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Learning to classify by color and by class.: a crosscultural study of concept discovery.

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LEARNING TO CLASSIFY BY COLOR AND BY CLASS: A CROSS-CULTURAL STUDY OF CONCEPT DISCOVERY

A Dissertation Presented

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To David, whose love and

support helped to make

this document a reality.

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Learning to Classify by Color and by Class:

A Cross-Cultural Study of Concept Discovery

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In a cross-cultural study of classification behavior the Evans-Segall Concept Discovery Task was administered to 365 Ugandan and 331 Colombian subjects. The study was designed to ascertain the ease with which perceptual and abstract bases for equivalence could be utilized by individuals from different cultural, age, school and degree of urbanization groups. In both cultures children in grades one, three and five were tested in schools representing different degrees of urbanization. In Africa three schools were included representing the urban, semi-urban, and rural populations. Children in Colombia were also sampled along the urban/rural continuum. However, since there were noticeable socio-economic differences between the schools in the urban setting, the Colombian sample consisted of four school types: urban upper class, urban lower class, semi-urban and rural. In Uganda, unschooled children and adults were also included in the study.

The results clearly indicate that the classification process is basically the same within the Ugandan and Colombian school populations sampled. The school-going children use perceptual cues

(e.g., color) as the basis of equivalency without difficulty, and the ease with which they are able to use the abstract class criteria is dependent upon their grade in school (rather than age) and, to some extent, whether the child lives in an urban or more rural environment. In addition, the results indicate that the experiential factors associated with school attendance play a significant role in children's ability to utilize the abstract class groups as employed in the task. Unschooled children and adults with little or no schooling learned color equivalence with ease, but they were unable to learn the abstract class aspect of the task. The results from the unschooled sample suggest that the systems of classification as developed and utilized by a culture may be quite different.

CHAPTER I

INTRODUCTION TO THE PROBLEM

> The discursive operations of our rational thought... require the existence and the employment of much that is intricate, in the form of categories, concepts, and abstract terms....They imply an ensemble of conditions which we do not find existing anywhere in social aggregates of a primitive type.
>
> Lévy-Bruhl, 1926, p. 105

Thus spoke one of the first men who attempted to understand the thought processes of non-European peoples. Lévy-Bruhl was a philosopher interested in understanding the philosophical bases within various cultures. However, he was never able to step out of his own world view in order to understand why or how it could be possible for other belief systems to be valid and at the same developmental level as a Western conceptual approach to the world. As a result, he reasoned that Western European man was at the high end of a cultural developmental continuum; all those who do not think in the same way as Western man are at some lower level of development. From this ethnocentric point of view began an interest in comparing peoples from different cultural groups.

The interest in studying different phenomenon in various cultures has persisted. Today all aspects of life are being studied and comparisons made cross-culturally, from economic development, to social organization, to psychological growth and development, to an understanding of comparative educational systems. While

studies in the mid 50s and early 60s were generally focussed on only one dimension within a culture, such as general level of economic development (Harbison & Myers, 1964), more recent studies have taken a cross-disciplinary approach in order to understand how the various dimensions interact with one another and provide an understanding of the total culture (Cole, Gay, Glick & Sharp, 1971).

During the 1960s, cross-cultural studies were administered in Africa. Essentially they were completed in an attempt to relate cognitive development in the United States and Western Europe to comparable development in other cultures (see Chapter II). In most instances the procedures for gathering and analyzing data were derived from tasks originally developed in the Euro-American cultures and revised for usage in Africa. The research included in this report is based on a task developed in Uganda to be utilized in that culture (the Evans-Segall Concept Discovery Task). Based on the results from the African study it was seen as important to further explore the variables of urbanization, schooling and age as found within another culture. Thus the Evans-Segall Task was administered in Colombia, South America. While the focus of this report is on the use of the task in Colombia, the results from Africa are also included so that comparisons can be made where appropriate.

