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The Effects of Mental Age and Chronological Age on Conservation and Classification in Normal and Retarded Children

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THE EFFECTS OF MENTAL AGE AND CHRONOLOGICAL AGE ON CONSERVATION AND CLASSIFICATION IN NORMAL AND RETARDED CHILDREN

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Abstract

The effect of experience, as measured by CA, and intelligence on conservation and classification ability was systematically investigated, using groups of retarded and normal subjects matched on MA and CA. Three groups of subjects were matched on a MA of 72 months: a group of 12-year old retarded subjects, a group of 16-year old retarded subjects, and a group of 6-year old normal subjects. The 6-year old normal group was also matched on CA with a mentally retarded group whose MA was 36 months. Three conservation tasks (length, number, liquid) and three classification tasks (some-all, resemblance sorting, hierarchical classification) using both routine test items and real life items (candy and juice) were used. The results indicated that MA was the best predictor of both conservation and classification ability. Subjects also performed better on tasks using real life objects. The results offer support for a number of theoretical assumptions, such as, Inhelder's (1968) theory of "fixed operational thought," Piaget's concept of horizontal decalage, and Flavell and Wohlwill's (1969) competence-performance model. It was also demonstrated that mentally retarded children were just as likely to resist the countersuggestion of the experimenter as were normal children. All children showed more confidence in their decisions when real life objects were used, by demonstrating greater resistance to countersuggestion on these tasks. The effects of educational experience and individual differences among the subjects were discussed.

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Chapter I

Introduction

Conservation in normal and retarded children has been investigated in a number of studies using a mental age (MA) as well as a chronological age (CA) match (e.g., Gruen & Vore, 1972). In general, MA seems to be the best predictor of conservation ability (e.g., Brison & Bereiter, 1967). Unfortunately, most of these studies have overlooked a major problem with the MA-CA match paradigm. Chronological age and mental age have been confounded through the process of subject selection or the procedures used to determine MA. Thus, in most studies the groups with higher MAs also tended to be older. This relationship has a definite biasing effect which may explain incongruities among studies. The basic methodological problem is that CA denotes not only age, but also the length of exposure to natural life experiences. Since vicarious social learning can be applied to acquisition of conservation (Wallach,1969), conservation learning which may take place as a result of day to day experiences with conservation-like tasks is not adequately determined through an IQ test, and the subsequent assignment of a MA. The question posed in this study concerns the effects MA and varied exposure to natural life experiences, as indicated by CA, on conservation and classification abilities in normal and retarded children.

The analysis of conservation ability has played an important role in Piaget's theory of cognitive development (Flavell, 1963). The appearance of conservation in a young child marks the beginning of a major stage of cognitive growth, in that the child progresses from interacting with the world on a totally concrete plane, as during the pre-operational stage of development, to abstracting information and interacting with the environment in the sophisticated manner characteristic of the formal operations period. This transition begins with the realization that "certain attributes of an object remain invariant in the wake of substantive changes in other attributes" (Flavell, 1963, p. 47). Successful completion of conservation tasks requires that the child make use of the assimilation and accommodation functions (i.e., mental process) in order to think logically and abstractly.

According to Piaget (Flavell, 1963), conservation develops in a sequential pattern. An 8-to 10-year-old child can conserve matter, but usually not weight or volume. By the age of 10, weight conservation is achieved, and at 12 years of age (typically the age of onset of formal operations) the child usually can conserve volume. But, for many mentally retarded children this pattern of development and transition can decrease rather than increase, as shown by Inhelder (1968) in a series of observations and structured conversations with a group of retarded children obtained from institutions, special classes, physicians and teacher referrals, a group of normal children, and children considered to be slow learners. Based on her observational data, Inhelder (1968) argued that developmental retardation at the concrete operational or pre-operational stage is a function of general intellectual equilibrium. That is, normal intellectual equilibrium is "ever widening because it includes an increasing number of notions" (p. 68). Notions, in this case, refers to cognitive structures or organizational properties. The normal child passes through one level of equilibrium to the following one more and more rapidly as more and more notions are built upon. For the most part these levels of equilibrium are integrated and follow a discernable pattern. The first level or notion is that of the object in general. This notion gives way to the acquisition of conservation of substance, from which later develop the notions of conservation of weight and volume. The time lags between levels become increasingly smaller as development progresses and the child masters specific cognitive skills. The usual period between the discovery of the object in general, and conservation of substance is about six years. The next integration of levels, which is the transition from conservation of substance to the ability to conserve weight, requires about two years, and the transition to volume conservation usually occurs in one additional year. Inhelder (1968) believes that this rapid development is due to the increasing mobility of operational thought. Inhelder (1968) further argues that in some cases there is a permanent state of stagnation, i.e., the mentally deficient child can attain a lower level of development, but remains fixed at this level for several years, or permanently. Inhelder suggests that "mental deficiency" could be defined as an "unfinished operatory construction" (p. 292). On the basis of these assumptions it would appear that a retarded child may not benefit from educational or training programs, and the potential role of vicarious learning or exposure to natural experiences in contributing to cognitive growth is therefore greatly diminished.

Gruen and Vore (1972), in a study on number, quantity, and weight conservation using normal and retarded children, also provide some data which suggest that the transition from one stage of cognitive development to another can be slower in the retarded child. They found that normal children with MAs of 7 years advanced through the transition period between pre-operational and concrete operational thinking much more rapidly than the retarded children of the same MA. McManis (1969), in a study comparing normal and retarded children on weight and length conservation tasks, also found that retarded children progress through the concrete operation period more slowly than normal children.

Classification skills also develop in a sequential and well defined order. The origin of classification abilities is seen when the child groups together two objects that are equivalent because they look alike in some way (Kofsky, 1966). From that point, classification skills expand to include groupings of more than two objects, and then to groupings of all objects which could be considered similar in some respect, e.g., exhaustive sorting. Gradually the child learns to form successive and simultaneous classifications. The realization that objects of one category can also belong to a different category leads the child to actively try out different groupings of the same objects, e.g., horizontal classification. Successive classes or hierarchical classifications are developed as the child selects single attributes and then combinations of attributes to define classes. When children recognize that some objects can belong to more than one class, they begin to understand ways in which classes can overlap. The development and use of terms such as "some" and "all" which can be used to compare classes, enable the child to construct "classes that stand in an inclusion relationship" and to experiment with the complementary processes of joining subclasses to form a superordinate class (A' + A) and dividing superordinate classes into constituent parts (B - A') (Kofsky, 1966). These stages in the development of classification skills are consistent with Inhelder's theory of general intellectual equilibrium. The initial basis for classification, that of a resemblance between two objects, is the primary building block for the development of more complex notions such as those found in hierarchical classification.

The idea of explaining cognitive development by means of a "stage" theory is not without problems. A major problem in conservation and classification studies has been the assignment of children to experimental groups so that the child's cognitive stage matches his/her chronological age. For example, although a child is 7 years old and bright, this does not necessarily mean that the child can conserve substance, since children may be in the intermediate phases of stage transition at different times in their experiential lives. Many researchers have tried to avoid this problem through a series of experimental manipulations. In studies of conservation and classification, researchers have used groupings by MA (Roodin & Gruen, 1970), by CA (Keller & Hunter, 1973), by IQ (Feigenbaum, 1963; McManis, 1969) or a combination of these (Goldschmid, 1967; Gruen, 1973). As previously noted, MA seems to be the best predictor of conservation ability (Boland, 1973; Brison & Bereiter, 1967; Gruen & Vore, 1972; Keasey & Charles, 1967). But the findings of these studies using a MA match design are suspect since the use of MA may have introduced a bias because children with identical MAs had significantly different CAs. For example, in the Gruen & Vore (1972) study, CA is confounded with MA since the mean CA for each MA group systematically increased as the MA increased. The mean CA for retarded subjects with a MA of five years was 94.5 months; for the subjects with MAs of seven years the mean CA was 123.3 months; and for the subjects with MAs of nine years the mean CA was 149.8 months. Therefore, the children with the higher MAs, although delayed in comparison to their normal counterparts, tended to be older than children with younger MAs.

