects Passing and Failing
Physical and Social Conservation Tasks

Physical Conservation		Social conservation: Fail	Pass	Total
	Pass	20	13	33
	Fail	42	15	57
	Total	62	28	90

Note. The criterion for passing was at least 75% correct responses on 12 physical conservation items and 18 social conservation items. The 6 exclusive kinship items were eliminated from the social conservation category because of the ceiling performance on this task.

CHAPTER 4

DISCUSSION

The discussion of the results is organized according to several of the major hypotheses proposed in this study. These hypotheses refer to the development of conservation of single and multiple kinship roles, effects of chronological and mental age on conservation, the role of restorable and nonrestorable transformations on conservation, and the relationship between social and physical conservation. The conclusion appears in the final section of the Chapter.

Conservation of Single Kinship Roles

The results from this study suggest that conservation of single kinship roles develops in an hierarchical sequence, beginning with identification of kinship roles, and culminating in the recognition of the permanence of those roles. The data indicate that virtually all children are correctly aware of their membership in child and sibling roles by the age of five. This early recognition of one's kinship roles coincides with the relative early recognition of gender (Thompson, 1975), and it would not be surprising if kinship identification was correlated with gender identification. Thus, recognition of kinship membership can be considered a preoperational acquisition.

The early acquisition of kinship membership reported here does not correspond with Piaget's (1928) sibling study in which class sibling concepts were not acquired by a majority of children until the age of ten. However, the source of this discrepancy resides in Piaget's, and other's, reliance on kinship definitions as the sole criterion for membership concepts. When a distinction is made, as in this study, between identification of kinship classes and definitions of those classes,

then the early acquisition of membership recognition is observed. Thus, while children are cognizant of roles to which they belong, their descriptions of those roles still rely on perceptual features such as sex, size or caretaking functions at this age, rather than the more inferential logical features of these roles. The nature of the kinship definitions obtained in this study correspond to those obtained by Haviland and Clark (1974), and were primarily a function of CA rather than operational status, since correlations between kinship definitions and both types of conservation were not significant after the effects of CA were eliminated.

The recognition of the permanence of kinship roles appears to follow identification of kinship classes. While the proportion of conservation judgments increased with age, across all age levels, two thirds of the children acknowledged the permanence of their own child and sibling roles, and on time conservation, about one half (56%) acknowledged the permanence of child roles into remote-future time spans. Thus, regardless of whether the referents of conservation questions are fictitious children or the subjects themselves, approximately one third to one half still deny the invariance of these roles. These results correspond to Guardo and Bohan's (1971) findings that 62% of 6- to 9-year old children acknowledged the permanence of their self-identity into remote-future time spans.

The effect of varying the amount of elapsed time on conservation of child roles was significant, since significantly fewer conservation judgments occurred on remote time span conditions. The explanations made by nonconservers illustrated their reliance on nonessential but perceptually salient physical changes associated with age. For these

children, reaching a certain chronological age is equivalent to a permanent transformation from child to adult kinship roles, thereby negating the invariance of child roles. The fact that permanence of sibling roles was acknowledged more often than child roles suggests that sibling roles may be perceived as relatively less dependent on specific age or generational cues than are child roles. However, the reliance on perceptual, rather than logical features of kinship concepts is typical of the nature of preoperational thought in general.

While conservation of single kinship roles appears to be based on recognition of kinship membership, it also seems to be based on identification and conservation of gender. That is, the recognition that a child is, and will always remain a son despite changes in age, also reflects an implicit recognition of the permanence of male gender. In this study, denial of kinship permanence was based exclusively on age, rather than the absence of gender constancy. Research concerning gender identification and constancy suggests that by the age of five, a majority of children recognize their gender but may not acknowledge its permanence under remote-future time transformations (Slaby & Frey, 1975; Thompson, 1975; Thompson & Bentler, 1973). However, an analysis of these gender constancy studies in which nonconservation of gender occurs reveals that gender changes were confounded with kinship changes. For example, children were asked whether they would be a "mommy or daddy" when they grew up, and affirmitive responses were interpreted as evidence for gender constancy. However, the use of parental kinship roles is not isomorphic with gender roles such as "man" and "woman," yet they are regarded as such in these studies. It would be of interest to further examine the relationship between gender and kinship conservation by

removing this confounding of gender and kinship under remote-future transformations. Based on the present findings it would be expected that gender constancy would be a necessary, but not sufficient prerequisite for kinship conservation.