The Evans-Segall Concept Discovery Task (E-SCDT) is one which attempts to ascertain children's ability to use two different bases for creating groups said to be "alike." In essence the task was developed because of an interest in understanding the classification process within various cultures. However, before discussing how the E-SCDT was developed, it is important to define what is meant by classification and then to summarize current theories relating to the development of the classification process. Thus this chapter is devoted to reviewing and comparing various theoretical approaches to classification behavior. The points of agreement and disagreement among the theories provide the base for the hypotheses to be tested in this study.

Classification

People operate in an increasingly complex world of objects, events and ideas, and, for the most part, their operations are understood by others. This understanding is possible because man has organized the world into defined concepts or equivalence groups. For example, individuals within a given cultural group agree on the majority of objects to be included in a class labelled "food" or "clothing." In order to arrive at such an agreement, or to differentiate classes, an individual must be able to abstract a quality from its existence in material objects and group those objects which have similar qualities. It is through the formal and informal education process within the culture that an individual learns which

qualities delineate a given equivalence group. This delineation begins at birth.

A baby's reliance on his senses to provide him with the feedback necessary to grasp how his world is put together is obvious to those who have observed the way in which the child uses his hands, eyes, mouth, nose and ears to learn about the world around him. As the baby gains a sense that objects are not just an extension of his own body and that they have a permanence of their own, he forms mental images which can then be manipulated internally. The child no longer has to rely on the presence of an external stimulus in order to think about the object. Soon there become many such images that must be dealt with, and the child begins to sort the objects into groups. This grouping of objects facilitates identification and manipulation; the child can associate the object with a set of known objects and has some idea of how to handle it based on what he already knows about other members of the set. What is of interest is the type of criteria that children use to assign an object to a group.

It appears that the criteria the child uses to create groups changes. At a given point in time a child may rely heavily on perceptual cues--color, form or size--to differentiate objects from one another and integrate them into groups. In other instances he sees things as equivalent that share a common function or are used together. "A hammer is used to hit the nail." Other children are able to label a group of elements with one word that takes into account the

inherent characteristics of the objects. Examples of such class labels are: toys, tools, and animals.

It may be that since the child begins to learn about his world through his senses, his initial grouping of objects will be based on their external, perceptual attributes. It is only as the child learns more about the objects and sees ways in which others in his environment have chosen to group them together that he begins to learn that there are other than perceptual criteria for equivalence. Researchers are interested in defining the variables within the child and his environment which influence the way a child creates equivalence groups. In the following section of this chapter three important contemporary theoretical constructs relating to classification behavior are presented and discussed.

Theoretical Constructs Describing Classification Behavior

A delineation of the classification process is provided through the works of Piaget, Bruner, and Sigel and their associates. Inhelder & Piaget (1964) have explored the development of classification skills and suggest that there are a series of sequential stages which characterize a child's organization of his world. While these stages are thought to be basically universal in their unfolding, Inhelder & Piaget believe that the delineation of concepts is dependent upon an interaction between the individual and his environment--physical and social--for development at the highest level.

Also postulating a developmental stage theory of equivalence grouping are Bruner and his associates (1966). As compared to Inhelder and Piaget, Bruner et al. spend less time delineating specific stages and put more emphasis on discovering the variables which affect classification behavior. Analyzing the results of cross-cultural research which they feel provides data on the universality of a stage theory of equivalence grouping, Bruner and his associates suggest that cultural factors affect the termination point of equivalence grouping, with some people never reaching the highest stage. They conclude that in any society the behaviors involved in equivalence grouping are learned and that the type of behavior which emerges may be specific to only a given culture.

A third emphasis in the study of classification behavior is provided by Irving Sigel, who, rather than being concerned with developmental patterns of classification, has been looking at individual preferences within concept sorting tasks. While some preferences seem to be associated with age, there are a number of other variables which Sigel has found to relate to the way people group objects in their world. For example, personality traits, sex, race (Negroid & Caucasian), and socio-economic status all appear to correlate with classification preferences.