The effects of exposure to natural experiences, as reflected in CA, also may explain differences in the ability of older and younger children to conserve; that is, older children may perform better or worse than the younger children of the same MA. Several explanations for these differences can be advanced. The items on the intelligence test used to determine MA might not be measuring intellectual constructs which contribute to conservation ability. DeVries (1974) compared Piagetian, IQ, and achievement assessments and concluded that psychometric tests and Piagetian tasks "appear to measure a different intelligence" The psychometric definitions and perspective of intelligence are very narrow in that they are defined by the "educational expectations of children" (p. 747), while the Piagetian perspective is a "broader one, defined by children's changing reasoning about reality" (p. 747). Consequently, standard intelligence tests would not measure any progress in the conservation area for the older children. In addition, exposure to natural life experiences which are conservation-like can enhance a child's ability to conserve in spite of limited mental capabilities (Wallace, 1965). Further, children can learn to conserve. Wallach and Sprott (1964) demonstrated that nonconserving first graders could be trained to conserve number through repeated experiences in reversing a transformation in a series of tasks where the child was required to predict the reversibility of a subtraction and then confirm the prediction through the manipulation of materials. In addition, Brainerd and Allen (1961) cite a number of successful attempts at inducing conservation of number (Gruen, 1965; Kingsley & Hall, 1967; Rothenberg & Orost, 1969), length (Bearison, 1969; Sullivan, 1969), substance (Brison, 1961; Gelman, 1969), area (Beilin, 1965), and weight (Smith, 1968). However, these conservation abilities did not generalize to other conservation tasks, and extinction appeared to occur more quickly in the trained children than in children who had acquired conservation skills naturally. But Keasey and Charles (1967) note that these studies do not reflect the natural mode of cognitive development since they are restricted to artificial, concentrated experiences in a laboratory setting. The effects of more natural experiences extend over a longer period of time and are integrated with other experiences.

Limited data are available on the role of vicarious conservation learning occurring as a result of day to day experiences (Keasey & Charles, 1967; Wallace, 1965; Wallach, 1969). Such learning may occur when a child has to choose between the longer or shorter piece of licorice (length conservation), the taller and thinner as oposed to the shorter and wider glass of juice (liquid conservation), or the sudden realization that one can make a long sausage out of a ball of Play Dough and then roll it back into the same sized ball again (substance conservation).

In addition to the more obvious factors that can contaminate experimental results, several cognitive theorists have offered various hypotheses to explain the phenomena of lack of cross-study reliability in Piagetian studies. Piaget (1954) attempted to account for discrepancies between conservation studies through his theoretical concept of horizontal decalage. This concept implies that during any level of development, a cognitive structure which is characteristic of that level can be successfully applied to task _X_, but not to task _Y_. At a later point in time the same organization of operation can be successfully applied to task _Y_ as well as to task _X_. Flavell and Wohlwill (1969) have offered a more sophisticated explanation through the use of a competence-performance model. This model is similar to the decalage concept in that it suggests differential task performance is the result of considerable situational variance occurring during the intermediate phase of stage transitions. According to Flavell and Wohlwill, three parameters jointly determine a child's performance. The first parameter, P_a is the probability that an operation will be functional in a given child, or the degree to which a given operation has been fully established in a child. Parameter P_b is a coefficient applied to a given task or problem, which determines whether, given a functional operation, the information will be used by the child. Task difficulty, the ability to abstract relevant information, and the information load put on the child influence this parameter. The third parameter, k, represents the weight to be attached to the P_b factor in a given child.

> The assumption here is that during the period of transition from preoperational to operational thought these structures have a probabilistic character, appearing now in evidence, now absent (Flavell & Wohlwill, 1969, p. 99).

Inhelder has offered a similar explanation for cross study inconsistencies. Nevertheless, experimenters are attempting to isolate those variables which can be identified as contributing to these discrepancies (Almy, 1966; Gelman, 1969; Goldschmid, 1967; Keller & Hunter, 1973).

When all factors are considered, the equivocal and sometimes conflicting results reported in the conservation literature are more interpretable. For example, Keasey and Charles (1967) and Brison and Bereiter (1967) found that normal and retarded children of the same MA did not differ in ability to conserve substance. On the other hand, Stevenson, Hale, Klein and Miller (1968) showed that retarded children performed more poorly on volume conservation tasks than their MA matched peers. The argument that these discrepancies might be due to varying degrees of task difficulty was negated by Gruen and Vore (1972), who found that differences between normal and retarded children of the same MA were not increased.

As previously noted, the focus of this investigation is on the methodological problems inherent in the Piagetian studies involving normals and retarded, resulting from the confounding effects of MA and CA matching of groups. It is assumed that CA measures exposure to natural experiences and thus potential for vicarious learning of conservation and classification. Therefore, differences in natural life experiences, or varying lengths of exposure to real life experiences with conservation and classification-like tasks should emerge when groups are matched on MA but differ on CA. The aim of this study was to investigate the effects of exposure to natural life experiences on conservation and classification ability using four groups of subjects who vary on CA and MA. These subjects were presented with three conservation tasks: number, length, and quantity, based on the research of Goldschmid and Bentler (1968), and one classification task from Kofsky (1964). By age 6 the average child can successfully work through these tasks, thus differences between the normal and retarded groups were maximized. Gruen and Vore (1972) and Zigler (1967) previously have shown that IQ is not an accurate predictor of conservation or classification ability. Further, Lipman (1963) has noted that retarded children do poorly compared to normal children of similar MA in most experimental conditions, especially when the task involves abstract and verbal components. Significant differences on tasks where cognitive ability, as measured by MA is held constant while the length of time or the number of opportunities, as measured by CA is varied, should show the effect of experience in the development of conservation and classification ability. The differences should increase in significance when mental ability is somewhat limited and the role of experience is maximized. Therefore, conservation and classification skills should be more developed among retarded subjects who are older than their MA matched peers, and therefore have been exposed to a greater number of perceptual and natural experiences that are conservation or classification-like in nature.

On the basis of the previous discussion the following predictions were made:

1. If experience as reflected in chronological age has a measurable effect on conservation ability, then the oldest subjects in the groups matched by MA are expected to demonstrate more evidence of conservation. The MA-72, CA-192 group will perform better than the MA-72, CA-144 group, and the MA-72, CA-144 group will perform better than the MA-72, CA-72 group.

2. If experience as reflected in chronological age has a measurable effect on classification ability, then the oldest subjects in the groups matched by MA are expected to demonstrate more evidence of classification. The MA-72, CA-192 group will perform better than the MA-72, CA-144 group and the MA-72, CA-144 group will perform better than the MA-72, CA-72 group.

3. If MA is the best predictor of conservation ability, then all groups with MAs of 72 months are expected to score in the same range and also show greater conservation abilities than the group with a MA of 36 months.

4. If MA is the best predictor of classification ability, then all groups with MAs of 72 months are expected to score in the same range and also show greater classification abilities than the group with a MA of

36 months.

5. If familiarity with objects can facilitate a child's ability to understand the constructs behind the manipulation of objects, then edible test items found frequently in everyday life, such as candies and fruit drinks, will be conserved more readily than standard test items such as colored sticks, water or poker chips.