Conservation of Multiple Kinship Roles

The present study examined two kinds of multiple kinship roles, one involving inclusive or exclusive kinship pairs, and one involving conventional and unconventional kinship-social pairs. With respect to the effects of logical exclusivity, it was found that inclusive combinations of kinship roles were significantly more difficult to conserve than exclusive roles. By the age of five, almost all children recognized that opposite-sex kinship pairs cannot exist simultaneously, and this near ceiling performance suggests that the sex component is one of the earliest features of kinship concepts that is acquired. Many of the children were so certain of the impossibility of these exclusive pairs that they considered these questions "silly," and their explanations reflected an attitude of the obvious irreversibility of kinship roles based on sex. These findings concerning exclusive kinship pairs support the earlier appearance of the sex component reported in componential analyses of kinship terms (Jacobowitz, 1975), as well as findings concerning the development of gender constancy among preoperational children (see above). In addition, these findings are consistent with those regarding higher performance on nonreversible sentences as compared to reversible sentences on passive sentences (Slobin, 1966).

Conservation of inclusive kinship pairs did not approach ceiling level at the oldest age level. It was apparent that the source of difficulty on these pairs occurred primarily among across-generation pairs,

since less than half the children gave conservation judgments on those items, but over three quarters gave conservation judgments on within-generation items. This frequency of conservation on across-generation items corresponds to that reported elsewhere (Kooistra, 1963). The greater difficulty of these items suggests that children are aware of the generation component underlying kinship terms. In fact, perception of age or generational features are so salient that they tend to conceal the more abstract logical relationship underlying kinship roles. It is proposed that an hierarchy exists for permissible kinship combinations, with the sex component being the initial prerequisite for multiple kinship roles. Once the sex component prerequisite is satisfied, the age component becomes the major criterion for kinship combinations, but this criterion often excludes other logical criteria for many children.

The second type of transformation performed on multiple kinship roles was the conventionality of the accompanying social role, and this transformation also played a significant role on conservation judgments. Significantly more conservation judgments occurred on conventional, as compared to unconventional kinship-social pairs, although the effect was largely associated with parental-social pairs, rather than sibling- and child-social pairs. Explanations associated with nonconservation of parental-social pairs reflected an attitude concerning the inappropriateness of the sex roles on the unconventional pairs, indicating that mothers could not be doctors, or father be nurses, because both were an inappropriate sex for those roles. These findings concerning the effects of unconventional social roles correspond to those concerning the effects of positively and negatively evaluated

social roles (Saltz & Hamilton, 1967; Saltz & Medow, 1971).

Conservation of kinship-social roles was also affected by the type of kinship role which accompanied conventional and unconventional roles. That is, the obstacle to conservation of sibling- and child-social pairs was not the conventionality of the social role, but the perceived discrepancy between social roles which were implicitly considered adult roles, and kinship roles which were implicitly considered as nonadult roles. Thus, conservation of child- and sibling-social items was significantly lower than parental-social items because the former kinship roles were considered an inappropriate age to occupy the particular social roles. Sons could not be teachers, and daughters could not be pilots because both were too young at the present time, rather than the inappropriate sex for these roles. In contrast to inclusive kinship pairs in which sex was the initial prerequisite for kinship memebrship, chronological age was the initial prerequisite for kinship-social combinations. Once these perceived age restrictions were no longer applicable, as in the case of parental-social combinations, then the conventionality of the social roles became the barrier to multiple roles. Since the present study combined adult social roles with adult and nonadult kinship roles, it would be informative to examine the influence of social roles on multiple role conservation by pairing conventional and unconventional nonadult social roles with sibling and child kinship roles, in order to reduce the age discrepancies between kinship and social roles. This might yield a more precise analysis of the effects of unconventional social roles on conservation of social roles, since the present study clearly indicates that under some conditions, these acquired values do interfere with social role conservation.