To understand where these theories overlap and where legitimate differences in interpretation exist, it is necessary to discuss these approaches in greater depth. In each instance the tasks used by the researchers are described and the authors' interpretation of subject responses are reported.

A Developmental Stage Approach: Piaget & Inhelder

In their attempt to understand the classification process, Inhelder and Piaget (1964) give children (ages 3-11) a selection of toys, including representations of people, animals, plants, buildings and vehicles. The Subject is asked, "What could we put together so that they are alike?" A typical six-year-old might respond, "All the gentlemen, all the cars...I am going to put the houses in another lot (the church doesn't go there because it isn't a house), then we can have flowers, trees, prams, animals." As the child works he may keep birds separate from animals and children excluded from groups of adults. When the child has completed his small groups the experimenter encourages him to create larger groups from the small ones he has delineated. The child puts together adults and children and calls them "people," then "chickens with animals, 'because chickens are also animals,' then fir-trees with trees, to which he adds flowers, 'because a tree is also a thing like the flowers...plants which grow'." (Inhelder & Piaget, 1964, p. 57)

Thus the initial task used by Inhelder and Piaget involved asking children to "put together the things which were alike" from among a number of geometric elements varying in color, size and shape, and to perform a similar task with commonly known objects. After completing the sorting task children are asked to specify reasons for their grouping. The results of these interviews suggest to the researchers that an individual goes through three basic

stages in the ordering of his world. In order to understand the differentiation of these stages it is necessary to define two basic terms: intension and extension. The coordination of intension and extension serves as a focal point in the discussion of each stage.

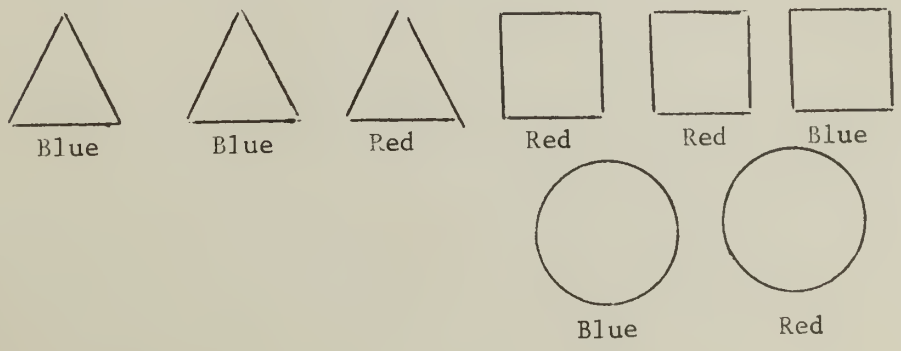
The intension of a class is the set of characteristics common to all members of the class as well as the set of differences which distinguish members of the class from other elements. In other words, intension occurs when an individual looks for similarities or differences among the elements and uses these to determine equivalence. Beginning with the exemplars, the child works to build a class. Intension implies an ascending process. Extension, on the other hand, serves to define the outer limits of the class. Beginning with extension, the individual descends from the genus to the exemplars. Extension is described in quantitative terms such as "all," "some" and "none."

One real difficulty in differentiating intension and extension is that they are needed to define each other. The intension, or properties common to a set of elements, cannot be understood by studying individual members in succession. To know what, in fact, are the common elements "all" the members of the class have to be compared. In other words, the extension of the concept has to be understood in order to define intension. Likewise we have to know the common properties in order to understand what is included in the extension of "all" or "some." Thus intension presupposes extension and vice versa.

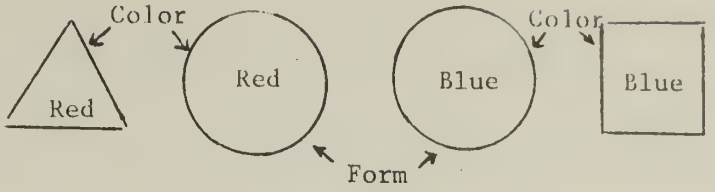
It is only in the highest or most advanced grouping stage (Stage III) as defined by Inhelder and Piaget that children understand the circular relationship between intension and extension and can coordinate these dimensions of a class. However, in the first two stages children have an imperfect understanding of the relationship and necessary coordination of intension and extension. The child may be able to use one or the other independently, but they are not truly coordinated because he cannot differentiate between them and utilize them consistently. A discussion of the three stages illustrates more fully the relation between intension and extension at different points in time.