6. If familiarity with objects can facilitate a child's ability to understand the constructs behind the oragnization of objects into groups, then edible items found frequently in everyday life, such as candies and crackers, will be more readily classified than standard test items such as colored blocks.

Chapter II

Method

Subjects

The subjects in this study were 30 mentally retarded children from special education classes and 10 normal children. All subjects were selected from schools in the Metropolitan Omaha area. Subject IQs and MAs were obtained from student records. With the exception of four subjects who had WISC IQs, all students had been tested on the Stanford-Binet Intelligence Scale Form L-M within the last 18 months. The 1972 norms for the four subjects with WISC IQs were transformed to a scale with a mean of 100 and a standard deviation of 16 to agree with Stanford-Binet scores. Those children who had not been evaluated in the last 18 months were retested for this study using the Stanford-Binet. Since the normal child group did not have previous IQ scores on file, a sample of 20 first-graders was randomly selected by their respective teachers for participation in the study. Each child was given the Stanford-Binet, and the first 10 children who met the MA criterion of 72 months were selected to participate in the study.

The 30 mentally retarded children (17 males and 13 females) were divided into three groups of 10 children each, based on MA and CA.

Procedure

Each subject was individually tested on all tasks in a private room at the child's school. The pretesting conditions used by Gruen and Vore (1972) were used, with some modification. The subject was shown a variety of candy bars and small toys and asked to select one which he/she would like to have. The subject was then told that he/she could have it if they played some games with the experimenter and did a good job. The following instructions were given after which the order of tasks was randomly administered.

> Now we are going to play some games. I will ask you to do some things for me and answer some questions about them. Some of them may be easy and some may be a little harder. Do the best you can on each of them. And remember, if you do a good job, you can have the __________ you selected.

Pretest

To ascertain that all subjects had the basic concepts to make comparisons, a series of questions were asked of each subject. The necessary concepts were "more and less," "longer and shorter," "same and different," and the ability to recognize the colors red, yellow, blue and black.

Understanding of color was assessed with a card showing 4 balls of different colors; red, yellow, blue or black. The subject was asked to point to the red ball, then the black ball, the yellow ball, and finally the blue ball. Two sticks, one six inches long the other three inches long were used to see if the subjects knew the meaning of longer and shorter. The experimenter asked the subject to point to the longer stick. Next the subject was asked to point to the shorter stick. The order of these questions was counterbalanced. A card with a picture of two flower pots, one pot filled with flowers the other with just two

Table 1

Means and Standard Deviations for MA, CA, and IQ Scores of Experimental Groupings

Groups[1]	MA (in months)			CA (in months)			IQ		
	M	SD	Range	M	SD	Range	M	SD	Range
MA-36 CA-72	38.80	7.59	32-54	79.10	3.41	73-83	41.40	10.56	26-71
MA-72 CA-72	75.60	4.88	66-82	81.60	2.11	78-84	102.60	7.94	85-111
MA-72 CA-144	71.00	5.79	63-80	146.90	4.84	138-152	53.20	6.14	44-62
MA-72 CA-192	71.20	9.30	56-86	193.90	3.07	190-198	48.10	11.22	36-76

[1] n = 10 subjects in each group

flowers, was used to determine the subjects understanding of "more" and "less." The experimenter asked the subjects to point to the flower pot with more flowers. Next the experimenter asked the subjects to point to the flower pot with less flowers. A card showing a red circle and a green square, side by side, and two blue triangles side by side was used to determine the subject's understanding of same and different. The subject was asked to point to the "things which are the same." Next the subject was asked to point to "the things which are different." If a subject demonstrated that he/she lacked any of the above concepts the experimenter trained the subject on those concepts.

Conservation Tasks

Conservation of length. The test meterial for the length conservation task used two sticks (red and blue), six inches long and one-half inch on each side. First, the blue and red sticks were presented to the subject so that he/she could see that the sticks were of equal length, and that the ends for both sticks matched. The instructions given by the experimenter were: "You see these two sticks. They are both the same length. Is the red stick as long as the blue stick, or is it longer or shorter?" Then the sticks were placed parallel to each other and horizontally in front of the child. The blue stick was then moved one inch to the right and the experimenter said: "Now, is the red stick as long as the blue stick, or is it longer or shorter?" If the child gave a correct answer, the experimenter pointed out that the end of the blue stick extended further than the end of the red stick by saying, "But look where the red stick ends, the blue stick doesn't end till here. Perhaps the blue stick is longer, don't you think so?" The subject's yes or no response was recorded.

If the child answered incorrectly, the experimenter reminded him/her of how the sticks looked initially when they had been parallel to each other, e.g, "Remember that these sticks were both the same length. I moved this one over a little bit. Now is the red stick as long as the blue stick, or is it longer or shorter?" The subject's response was recorded.

In the real life task a stick of red licorice and a stick of black licorice, both equal in size, were placed parallel to each other, and in front of the child, to make sure that the subject could see that they were identical in length. The same initial instructions for the test materials were given. Then, the red licorice was moved to the left by one inch, and the experimenter asked: "Now, is the black licorice as long as the red licorice, or is it longer or shorter?" The response was recorded. If the child gave a correct answer, the experimenter pointed out that the end of the red licorice extended further than the end of the black licorice: "But look where the black licorice ends. The red licorice doesn't end till here. Perhaps the red licorice is longer, don't you think so?" The subject's yes or no response was recorded.

If an incorrect answer was given, the experimenter reminded the child how the sticks looked initially when they had been parallel to each other: "Remember that these licorice sticks were both the same length. I moved this one over a little bit. Now is the red licorice as long as the black licorice, or is one longer or shorter?" The subject's response was recorded. Presentation order of the two conservation tasks was counterbalanced.

Conservation of number. The test materials for the number conservation task began with the experimenter saying, "Watch what I do," after which the experimenter placed six red poker chips in a straight line about four inches apart. Parallel to and below the red chips, six white chips were placed in corresponding position, also in a straight line. The experimenter asked: "Are there as many red chips as white chips or are there more red chips than white chips?" If the subject said that one line had more than the other line the experimenter said: "No, look. There is one red chip for every white chip. Do you see now that there are as many red chips as white chips?" The experimenter also pointed to the chip similarity as these instructions were given. Once the child had agreed that there were an equal number of red and white chips the experimenter said, "Watch what I do." Then the experimenter left the two lines of chips in a horizontal position, one line below the other, but spread out the white chips (six inches apart), and moved the red chips closer together (two inches apart). When the arrangement was finished, the experimenter asked: "Now, are there as many red chips as white chips, or is there more of one kind?" The response was recorded. If the child gave a correct answer, the experimenter pointed to the arrangement and said: "Look how long this line is, aren't there more white chips?" The response was recorded. If the child's response was wrong, the experimenter reminded him/her of the initial equivalence: "But don't you remember before we put one red chip in front of each white one, and someone else said that there are the same number of red and white ones now, what do you think? Are there as many red chips as white chips, or is there more of one kind?" The subject's response was recorded.

The real life number conservation task made use of red and yellow M & Ms. Again the task began with the experimenter saying "Watch what I do," and placing six yellow M & Ms in a straight line about two inches apart. Parallel to and below the yellow M & Ms, six red M & Ms were placed in corresponding position, also in a straight line. The experimenter asked: "Are there as many yellow M & Ms as red M & Ms or are there more yellow M & Ms than red M & Ms?" If the subject said that one line had more than the other, the experimenter said: "No, look. There is one yellow M & M for every red M & M. Do you see now that there are as many yellow M & Ms as red M & Ms?" Once the child agreed that there were equal numbers of yellow and red M & Ms the experimenter said, "Watch what I do." Then the experimenter moved all of the M & Ms from one row into a circular bunch. When finished the experimenter asked: "Now, are there as many yellow M & Ms as red M & Ms, or is there more of one kind?" The subject's response was recorded and the experimenter began the same countersuggestion arguments used for the red and white chips. Presentation order of the number conservation tasks were counterbalanced.