Another feature of the influence of kinship terms on multiple role conservation was that conservation of child-social pairs was significantly lower than that on sibling-social pairs. This finding coincides with those concerning permanence of single kinship roles, since the recognition of the permanence of one's sibling role was significantly higher than that of one's child role. Thus, it is again apparent that perception of chronological age is closely linked to child kinship roles, and that age transformations interfere more on child-kinship roles than they do for sibling-kinship roles. Moreover, performance on child-social pairs did not improve with age, so the age at which conservation of child roles occurs for a majority of children has not yet been established.

The critical importance of age, or generational cues on conservation of kinship roles may reflect to some extent, children's concepts of age in general. It may be recalled that Piaget (1969) contends that age concepts per se are based on the coordination of seriation of birth with conservation of relative age differences across time, and the ensuing independence from physical features as determinants of age. It is conceivable that children who did not conserve across-generation inclusive kinship pairs, or child and sibling roles, have not yet acquired an operational understanding of these age concepts. It would be instructive to explore this possibility by assessing the relationship between conservation of kinship roles and age concepts.

Finally, strong evidence was obtained concerning the existence of convergent validity among both single and multiple kinship tasks. Correlational data revealed moderate interrelationships among these tasks which remained significant, for the most part, after the combined effects of CA and MA were removed. Moreover, factor analytic results yielded a

distinct Social Conservation factor on which all of the kinship tasks (eliminating exclusive kinship) appeared. While all of these kinship tasks were significantly related to CA and MA, the age at which ceiling performance is achieved on the more difficult kinship tasks is still unknown, and may not occur until the middle of the concrete operational period. Thus, while concepts such as kinship membership, kinship permanence over near time spans, and exclusive kinship concepts appear to be preoperational acquisitions, kinship permanence over remote time spans, and multiple kinship combinations appear to develop over the course of the concrete operational period.

Effects of Chronological and Mental Age on Conservation

As expected, conservation performance increased significantly with age, although evidence from several sources revealed differential patterns between CA with social and physical conservation. The main effect of age was significant for all tasks and total conservation batteries, but the frequency of significant pair-wise differences between adjacent (i.e., 5- to 6-year-olds, and 6- to 7-year-olds) and nonadjacent (i.e., 5- to 7-year-olds) age groups differed for physical and social tasks. There were four physical conservation tasks, and 75% of the adjacent, and 100% of the nonadjacent pair-wise comparisons were significant. In contrast, there were 10 social conservation subtasks, and 20% of the 5- to 6-year-old, 30% of the 6- to 7-year-old, and 80% of the 5- to 7-year-old pair-wise comparisons were significant. Thus, increases in physical conservation occurred in yearly increments, while increases in social conservation occurred primarily between the youngest and oldest, rather than adjacent age groups.

The results from the regression analysis corroborate this differential

patternof age effects, since the correlation between CA and physical conservation was significantly higher than that between CA and social conservation. As a conseqeunce, CA accounted for almost twice as much variance in physical conservation performance that it did for social conservation performance. These findings suggest that while both types of conservation are influenced by developmental changes, social conservation is influenced to a greater extent by non-developmental variables than is physical conservation. These results concerning the relationship between CA and physical conservation concur with those pertaining to other conservation tasks (Jordan & Jordan, 1975), particularly with regard to studies in which a wide age range of children were sampled.