Stage I - Graphic Collections.-- This stage is characterized by the child's inability to use consistent criteria for his sorting of all elements in an array and/or his shifting of criteria in response to changes in some of the other attributes. Groupings within this stage may take one of several forms:

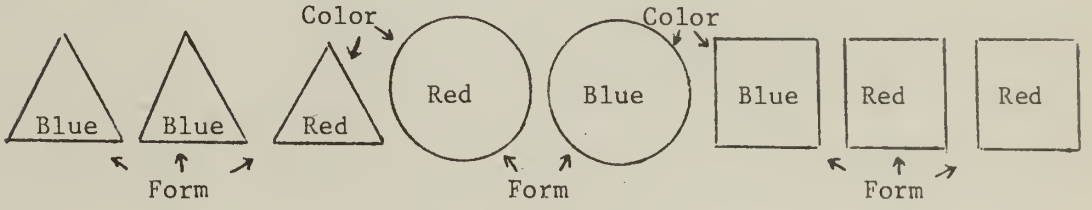
A. Small partial alignments. -- These occur when the child relates element one to element two by one criteria and then relates two to three using a different basis for equivalence. For example, given the following elements:



the child may group them as follows:

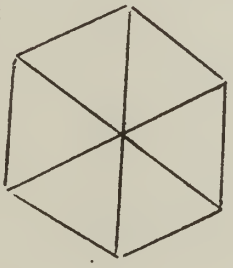


B. Continuous Alignments. -- In making continuous alignments with fluctuating criteria the child may arrange the elements shown above in yet another way:



Stage I has been termed graphic collections due to the fact that at the end of this stage children create graphic wholes in the form of a symmetrical design or the representation of an object in collective or complex groups.

C. Collective Groups. -- These occur when the child chooses to use a collection of homogeneous elements to form a unified figure. For example:



D. Complex Groups. -- Complex groups are composed of heterogeneous elements and result in a symmetrical design with

geometrical context. Or, the objects may be put together in such a way that the child can provide a thematic or descriptive meaning to his arrangement of the elements. For example, he might utilize the following shapes to create a house:

House  Bushes

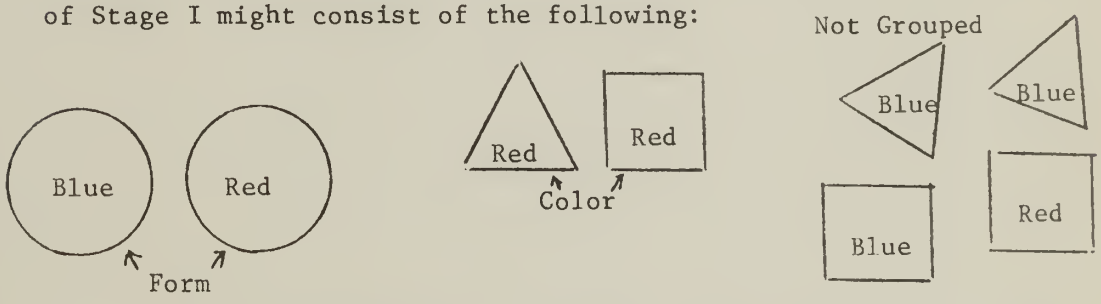
In Stage I the use of intension is imperfect. The child is not able to hold a consistent "common" characteristic in his mind. While he can select similar characteristics among the elements presented to him and thus create groups, the extension of these groups is basically spatial or graphic. The child deals only with the objects in front of him; he cannot anticipate the logical extension of the classes he uses. Extension is an artifact of the situation and dependent upon the exemplars present for its definition.