Conservation of quantity. The test item for the liquid conservation task made use of two large glasses of equal size and one taller glass. The large glasses were filled with equal amounts of red colored water and placed in front of the child. The experimenter said: "See, here are two glasses both filled with the same amount of colored water. Is there as much water in this glass as in that one, or does one have more in it?"

If the subject said that one had more, the experimenter said: "Let's make them the same. See, I am pouring some water from this glass into that one. Now is there as much water in this one as in that one or does one have more?"

The experimenter continued to adjust the water levels in the two glasses until the subject said they both had the same amount. Next the water from one of the equal sized glasses was poured into the tall glass as the experimenter said: "Watch what I do. See, I am pouring the water from this glass into that one." When finished the experimenter asked: "Now, is there as much water in this one as in that one, or does one have more?" The response was recorded. If the subject gave a correct response the experimenter said: "Someone else told me that there is more here because it's taller. Do you think that child was right or wrong?" The subject's response was recorded.

If the subject gave an incorrect answer the experimenter pointed to the dimension he/she appeared to be ignoring: "But this one is narrow, while the other is wider, so is there the same amount of water in each glass?" The subject's response was recorded.

The real life conservation of quantity task made use of the same two equal sized large glasses used in the first task, and four identical smaller glasses each about a fourth the volume of the larger glasses. The large glasses were filled with four ounces of orange juice each and placed in front of the child. The experimenter said: "See, here are two glasses both filled with the same amount of orange juice. Is there as much juice in <u>this</u> glass as in <u>that</u> one, or does one have more in it?" If the subject said that one had more, the experimenter said: "Let's make them the same. See, I am pouring some juice from this glass into that one. Now, is there as much juice in <u>this</u> one as in <u>that</u> one or does one have more?" As in the first quantity conservation task, the experimenter continued to adjust the juice levels until the subject said that both glasses had the same amount of juice. Next all of the juice from one glass was poured into the four small glasses. The experimenter asked: "If you drink this juice (pointing to the large glass of juice) and I drink that juice (pointing to the four small glasses) will we both have the same amount to drink?" The subject's response was recorded. If the subject gave a correct answer, the experimenter pointed to the different levels of liquid in the five glasses. "But here (pointing to the large glass), it's higher. . .don't you think that makes more to drink than in the four?" (pointing to the four smaller glasses).

If the child gave a wrong answer the experimenter reminded him/her of the initial equal quantities. "If I pour these little glasses of juice back into the glass will there be the same amount of juice to drink as in the other one." If the child did not correctly solve this empirical return problem the experimenter actually poured the juice from the smaller glasses back into the empty large glass, allowing the child to see that the quantities in the two glasses were equal. Following this transformation, the juice was again poured into the four small glasses. The experimenter then asked: "If you drink <u>this</u> juice and I drink <u>that</u>

juice, will we both have the same amount to drink?"

Conservation task scoring. Behavior scores and countersuggestion scores were given for each task. For behavior, the child's response was scored as correct if he/she said that the two objects were the same (in amount of number, or length, etc., as appropriate). If the child indicated they were not the same (a or b had more), the response was scored as incorrect.

The countersuggestion response was scored as correct only if the subject's conservation behavior was scored as correct and if the subject resisted any countersuggestion by the experimenter. For both the behavior and countersuggestion part of a task a correct response was scored as 1, an incorrect response as 0.

Classification Tasks

As with conservation, classification ability was assessed by the use of three tasks, each of which consisted of two parts. One test for each task made use of candies or food stuffs while the second test used the more conventional materials, such as hardwood play chips. All classification tasks were based on the research of Kofsky (1964), with modification only in materials.

"Some-All." The "some-all" task, described by Kofsky (1964) deals primarily with the child's ability to understand multiple class membership. The objects used for the first test of this task were hardwood play chips. These chips had a two inch surface and were 5/16 inch in thickness. Only squares and triangles were used. Four squares and two triangles were painted blue. Three additional triangles were painted red. According to Inhelder and Piaget (1958), a superordinate class is called B, and its subclasses are A and A', A being the larger of the two subclasses. In this study the supraordinate class was all the objects painted blue (B) and contained four squares (A) and three triangles (A'). Another supraordinate class considered was all triangles (B) and contained three reds (A) and two blues (A'). Each subject had to determine whether the members of the supraordinate class (B) were all members of one subordinate class (A), and the converse, if all the As belong to B. The order of questioning was randomized among the subjects. The categories of chips were mixed so that the subdivisions were not readily apparent to the subject. First, the child was asked to find the reds, blues, triangles, and squares to determine if he/she knew the proper labels. Then the experimenter asked the following questions, recording both the child's answer and reason:

Are all the reds triangles? Why?

Are all the triangles red? Why?

Are all the squares blue? Why?

Are all the blues squares? Why?

The second "some-all" classification test was identical to the first except that the material included four red Chiclets, two red Life Savers, and three yellow Life Savers. The experimenter asked the following questions:

Are all the yellows squares? Why?

Are all the circles yellow? Why?

Are all the squares red? Why?

Are all the reds circles? Why?

"Some-all" task scoring. As in the conservation tasks, behavior and explanation scores were given. For behavior, the child must have answered "yes" or "no" correctly to three of the questions in order to be scored as correct. If the child answered less than three questions correctly the response was scored as incorrect. For explanation, the child's response was scored as correct if the behavior score was correct and if the reasons demonstrated one of the following principles:

a. Comprehension--the sum of qualities which define membership in a logical class, i.e., every red is a triangle.

b. Class extension--the sum total of objects which possess the critical qualities, i.e., every square is blue.

c. Inclusion relations--the recognition that a subclass (A) is included in class B, but does not exhaust it, i.e., some of the triangles are blue.

The explanation responses were scored as incorrect if the child's classification behavior was scored as incorrect or if his/her answer did not conform to the above principles. A correct response was scored 1, an incorrect response was scored 0.

Resemblance sorting. Four patterns of 8-10 blocks were placed in front of the subject. The experimenter pointed to one of the blocks that was part of the design and said: "Find me another block like this. Choose from these two." The choice consisted of a second block which was taken from the pattern but did not resemble the first in color or shape, and a third block which was either the same color or shape as the first. The third block was not one of those used to construct the pattern. Each subject was to point to his/her choice and to explain his/her reason for making it. The four block design and the block choices for each design can be seen in Figure 1. A successful sorter must have made three correct matches on the basis of form, color, or some perceptual property.

The second resemblance sorting task was identical to the first except that a number of crackers of varying shape, and color were used. Figure 2 shows the four patterns and choices which were used. Again a successful sorter must have made three correct matches to obtain a score of 1. Failure to match three or more figures resulted in a score of 0.

Hierarchical classification. Four red triangles and three blue triangles were placed in two parallel rows in front of the child. Each row contained both reds and blues. As in Kofsky (1964), the experimenter said:

> All of these are called MEFs (pointing to each), but only some are TOVs. What are MEFs? Which are TOVs?

The child was to point to the MEFs and TOVs and explain his/her actions.

To classify correctly, the child had to define MEFs in terms of some attribute shared by all the members of the group (such as "triangle"). TOVs were defined by an attribute shared by one part of the group but not the entire group (such as "blue"). If the child was unable to do this he was given a score of 0. A score of 1 was given for a correct response.