The estimate of MA used in the present study, based on WISC vocabulary scores, was also significantly related to social and physical conservation, and accounted for approximately one quarter of the variance on each conservation battery. Furthermore, unlike CA, the relative contributions of MA to social and physical conservation were almost equivalent, suggesting that MA is a consistent predictor of conservation performance across a variety of conservation domains. This observation also concurs with findings concerning a range of other conservation tasks (Jordan & Jordan, 1975).

Effects of Restorable and Nonrestorable Transformations

The present study proposed a distinction between restorable transformations in which materials could be restored to their pretransformation condition, and nonrestorable transformations in which materials could not be restored to their pretransformation condition. Since one cognitive operation underlying conservation is the recognition of logical reversibility,

it was predicted that the absence of physical (but not logical) reversibility might obscure the recognition of logical reversibility, and thus make conservation under nonrestorable conditions more difficult. This distinction between restorable and nonrestorable transformations differs from one proposed by Piaget between "empirical" and "logical" reversibility. Empirical reversibility refers to an intermediary level in the development of conservation during which children acknowledge the equivalence of materials when they are returned to their original condition, but simultaneously maintain that the materials are not equivalent while one is in a transformed state. Thus, the recognition of empirical reversibility "neither cancels out this transformation nor compensates for it; it is merely a second action which for the child is completely independent of the first." (Inhelder, Sinclair & Bovet, 1974, p. 33). In the present study, the nonrestorable transformations were not isomorphic with empirical reversibility, although it is conceivable that the existence of the former might preclude the latter.

On social conservation, both types of nonrestorable tasks, i.e., exclusive kinship and time conservation, were significantly easier than their restorable counterparts, a finding which was in the opposite direction of the prediction. However, as the above discussion of these social conservation tasks indicated, the relative ease of these nonrestorable tasks can be attributed primarily to their respective content areas, rather than to the absence of restorable transformations. It is sugggested that for the social conservation, variables which are germane to kinship per se, appear to be greater influences on performance that is the nature of the stimulus transformations.

Some support for the prediction was obtained with regard to physical

conservation, since the most difficult physical task was conservation of nonrestorable weight. Clearly, the gradual disappearance of dissolving sugar had a powerful effect on masking the implicit logical reversibility of the materials. However, since conservation of weight was also more difficult than conservation of mass, the effects of the nonrestorable transformation are partly confounded by the nature of the conservation task. Furthermore, it is also possible that the two nonrestorable tasks differed in the degree of perceptual salience of the stimulus transformation. That is, although the materials used for nonrestorable mass could not be restored to their pretransformation condition after being crushed, they were still present and visible in their transformed state. In contrast, the sugar cubes used for nonrestorable weight gradually became invisible by the final trial, so the absence of the transformed materials, beyond their nonrestorability, may have partly accounted for the greater difficulty of the nonrestorable weight task over nonrestorable mass. The effect of nonrestorable transformations differing in the degree of visibility (or demise), independent of the type of conservation, should be further studied. This could be accomplished by applying both types of nonrestorable transformations designed in this study only on conservation of mass tasks, so the effects of nonrestorability per se can be measured. The results from this study indicate that the influence of nonrestorable transformations on physical conservation is a valid methodological issue which merits further attention.

Relationship between Social and Physical Conservation

One of the main issues in this study concerns the relationship between impersonal and interpersonal, or physical and social knowledge. As reviewed in Chapter 1, Piaget contends that knowledge of social concepts

is acquired through the same logical structures as knowledge of physical, or inanimate concepts. Therefore, it would be expected that these domains would be related in some measurable manner. The results from this study address this issue from several perspectives.

On the most general level, it was found that contrary to the prediction, performance on social conservation was higher than that on physical conservation. However, this overall finding obscures the range of performances that occurred in both domains, as well as some similarities between several social and physical tasks. Thus, the overall higher performance on social conservation can be attributed to ceiling performance on two of the four social tasks, namely exclusive kinship and time conservation. In contrast, there was no difference in performance between inclusive kinship and kinship-social tasks one the one hand, and three of the four physical tasks on the other hand.