Thus in Stage I the child deals with associations. In Stage II, referred to as non-graphic collections, the child actually begins to organize objects into distinct separate groupings.

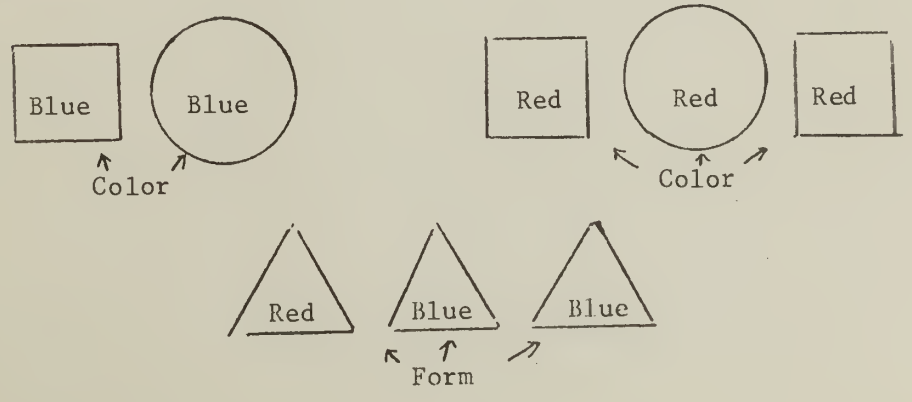
Stage II - Non-Graphic Collections. -- First it should be noted that the term "collection" is used rather than the word "class." Inhelder and Piaget consciously make a distinction between the two terms. Although at the end of stage II children are

beginning to use language terms correctly and understand intension, there is still an imperfect understanding of extension, as will be illustrated as this stage is discussed. In essence, groupings continue to represent collections, not true classes. The collections made during Stage II characteristically follow the sequence of development described below:

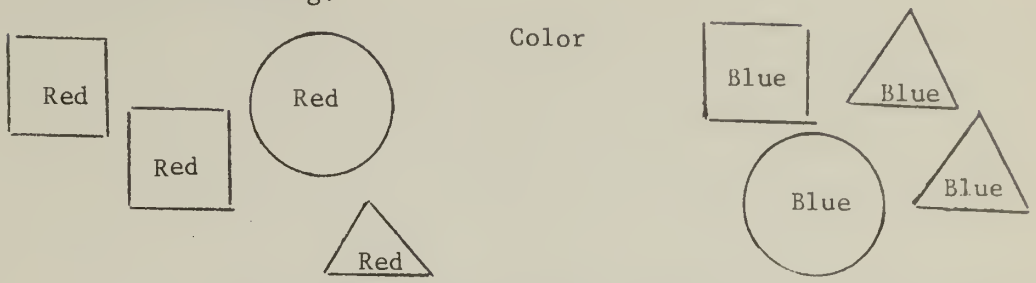
A. The simplist sorting consists of a number of collections with one or two elements, each collection being based on a different criteria. When the child has completed his grouping a set of elements remain which have not been included in any collection. A grouping of the elements pictured in the discussion of Stage I might consist of the following:



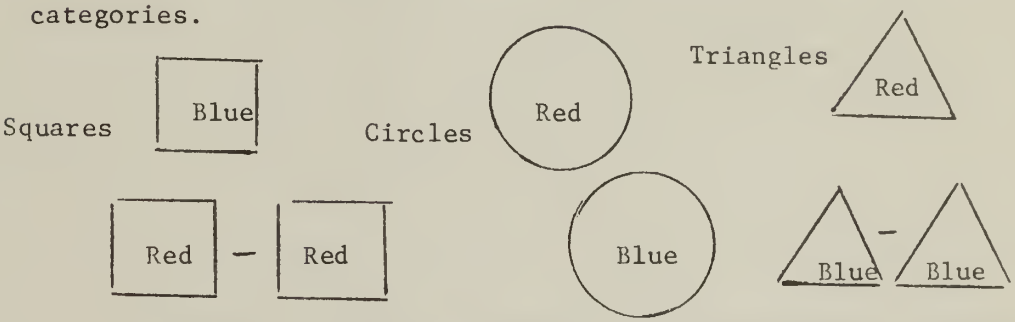
B. More elements are included in the collections. While there is still a diversity of criteria for the collections, all of the elements presented to the child are included and there is no overlap.