The second hierarchical classification task used cherry and chocolate

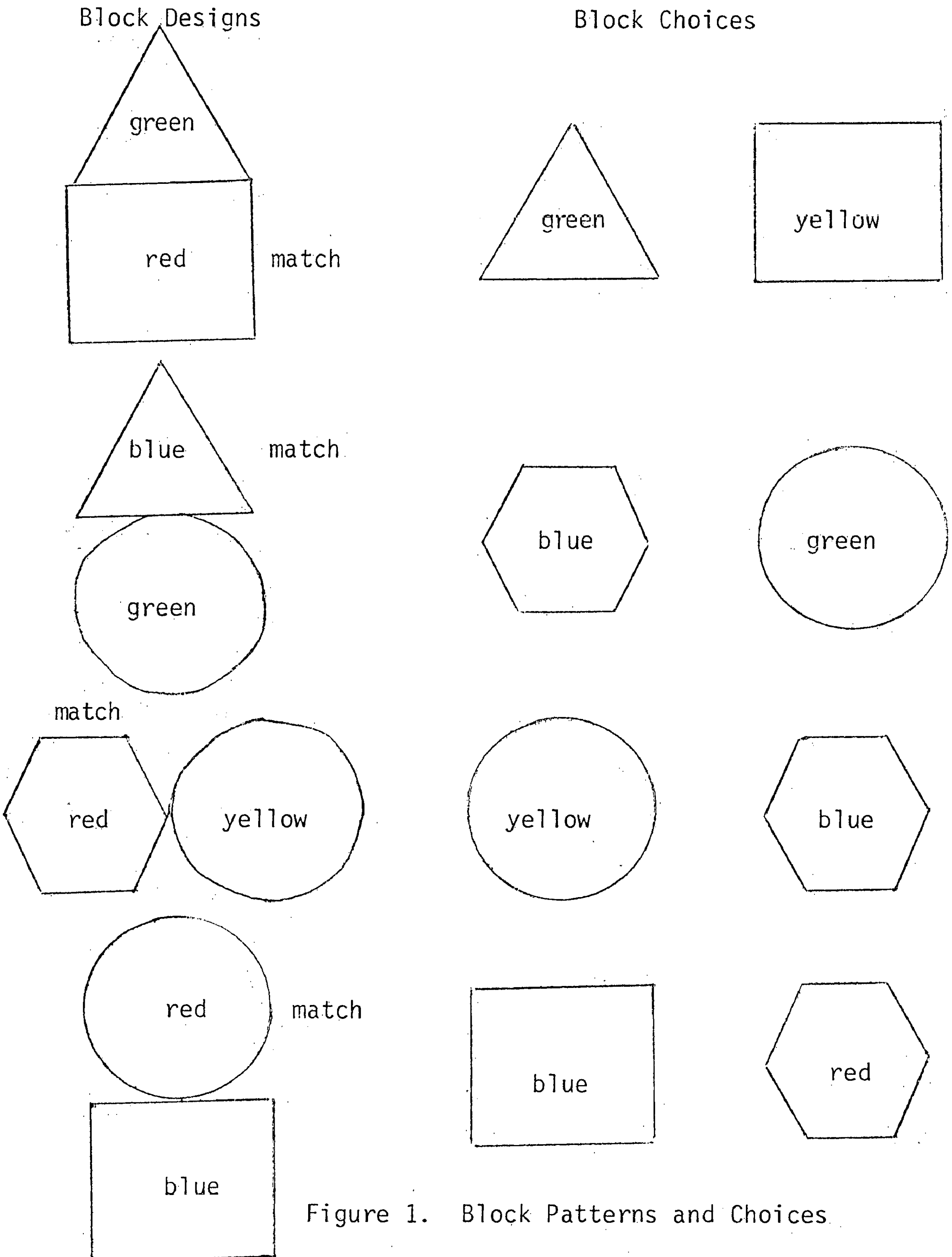

Figure 1. Block Patterns and Choices for the Resemblance Sorting Tasks, using Wooden Blocks.

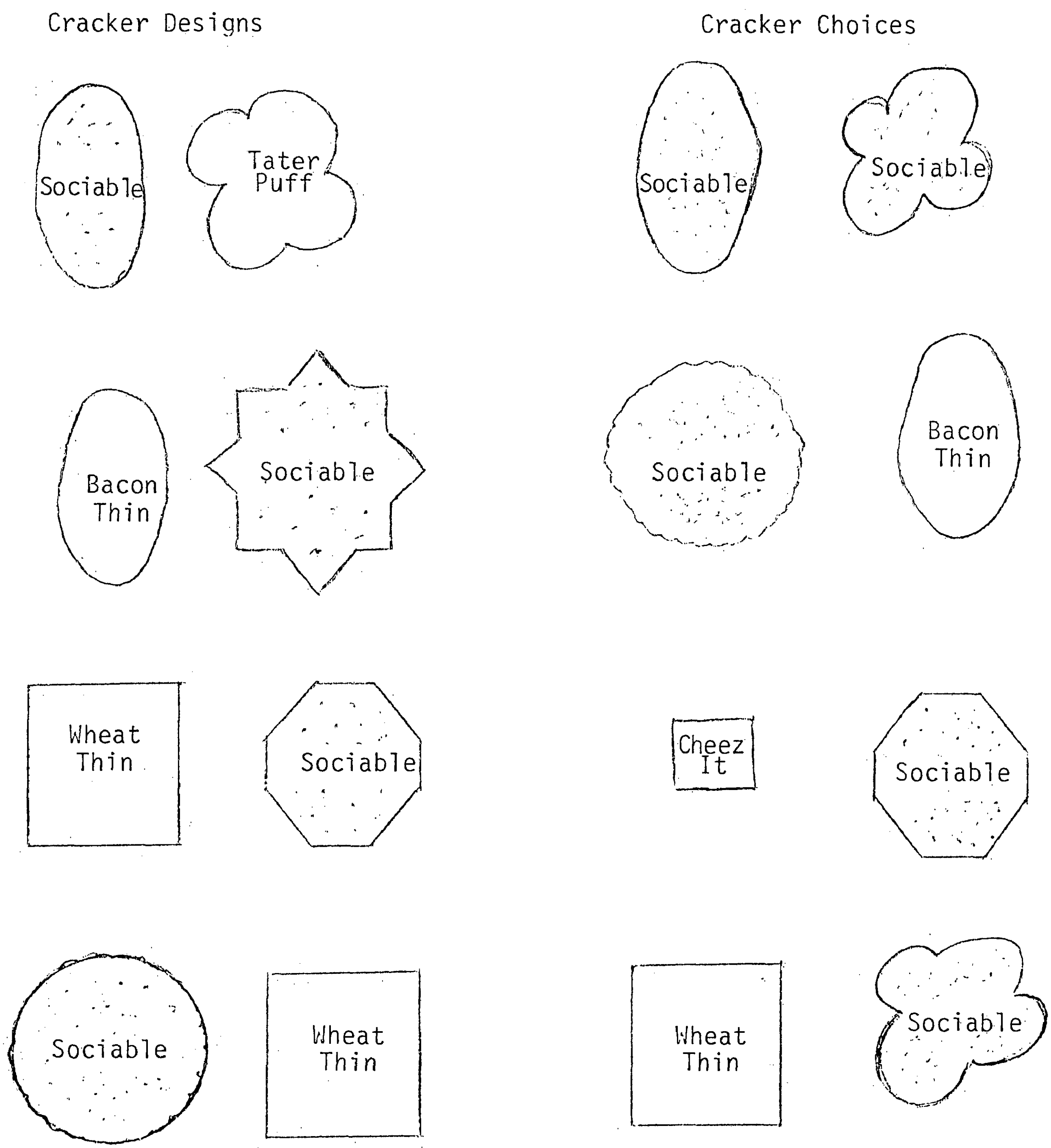

Figure 2. Cracker Patterns and Choices

for the Resemblance Sorting Tasks

Tootsie Roll Pop Drops. The task and scoring was identical except that the experimenter said:

All of these are NIVs, but only some are called SAFs.