A second approach to assessing the relationship betwen social and physical conservation is based on the results of correlational and factor analytic procedures. Strong evidence was obtained concerning the existence of convergent validity among each respective set of tasks, yet the relationship between social and physical conservation was moderate, and became negligible once their common relationship with CA and MA was removed. The results of the partial correlations strongly indicate that a large proportion of the correlations reported in the literature between physical and social tasks may be an artifact of their shared relationship with age. It would be advisable for future studies that address this issue to measure this relationship independently of chronological and/ or mental age.

Additional evidence concerning the nature of the relationship between

social and physical conservation was obtained from a factor analysis of these tasks. This analysis revealed two clearly identifiable and orthogonal factors, the first containing all physical conservation and verbal ability tasks, and the second containing all social conservation and kinship permanence tasks. The strength of respective task loadings, and the absence of any overlap between task loadings, provide strong evidence for the independence of physical and social conservation. The present factor patterns were similar to those reported by Hollos (1975) who obtained separate factors for logical operations and physical conservation on the one hand, and role-taking and communication tasks on the other hand. Thus, taken together with the correlational findings, it appears that while social and physical conservation are correlated, they nevertheless reflect distinct cognitive domains.

One argument which might be invoked to explain the absence of a formal relationship between social and physical conservation is whether the tasks used in this study (or in any study for that matter) were structurally equivalent. That is, the absence of correlational or factor analytic evidence concerning their relationship with each other might be construed as an artifact arising from the type of tasks used, thereby masking an underlying relationship. This argument has validity as far as some of the comparisons made in the literature between physical conservation on the one hand, and social cognitive tasks such as moral reasoning, empathy and decentration on the other hand, since these social tasks were not intended by Piaget to represent corresponding cognitive operations. In the present study however, the kinship tasks were designed specifically to overcome this shortcoming present in many

social cognitive tasks, so to the extent that this equivalence can ever be achieved, it is felt that the present kinship tasks were as conceptually and methodologically equivalent to physical conservation tasks as possible. It is possible however, that other types of tasks involving physical objects, such as multiple classification, might yield stronger relationships with social conservation than did the physical conservation tasks used in this study.

The question which remains then, is to reconcile the absence of a formal relationship between physical and social conservation on the one hand, with Piaget's position on the other hand. It is possible to partially resolve this issue by first distinguishing between those social tasks which were preoperational, rather than operational acquisitions, and are therefore not dependent on concrete operational structures. However, those social tasks identified as operational presumably rely on structures similar to those involving physical tasks. The results of the contingency analysis revealed that physical and social conservation are synchronous acquisitions, although some children seem to acquire social conservation before physical conservation. However, the absence of physical conservation may not necessarily imply the absence of operational structures; it may instead reflect the possibility that social knowledge may produce structural reorganization and change of the same kind, and through the same equilibration process that physical knowledge does. It is suggested that certain types of social experiences (described below) can influence structural development in such as way that operational development can at least begin (although not be consolidated), in the absence of physical conservation.

The present study was designed to address the influence of some noncognitive, or environmental factors which might influence social, but not physical conservation. One variable considered was that pertaining to family characteristics of family size and ordinal position. However, none of the social, kinship or physical tasks were correlated with either family variable, a finding that is consistent with other studies concerning social cognition (Shantz, 1975) and kinship definitions (Haviland & Clark, 1974). However, it is likely that the family setting does provide the context in which information pertaining to kinship concepts is shared between parents and children, although the family variables used in this study were not sensitive indices of these interactions. Many parents of the children tested at home reported that they had discussed with their children at some time many of the kinship concepts used in this study, although this anecdoctal information was not available for all subjects. One strategy which might be used to facilitate the acquisition of multiple kinship concepts would be to use children's parents as examples of persons who occupy more than one kinship role simultaneously, since occassionally children cited their parents as examples of these possibilities.