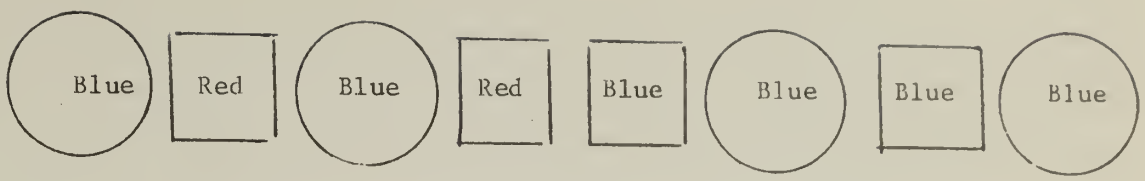
C. Using all the elements, the child can now find a common criteria for sorting.



D. At the highest level within Stage II the child is able to make internal differentiations of a lower rank within higher categories.



Stage III - Class Inclusion. -- The attainment of Level D within Stage II would seem to be a sufficient basis for stating that the child has reached the highest stage of classification. However, an example will illustrate that while the child's use of intension is correct--in the identification of similarities and differences--extension is still not understood. The child is presented with a row of wooden beads of various shapes and colors. He is then questioned about the relationship between them. The following excerpt illustrates the confusion in the child's mind when he tries to explain what is included in the word "all."



E. What do we have?
S. Blue circles and red and blue squares. (A correct response).
E. Are all the circles blue?
S. No (Incorrect response), because there are (blue) squares and circles.
E. Are all the blue ones circles?
S. No (Correct), because there are (blue) squares and circles.
E. Are all the red ones square?
S. Yes (Correct), because there are only the squares.
E. Are all the circles blue?
S. No (Wrong), there are circles and squares (blue).

Inhelder & Piaget, 1964, p. 61.

The interview indicates that the child is still dependent upon perceptual cues and can only deal with one dimension at a time (either shape or color, but not both). While the child uses intension correctly he clearly is unable to understand the quantitative use of the word "all." Thus, he does not understand intension.

Inhelder and Piaget state that it is only when the child can differentiate between intension and extension of a class that he can co-ordinate them and indeed be flexible in his use of handling the elements abstractly. The attainment of this stage is far more than the child's ability to specify that a dog is an animal or that an orange is a fruit, or on the other hand to give an example of a fruit as an apple. The verbal label indicates that the child has some

understanding of the parts and the whole, but given the fact that the child has the correct labels it is erroneous to conclude that he understands and can co-ordinate intension and extension without further testing his understanding.

A Second Developmental Approach: Bruner & Associates

While both Inhelder and Piaget and Bruner and his associates postulate an interactional developmental theory of classification development, they differ in their view of the internal processes associated with changes in classification behavior. To Inhelder and Piaget there is a change in the structure of thinking as children move from one stage to another. Children in the first stages are unable to operate at the higher level because their mental structures are not sufficiently developed to handle the logic necessary to coordinate intension and extension.

Bruner described the internal process in classification in somewhat different terms. In his works he makes a clear distinction between what is referred to as the semantics and syntax of equivalence. The words semantics and syntax do not refer only to the child's verbal response; they are terms used to distinguish two distinct internal processes, both of which are involved in creating equivalence groups. Semantics refers to the relative reliance on different modes to determine the basis for stating equivalence while syntax refers to the structure of equivalence. These terms need to be defined further to illustrate how they interact.