What are NIVs? Which are SAFs?

Hierarchical sorting. The child was presented with the following objects: two green wooden triangles, one red wooden triangle, two yellow wooden circles, one red wooden circle, two blue wooden squares, one green wooden square, two red Tootsie Roll Pop Drops, one green Tootsie Roll Pop Drop, two white Chiclets, one yellow Chiclet, two yellow pieces of candy corn, two brown pieces of candy corn. The child was then asked to "put the things together that belong together."

A color photograph of the arrangement made by the child was taken by the experimenter. For this task no score was given. The final arrangement was evaluated on whether or not the child approached the problem through one of four distinct classification approaches. The first kind of arrangement, graphic collections, are generally found in younger children and are characterized by the lack of any coherent classification system. Some children may make a row of objects in which the first few are alike, then at some point the color may hold constant, but the shapes change. It is also possible that some children might arrange the objects in some kind of a geometrical form. The second kind of arrangement, non-graphic collections, occur later in the child's life and is a transition stage between the notion of a collective object, in which the elements are parts, and the notion is of a class, in which the elements are members. Although the child does not arrange the objects in patterns, he/she will continue to place them in geometric proximity. The objects are collections in the sense that they are put together, but they are not collections in the sense that they are arranged to have a particular total shape. Generally the non-graphic arrangements include a number of small collections, each based on a different criterion, together with an unclassified, heterogeneous residual.

The next and developmentally more advanced type of arrangement is characterized by a variety of shapes and materials being put together into a single class, based on one element, (i.e., color), without any attempt to arrange the objects in a hierarchical classification. One criterion may be used throughout to make the sub-division into classes.

The final and most developed approach to classification consists of a hierarchical arrangement in which the various criterion are used to subdivide larger classes. In this task the child might arrange objects on the basis of rectilinear forms with squares and triangles separated.

Chapter III

Results

Mental age and IQ appear to be the best predictors of performance for both conservation and classification. Chronological age was not a significant factor in conservation ability and it influenced only performance on the standard test item tasks and resemblance sorting tasks in classification. Only two subjects, a normal child and a 16 year old retarded child conserved on all tasks. A total of 29 subjects did not receive a passing score on any conservation task. When the resistance to countersuggestion criterion was dropped, subjects received passing score on 27% more tasks. For two groups (the normal group and the 12 year old MR group), agreement with the experimenter was influenced by the materials in use. That is, the subjects were less likely to agree with the experimenter's countersuggestion when real life items were used. In general, conservation was more evident for real life items than standard test items.

A passing conservation score was given only if the child could perform the conservation task and resist the countersuggestion of the experimenter. The number of times each experimental group solved given tasks within a subtest was divided by the total number of tasks presented in the subtest and multiplied by 100 to determine the averaged percentage score on conservation for each group.

A 4 x 2 unequal n, unweighted means analysis of variance was performed on the total classification score and the subscores for real life and standard test items to assess differences between the four experimental groups. Because differences were hypothesized between MA-CA groups, mean comparisons were made with the Scheffé procedure. Binomial comparisons were used to determine differences between groups on levels of hierarchical sorting.

Pearson and point biserial correlational analyses were used to examine the relationships between the subject variables of MA, CA, IQ, and conservation, and classification scores. A Pearson correlational analysis was also performed on conservation and classification subscores.

Conservation-Correlations of Subject and Task Variables

Table 2 presents the correlational values between the subject variables of MA, CA, IQ, and conservation scores. Both MA and IQ were significantly correlated with subscores for standard test and real life items, as well as the total conservation score.

Total Score-Conservation

The total conservation score was obtained by summing the scores on the six individual conservation tasks. Since each task received a score of 0 or 1, the range for total conservation score was 0 to 6. Table 3 shows the number of subjects at each score increment. The normal group (MA-72, CA-72) and the 16 year old group had the greatest range of scores. None of the subjects in the MA-36, CA-72 group were able to obtain passing scores. The only MR group which had one or more children with passing scores on more than two tasks was the MA-72, CA-192 group.

Subscore-Conservation of Test Items

This score represents the subject's conservation and subsequent

Table 2

Correlations for Subject Variables and Conservation Task Scores[a]

	Test Items				Real Life Items				Total
	Length	Number	Liquid	Total	Length	Number	Liquid	Total	Score
MA	.23	.23	.11	.34*	.18	.31*	.39	.44*	.42*
CA	.07	-.34*	-.14	-.02	-.14	-.38*	-.17	-.14	-.10
IQ	.09	.60**	.29*	.34*	.25	.70**	.43	.55**	.48**

[a]Correlations for subscores and total score are Pearson correlations. Correlations for individual conservation tasks are point biserial correlations.

*$p < .05$

**$p < .001$

Table 3

Frequency of Subjects at Each of Four Scores on Total Conservation[a]

MA-CA Grouping	Conservation Score			
	0	1-2	3-4	5-6
MA-36 CA-72	10	0	0	0
MA-72 CA-72	3	4	2	1
MA-72 CA-144	8	2	0	0
MA-72 CA-192	8	1	0	1

[a] n = 10 subjects in each MA, CA group

explanation on standard test items. Conservation performance denotes the subject's ability to give a correct conservation response. The explanation score was the subject's response to the countersuggestion argument. To earn a passing conservation score the subject had to give a correct conservation response and resist countersuggestion. Table 4 shows the percentages of standard test conservation tasks successfully or unsuccessfully passed with or without resistance to countersuggestion.

Subscore-Conservation of Real Life Items

Table 5 shows the percentages of real life items tasks on which subjects were able to unable to conserve and resist countersuggestion. Table 6 presents the percentages of subjects falling into each response category for the six standard test and real life conservation tasks. The sequence of tasks from least frequently solved to most frequently solved was: length conservation of real life items and liquid conservation of standard test items, where an average of 5% of the subjects met the conservation criteria; length conservation of standard test items (7.5%); number conservation of standard test items (15%); conservation of number with real life items (17.5%); and conservation of liquid for real life items (25%). Real life tasks concerned with number and liquid were successfully completed more often than the same task using standard test items.

Classification-Correlation of Subject and Task Variables

A Pearson correlational analysis was used to determine the relationships between subject variables, classification subscores and total score. A point biserial correlational analysis was performed on the

Table 4

Average Percent of Subjects in Each Score Category for Subscore Conservation on Test Items[a]

MA-CA Grouping	Conservation Score Category[b] No Conserve No Resist CS	No Conserve Resist CS	Conserve No Resist CS	Conserve Resist CS
MA-36 CA-72	83.33	13.33	3.33	0.00
MA-72 CA-72	50.00	16.66	10.00	23.33
MA-72 CA-144	66.66	26.66	6.66	0.00
MA-72 CA-192	63.33	16.66	6.66	13.33

[a] n = 10 subjects in each MA, CA group

[b] Conserve refers to subject's response to questions regarding physical change in the material. Resist CS refers to subject's response to countersuggestion.

Table 5

Average Percent of Subjects in Each Score Category for Subscore Conservation of Real Life Items[a]

MA-CA Grouping	Conservation Score Category[b] No Conserve No Resist CS	No Conserve Resist CS	Conserve No Resist CS	Conserve Resist CS
MA-36 CA-72	80.00	13.33	6.66	0.00
MA-72 CA-72	36.66	16.66	3.33	43.33
MA-72 CA-144	30.00	33.33	6.66	30.00
MA-72 CA-192	56.66	20.00	10.00	13.33

[a] n = 10 subjects in each MA, CA group

[b] Conserve refers to subject's response to questions regarding physical change in the material. Resist CS refers to subject's response to countersuggestion.