The second approach to assessing the effects of environmental influences on conservation was the use of social role transformations which reflect culturally acquired values. As described earlier, results concerning unconventional kinship-social pairs indicated that these acquired values did interfere with conservation of certain kinship combinations. It is conceivable that some children might continue to deny the possibility of unconventional kinship-social combinations even as they mature because of the strength of their sex role stereotypes, rather than because of any cognitive deficits required to assimilate

this knowledge. One technique for assessing this possibility would be to measure children's sex role stereotypes in conjunction with the range of conventional and unconventional kinship-social combinations discussed earlier. It might be that among concrete operational children, those who deny certain kinship-social combinations may be those with strong sex role stereoypes.

An unexpected finding which further supports the influence of social experiences on social conservation was the superior performance of females on several social, but not physical conservation tasks. Females made significantly more conservation judgments on time conservation items in past and future time directions, remote time spans, and in the recognition of the permanence of their child and sibling roles. In addition, females made significantly more conservation judgments on inclusive kinship pairs, and this was primarily due to their higher scores on female, rather than male kinship pairs. The absence of any sex differences in physical conservation performance is consistent with a survey of over 40 conservation studies in which no sex differences were reported (Maccoby & Jacklin, 1974), but does not concur with the general absence of sex differences on a variety of social cognitive tasks (Shantz, 1975). The absence of any sex differences on any sample characteristic, CA, MA or other cognitive variable, precludes the attribution of these sex differences in social conservation to any underlying differences in cognitive competencies or developmental maturity.

One possible explanation for the superior performance of females on social but not physical conservation may be the different kinds of socialization experiences which females are likely to encounter during the preschool and middle school-age years. That is, a greater emphasis

is placed on adult kinship roles for girls, while less emphasis is placed on adult kinship roles for boys. Observations of children's play clearly reveals how often girls reherse adult kinship roles, while boys are usually not engaged in this rehersal since it is typically considered sex stereotyped. Moreover, it is conceivable that just as role-playing adult kinship roles is perceived as feminine, information regarding kinship roles per se might also be perceived by children in general, and boys in particular, as feminine. Thus, the lower performance of males on these kinship tasks may reflect an underlying attitude that social conservation is essentially feminine, while physical conservation is either masculine or neutral in content. Not only might children consider kinship information as being more feminine than masculine, but parents might share this perception and therefore communicate information pertaining to kinship roles and relationships more freely with their daughters than with their sons. Since unconventional social roles interfered with kinship-social combinations, it is not unreasonable to expect that these implicit stereotyped perceptions of kinship conservation tasks might contribute to the differential pattern of performance by girls and boys on these tasks.

However, the superior social conservation performance of females was partially confounded by an unexpected interaction between task order and sex. It may be recalled that females performed higher than males on social conservation only when they received the social conservation battery prior to the physical conservation battery. Conversely, males performance on social conservation was enhanced when they received physical conservation prior to social conservation. The practice effects

which might have occurred for boys when they received physical conservation first may actually support the observation made above concerning sex stereotyped perceptions of the social tasks. That is, if these tasks were perceived as feminine to boys, then their interest or concentration on them may have been diminshed when they preceded the supposedly neutral or masculine physical tasks. However, since the sex differences in performance were consistent across a variety of social conservation tasks, the relative influence of task order per se may be a small, albeit significant performance factor. Further examination of social conservation might clarify this issue.

Conclusion

The present study was designed to examine the development of conservation of social concepts pertaining to kinship, and the effects of different types of transformations performed on these tasks, as well as its relationship with physical conservation, CA and MA. It was found that conservation of kinship concepts develops gradually during the preoperational and concrete operational periods, with preoperational acquisitions reflecting knowledge of kinship classes, conservation of single kinship roles under near time transformations, and recognition of logically exclusive kinship combinations. Concrete operational acquisitions reflected the permanence of single kinship roles over remote time spans, and the recognition of inclusive kinship, and kinship-social combinations. The effects of time transformations on kinship concepts was significant, and perceptions of age, or generational cues were highly salient factors which influenced kinship concepts and the recognition of their invariance.