Semantics: The Modes of Equivalence. -- In essence, semantics refers to the criterion used for sorting. While the authors list five modes and discuss them briefly, they are basically concerned with the child's use of two of the modes, the perceptible and the functional. Each of the five modes is briefly described below.

A. Perceptible. -- Using this basis for stating equivalence the child is focussing on immediate perceptual phenomenon such as color, size or shape to create equivalence groups. This type of grouping also includes instances where the child relates objects in time or space. For example, he may say that the things are all found in the kitchen.

B. Functional. -- In this instance the child relates one object to another in terms of similar usage, something they both do, or something that can be done to both of them. An example is: "You can turn them both on."

C. Affective. -- This is a more subjective way of grouping objects. Things are put together which arouse the same emotion in the child. "I like them." "They both make me sick."

D. Nominal. -- In this instance the child uses a word which exists in the language to relate the objects grouped together. For example, given a dog and a cat he will relate them and say they are both animals.

E. Fiat Equivalence. -- After grouping objects the child states that they are alike because they are the same. He can provide no further rationale for his grouping.

Syntax: The Structure of Equivalence. -- This refers to how groupings are made. Within this category the authors have identified three basic structures. In stating how objects are alike or different children either respond by: (a) Thematic interpretation - utilizing a theme or telling a story to include all the elements; (b) Complexive organization - groupings made on the basis of immediate, visible traits rather than characteristics which go beyond the given examples;[1] or (c) Superordinate - groups made on the basis of a common feature or features characteristic of all the elements.

Throughout the development of classification the semantics and syntax of equivalence grouping interact. In a given situation any one of the modes may be used with any one of the structures. Within a given age group a particular mode and structure interaction may be more common than others.

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[1]Another term for this type of grouping is "family resemblance". There are several ways that objects can be put together within the category. Objects in an array can be related to each other through edge matching (the shoe and shirt are both brown, the shirt and pants are made of the same material, the pants and the hat are things to wear...), key rings (using one object as a referrent for all the other objects. The shirt is like the shoe because they are both brown, the pants are like the shoe because you wear them...), association (two items are linked together and their association becomes the referrent in the linkage of other items. The horn and bell make noise, wrinkling newspaper makes a noise...), Collections (listing attributes which objects do or do not have which are related, but not putting them together by naming a shared attribute. The shoe is to wear on your foot, the shirt is to cover you up when you are cold, you can wear pants...), and multiple grouping (forming subgroups, usually of two members. The shoe and shirt are brown, the pants and hat are things to wear...). Many of these structures are reflective of the patterns for grouping as described by Inhelder and Piaget as characteristics of Stage II (Olver & Hornsby, 1966, p.75-76).

As an example of the interaction between syntax and semantics Olver & Hornsby (1966), who studied children between the ages of 6 and 16, note that the functional mode predominates across all age groups in terms of frequency of usage. However, a child's description of function changes syntactically across age groups, illustrating that there is a different level of understanding and usage by the younger and older children. For example, to a six-year-old child function is illustrated by his statement, "I can cut meat with a knife and eat it with a fork." In more mature forms of functional grouping as characterized by 16 year olds, function would be expressed, "Knives and forks are both utensils." According to Olver and Hornsby a young child's responses can be classified as perceptible-complexive. On the other hand, the highest order of classification occurs under the superordinate-functional category.

It is important to realize that although Olver and Hornsby have described the characteristics of stages in somewhat different terms than Inhelder and Piaget, the postulation of a progression from reliance on the concrete to the ability to utilize abstract concepts is found in both descriptions of classification or equivalence grouping. Irving Sigel, on the other hand, suggests that performance on grouping tasks is more likely to reflect an individual's preferences, as determined by a wide range of variables, than his stage of development.

A Preferences Approach: Irving Sigel

Irving Sigel has looked at the variables which he feels relate to classification preferences rather than suggesting that performance is related to a developmental stage. Variables included by Sigel in a series of experiments with children ages 4 - 11 were: personality traits, socio-economic status, race, and sex as well as age. From his work Sigel identified three basic preferences for equivalence grouping: descriptive, relational-contextual, and categorical-inferential classifications.