Table 6

Percentage of Subjects in Each Score Category for Length, Number and Liquid Conservation Tasks[a, b]

MA-CA	Test Items												Real Life Items											
	Length				Number				Liquid				Length				Number				Liquid			
Groupings	NC NR	NC R	C NR	C R	NC NR	NC R	C NR	C R	NC NR	NC R	C NR	C R	NC NR	NC R	C NR	C R	NC NR	NC R	C NR	C R	NC NR	NC R	C NR	C R
MA-36 CA-72	90	0	10	0	90	10	0	0	70	30	0	0	90	10	0	0	80	20	0	0	70	10	20	0
MA-72 CA-72	60	20	10	0	40	0	10	50	50	30	10	10	70	20	0	10	10	30	0	60	30	0	10	60
MA-72 CA-144	80	20	0	0	70	20	10	0	50	40	10	0	70	10	20	0	60	30	10	0	20	50	10	20
MA-72 CA-192	70	0	10	20	60	20	10	10	60	30	0	10	90	0	0	10	70	10	10	10	10	50	20	20

[a] n = 10 subjects in each MA, CA group

[b] The notation system used for the score categories for each conservation test is as follows:
NC-NR = no conserve, no resist countersuggestion C-NR = conserve, no resist countersuggestion
NC-R = no conserve, resist countersuggestion C-R = conserve, resist countersuggestion

subject variables and the subject scores on specific classification tasks. These correlations appear in Table 7.

Mental age was correlated with the total classification score, while IQ was correlated with both total classification score and the subscore on real life items. Chronological age, on the other hand, was correlated with the subscore for standard test items. Significant individual task correlations with IQ were found only on the "some-all" tasks using standard test and real life items.

Total Score-Classification

A 4(MA-CA group) x 2(Sex) unequal n, unweighted means analysis of variance revealed a significant difference between MA-CA groups. The analysis of variance summary appears in Table 8. Mean scores and standard deviations for males and females on classification total scores and subscores are shown in Table 9. Sex differences and interaction effects between sex and MA-CA groupings were not significant. Comparisons using the Scheffé procedure showed that only the MA-36, CA-72 and the MA-72, CA-72 groups were significantly different from each other.

Subscore-Classification of Test Items

The 4 x 2 unequal n, unweighted means analysis of variance for standard test items did not reveal a significant difference between MA-CA groups. The analysis of variance summary appears Table 10. Because differences were hypothesized between MA-CA groups, mean comparisons were made with the Scheffé procedure. None of the differences between MA-CA groups were significant. Sex differences and interaction effects between sex and MA-CA groups were not significant.

Table 7

Correlations for Subject Variables and Classification Task Scores[a]

	Test Items				Real Life Items				Total Score
	S-A	RS	HC	Total	S-A	RS	HS	Total	
MA	.41*	.17	--	.45*	.41*	.31*	.09	.53**	.57**
CA	.05	.30*	--	.31	-.26	.11	-.06	-.03	.16
IQ	.40*	-.13	--	.14	.58**	.14	.17	.52**	.38*

[a] Correlations for subscores and total score are Pearson correlations. Correlations for individual classification tasks are point biserial correlations.

*$p < .05$

**$p < .001$

The notation system used for the conservation test is as follows:

S-A = Some-All

RS = Resemblance Sorting

HC = Hierarchical Classification

HS = Hierarchical Sorting

Table 8

Analysis of Variance Summary Table for

Total Score--Classification

Source	df	MS	F
Sex	1	0.199	0.15
MA-CA Group	3	6.310	4.69*
Sex x MA-CA Group	3	2.122	1.58
Error	32	1.345	

*$p < .01$

Table 9

Means and Standard Deviations for Classification Subscores and Total Classification Scores for the Four MA-CA Groups

MA-CA Groups	Total Class. Scores				Subscore Stan. Test Items				Subscore Real Life Items			
	Males		Females		Males		Females		Males		Females	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
MA-36 CA-72	1.00	1.09	1.33	1.53	.50	.55	.33	.58	.50	.55	1.00	1.00
MA-72 CA-72	3.40	.89	2.67	1.50	1.40	.55	1.00	.89	2.00	.71	1.67	.82
MA-72 CA-144	2.60	1.14	2.80	.84	1.20	.84	1.00	.71	1.40	.55	1.80	.45
MA-72 CA-192	2.29	1.25	3.00	1.00	1.29	.76	1.67	.58	1.00	.58	1.33	.58

Table 10

Analysis of Variance Summary Table for Subscore

Classification of Test Items

Source	df	MS	F
Sex	1	0.042	0.08
MA-CA Group	3	1.444	2.74
Sex x MA-CA Group	3	0.582	1.11
Error	32	0.526	

Subscore-Classification of Real Life Items

The 4 x 2 unequal n unweighted means analysis of variance performed on the classification task involving real life items indicated significant differences between the four MA-CA groups. The analysis of variance summary appears in Table 11. The Scheffé analysis of means differences indicated that the MA-72, CA-72 group scored significantly higher than the MA-36, CA-72 group. All other group comparisons were nonsignificant. Sex differences and interaction effects between sex and MA-CA groups were not significant.

"Some-All," Resemblance Sorting, and Hierarchical Classification Tasks

The number of subjects successfully completing all classification tasks are shown in Table 12. Binomial analyses were used to make pair comparisons between MA-CA groups. More normal 6 year olds than MA-36, CA-72 subjects solved the problems successfully on the standard test items ($p < .02$). On the real life tasks more MA-72, CA-72 subjects were able to solve the problems than MA-36, CA-72 or MA-72, CA-192 subjects ($ps < .05$), but more MA-72, CA-144 than MA-72, CA-192 subjects could solve the "some-all" real life problem ($p < .05$). MA-CA groups did not differ significantly on ability to successfully complete the resemblance sorting tasks using either the standard test items or real life items. No differences were found between groups on the hierarchical classification tasks using standard test or real life items.

Hierarchical Sorting

Table 13 shows the number of subjects at each developmental level of hierarchical sorting for each MA-CA group. Binomial comparisons

Table 11

Analysis of Variance Summary Table for Subscore

Classification of Real Life Items

Source	df	MS	F
Sex	1	0.422	1.14
MA-CA Group	3	2.584	6.95*
Sex x MA-CA Group	3	0.664	1.79
Error	32	0.372	

*$p < .01$

Table 12

Number of Subjects Who Successfully Completed

Some-All, Resemblance Sorting and Hierarchical Classification Tasks[a]

MA-CA	Some-All		Resemblance Sorting		Hierarchical Classification	
Groups	Test Items	Real Life Items	Test Items	Real Life Items	Test Items	Real Life Items
MA-36 CA-72	0	1	5	6	0	0
MA-72 CA-72	7	9	5	9	0	1
MA-72 CA-144	3	6	8	9	0	1
MA-72 CA-192	4	1	8	8	0	0

[a] n = 10 subjects in each MA, CA group.

Table 13

Number of Subjects at Each of the Four Developmental Stages of Hierarchical Sorting[a]

MA-CA Groups	Stage One	Stage Two	Stage Three	Stage Four
MA-36 CA-72	4	6	0	0
MA-72 CA-72	0	0	9	1
MA-72 CA-144	3	1	5	1
MA-72 CA-192	1	4	2	3

[a] n = 10 subjects in each MA, CA group.

between groups at stage 1 were nonsignificant. The binomial comparisons at stage 2 showed significantly more MA-36, CA-72 subjects at stage 2 than MA-72, CA-72 subjects ($p < .02$), or MA-72, CA-144 subjects ($p < .07$), but not the MA-72, CA-192 group ($p > .10$). The stage 3 binomial comparisons showed significantly more MA-72, CA-72 subjects at this stage than MA-36, CA-72 subjects ($p < .002$) or MA-72, CA-192 subjects ($p < .04$), and more MA-72, CA-144 subjects at stage 3 than MA-36, CA-72 subjects ($p < .03$). All binomial comparisons at stage 4 were nonsignificant.