It was also found that social and physical conservation represented

distinct cognitive factors, with acquisition of physical knowledge more strongly associated with organismic and developmental variables, and social knowledge more strongly associated with socialization experiences and culturally acquired values. Those social experiences germane to kinship knowledge were identified as interactions between parents and children, socially learned perceptions of conventional and unconventional kinship-social combinations, and socialization experiences which contributed to greater kinship conservation among girls than boys. The unexpected presence of sex differences on social but not physical conservation was interpreted as additional support of the role of sex stereotyped attitudes in mediating the acquisition of social knowledge.

APPENDIX A

Restorable Social Conservation Tasks

Inclusive Kinship Pairs

1. Mother - daughter
2. Brother - son
3. Sister - mother
4. Father - brother
5. Daughter - sister
6. Son - father

Sex Stereotyped Kinship-social Pairs

Conventional roles- male form:

1. Father - doctor
2. Brother - car mechanic
3. Son - airplane pilot

Conventional roles - female form:

1. Mother - nurse
2. Sister - librarian
3. Daughter - __ grade teacher (grade of subject)

Unconventional roles - male form:

1. Father - nurse
2. Brother - librarian
3. Son - __ grade teacher

Unconventional roles - female form:

1. Mother - doctor
2. Sister - car mechanic
3. Daughter - airplane pilot

APPENDIX B

Nonrestorable Social Conservation Tasks

Exclusive Kinship Pairs

1. Daughter - father
2. Sister - son
3. Mother - brother
4. Father - s-ster
5. Son - mother
6. Brother - daughter

Temporal Transformations[a]

1. Near - past:
   Male: 10 to 9
   Female:12 to 11

2. Near - future:
   Male: 3 to 4
   Female:5 to 6

3. Intermediate - past:
   Male: 6 to 2
   Female:9 to 5

4. Intermediate - future:
   Male: 10 to 14
   Female:11 to 15

5. Remote - past:
   Male: 26 to 10
   Female:26 to 10

6. Remote - future:
   Male: 18 to 27
   Female:17 to 27

[a] The numbers accompanying each item indicate the initial and final ages to which the moves were made.

APPENDIX C

Item Order on Social Conservation

Subscale A:

1. Brother - son
2. Father - doctor or mother - nurse
3. Brother - daughter
4. Son - grade teacher or daughter - pilot
5. Father - sister
6. Sister - mother
7. Daughter - father
8. Brother - mechanic or sister - librarian
9. Son - father

Time conservation:

1. Near - past
2. Remote - future
3. Intermediate - past
4. Intermediate - future
5. Remote - past
6. Near - future

Subscale B:

1. Brother - librarian
2. Mother - daughter
3. Sister - son
4. Father - brother
5. Son - pilot or daughter - grade teacher
6. Daughter - sister
7. Son - mother
8. Father - nurse or mother - doctor
9. Mother - brother

APPENDIX D

Restorable and Nonrestorable Physical Conservation Tasks

Restorable Conservation

Conservation of mass:

1. A changed to hotdog, B unchanged
2. A unchanged, B changed to pancake
3. A changed to 8 pieces, B unchanged

Conservation of weight:

1. A poured into C (tall jar), B unchanged
2. A unchanged, B poured into D (short jar)
3. A poured into E (5 small jars), B unchanged

Nonrestorable Conservation

Conservation of mass:

1. A (shells) crushed, B unchanged
2. A unchanged, B (sugar cube) sliced
3. A (sugar cube) crushed, B unchanged

Conservation of weight:

1. A inserted in water, B intact
2. A dissolved after 1 2-minute interval, B intact
3. A dissolved after 2 2-minute interval, B intact

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