Correlations of Conservation and Classification Scores

A Pearson correlational analysis was performed between conservation and classification subscores. Table 14 shows that the highest correlations were found between subscores for the same areas.

Table 14

Correlations of Conservation and Classification Scores

	Conservation Real Life Items	Classification Test Items	Classification Real Life Items
Conservation Test Items	.75**	.20	.30*
Conservation Real Life Items		.26*	.36*
Classification Test Items			.52**

*$p < .05$

**$p < .001$

Chapter IV

Discussion

The hypothesis that experience, as reflected in CA, has a measurable effect on conservation ability was not supported. Although one of the 16 year old retarded subjects obtained a passing score on all conservation tasks, he was the only retarded child to do so. Normal six year olds were much more proficient at demonstrating conservation ability, although they were among the youngest in the study. Similarly, the hypothesis that CA has a measurable effect on classification performance was not supported. The only significant differences on classification were between the groups matched on CA (MA-36, CA-72 and MA-72, CA-72 groups).

The hypothesis that MA is the best predictor of conservation ability is supported by the higher correlations between MA and conservation scores. The three MA matched groups did not differ significantly from each other, but the MA-72, CA-72 group did differ significantly from the MA-36, CA-72 group. The hypothesis that MA is the best predictor of classification ability is also supported. In addition to significant correlations between MA and the total classification score, there were no significant differences between MA matched groups for the total classification subscores.

Although the MA prediction hypotheses were upheld, the obvious superiority of the normal group over the remaining MA matched groups indicates that the MA measure allows for a broad range of skill levels.

Mental age, as determined by the Stanford-Binet, is based on a child's performance on a series of tasks which are age graded. Identical MAs do not necessarily mean a child has answered the same test items correctly. It is possible for one child to have based out at 60 months, but have passed subsequent subtests to achieve a final MA of 72 months. Another child might have based out at 72 months but not be able to pass subsequent subtests. Consequently one could assume a basic difference in operational ability between these two children. Given these considerations it is not surprising that the various studies dealing with the role of MA show conflicting results. This problem is further compounded when different MA measures are used, such as the Peabody Picture Vocabulary Test (Keasey & Charles, 1967).

The proposition that differences exist in operational ability between retarded and normal children with a common schema foundation was put forth by Inhelder (1968). One trait common to retarded and normal children is that the retarded child's perceptions and abilities to act appropriately on cognitive tasks is controlled and influenced by the same egocentricism which dominates the thinking of the normal child between the ages of 4 and 7.

> The assimilation of intuitive and experimental facts typical of these retardates is governed by what has been noticed previously as a dominant trait of the method of induction in normal children below seven years of age. Instead of submitting to experimental observation, the retardate of this level, just like the young child, deforms reality through the

> use of previously established schemas of prediction, and remains thus impermeable to what it can teach him.
>
> (Inhelder, 1968, p. 285)

Therefore, one could argue that the 16 year olds who had been functioning in this manner four years longer than the 12 year olds are relying on more distorted and invalid schemas which would decrease performance scores and suggest a decay effect.

The hypothesis that familiarity with objects can facilitate a child's ability to understand the constructs behind the manipulation of objects is supported by the results. Tables 4 and 5 provide some support for the assumption that the use of real life items can aide the child's ability to understand conservation. Although there was not apparent change for two of the retarded groups (MA-36, CA-72; MA-72, CA-192), conservation did increase on real life items for the normal group (from 20.33% to 43.33%) and the MA-72, CA-144 group (0% to 30%). In addition, these two groups showed a greater resistance to countersuggestion with real life items. The normal group was able to resist countersuggestion on 20% more tasks, and the MA-72, CA-144 group resisted countersuggestion on 34% more tasks, indicating that the subjects had a greater confidence in their judgments. Further support for the hypothesis that performance would improve on real life items appears when the subject's initial responses (conserving or nonconserving) are compared without the resistance to countersuggestion criteria. All groups showed dramatic improvement in initial conservation responses when real life items were used. The percentage of correct conservation responses in the MA-36, CA-72 group on real life items (6.66%) increased 3.33% over responses on standard test items. Correspondingly, the average percentage of correct responses by the MA-72, CA-72 group increased from 30.33% to 46.66%, the MA-72, CA-144 group increased their correct responses from 6.66% to 36.66%, and the average percentage of the initially correct responses of the MA-72, CA-192 group increased from 19% to 23.33%. Similar results were found when the conservation criteria were used as the basis for comparison. Although the percentages of correct responses for groups MA-36, CA-72 and MA-72, CA-192 were identical on both test and real life tasks, groups MA-72, CA-72 and MA-72, CA-144 showed considerable improvement on tasks using real life objects.

The hypothesis that familiarity with objects can facilitate a child's ability to understand the constructs behind classification is also supported by the results. With the exception of the MA-72, CA-192 group, all groups performed more accurately with real life items than with standard test items.

Whenever mentally retarded subjects are involved in studies such as this, suggestibility is always an issue of concern. The conservation criteria, being both the demonstration of a skill and proof of the skill by resistance to countersuggestion provides some insight into subject suggestibility. The percentage of tasks on which subjects were unable to resist countersuggestion can be seen in Tables 4 and 5. On standard test items overall suggestibility was very high. The normal group was influenced by the experimenter on 60% of the tasks and the MA-36, CA-72 group followed the experimenter's suggestion on 86.66% of the tasks.

Although there was no difference in suggestibility for the MA-36, CA-72 and MA-72, CA-192 groups between standard test and real life items, some improvement was seen for the remaining two groups. The normal group was able to resist countersuggestion on 20% more tasks, and the MA-72, CA-144 group resisted countersuggestion on 34% more tasks when real life items were used. Overall the normal group and the MA-72, CA-144 group were least likely to agree with the experimenter's suggestion.

By systematically manipulating MA and CA, this study attempted to sort out the confounding effects inherent in the MA-CA paradigm of previous studies. In support of such authors as Keasey and Charles (1967) and Gruen and Vore (1972), the results indicated that MA is the best predictor of conservation and classification ability. On the other hand, CA, as a measure of repeated conservation and classification experiences, cannot be considered a reliable indicator of either conservation or classification ability. These results are consistent with the work of Brainerd and Allen (1961) and others in that children could be taught conservation skills before they would have developed them naturally, but that without adequate MA these skills did not generalize and were not retained.

While repeated exposure to conservation and classification-like tasks, as measured by CA, could not account for greater conservation or classification ability, familiar objects appear to be more successfully manipulated than classroom-like objects. The fact that the "familiar" objects also happened to be food stuffs added to the saliency of the real life tasks, otherwise we might have seen progressively better performance in the 12- and 16-year-olds with 7 to 11 years of experience with classroom-like objects. This finding is consistent with Flavell and Wohlwill's (1969) competence-performance model in that the use of a possibly more meaningful object (_K_) will influence the probability of a child using an established operation ($\underline{P}_b$).

Although Piaget's concept of horizontal decalage is accepted by many as an adequate explanation for inconsistencies between studies, it is obvious that other variables need to be examined. Control or measurement of individual subject differences, especially with retarded children who can vary dramatically in alertness, language comprehension, drug interference, success/failure histories, etc., need standardization. The effects of varied educational and institutionalization experiences also need attention. Finally, Piagetian enthusiasts must be more concerned about their experimental designs to avoid conflicting and erroneous interpretations.

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