Descriptive classification. -- Descriptive classification occurs when the individual uses an external, perceptual aspect of the object as the basis for sorting rather than considering the object as a whole. Examples include the use of color, form, in terms of either measurement or shape (round, flat, long, corners), and/or structure, which is indicated by reference to specific intrinsic or inherent parts of the objects (metal, wood, having handles, writing on them).

Relational-contextual. -- Sortings consisting of instances where interdependence of items in an array are noted in terms of function, theme or context are included within this preference. An example of a functional response would be, "You use a match to light a cigarette." Action takes place directly between two objects in the array (match and cigarette). Thematic sortings occur when the action takes place on an imported object or a story sequence is created. "You use a knife to cut the meat and a fork to eat it." (Meat is the imported item.) Objects put together because

they are found in the same location, "The knife and the fork are both kept in the kitchen," illustrates contextual groupings.

According to Sigel, the relational-contextual category is not developmentally higher than the descriptive category. In fact, the grouping of objects on the basis of relational-contextual characteristics appears to Sigel to be a less sophisticated way of grouping since it is neither reflective nor conceptual.

Categorical-inferential. -- There are different levels of complexity within this category. Low functional grouping occurs when only two objects are included in the group and a reason such as, "You can eat them," is given. If more than two objects are used with a verbal explanation similar to the one above, the response falls within the definition for high functional groups. When the subject is able to provide one term, or class label, to identify two or more objects correctly included within a class he is operating at the most complex stage (i.e. toys, food, clothing).

Sigel's definition of categorical-inferential classification includes what Inhelder and Piaget describe in Level 3 and 4 of Stage II as well as Stage III. However, Sigel does not differentiate between intension and extension, a distinction of major importance in Piaget's description of the acquisition of formal operations within classification.

Summary

It would appear that the three major classification research approaches described above evidence a concern for understanding more about both the semantics and syntax of equivalence grouping as discussed by Bruner (1966); they differ in the emphasis given to each of these. For example, Inhelder and Piaget's emphasis appears to be on studying the syntax of classification while Sigel's three stages of classification preferences illustrate basically semantic concerns. The work of Bruner, Olver and Hornsby illustrates an interest in knowing more about both the semantic and syntactic elements, with a special interest in the relationship between the two at different age levels and within various cultural settings.

Given the differences in emphasis, what are some general principles of classification that appear to emerge from the three perspectives? Sorting through the various terms and definitions used in reference to levels, stages and/or preferences which characteristically appear in research on classification, there is agreement on the relative position of two types of criterion: the perceptual and the abstract. The use of perceptual criteria is more common in young children; older children are able to employ more abstract criteria. Perceptual in this instance is defined as the attention to external, physical properties of the object, color, and form being the predominant exemplars. Abstract categorization, on the other hand, refers to the ability to identify an object as

an independent instance of a class label. The sorting is based on inherent criteria of the object rather than superficial external traits.

Another type of criterion is included in the discussion of classification by all three research groups, the criterion of function. However, its relationship to perceptual and abstract bases for equivalence is unclear. Functional criteria refers to instances where the child associates elements on the basis of their common use or association in time and/or space. Examples of a functional response include: "You sit on a chair at the table," "The hammer and saw are both used to build something." It is possible to identify a hypothetical functional response at each of the stages defined by Inhelder & Piaget, although it is briefly noted to appear at the end of Stage I. Bruner and his associates indicate a developmental sequence in the use of functional criteria, and Sigel argues that, in fact, a function response in classification may be less difficult than the utilization of perceptual qualities. Perhaps functional criterion do not fit within a continuum ranging from perceptual to abstract, but, rather, suggest a separate system to be explored in relation to classification.

The research reported above does suggest that a universal theory of classification can be entertained in terms of a developmental usage of perceptual criteria before abstract thinking as a basis for equivalence grouping. As noted earlier, these studies are based primarily on Euro-American samples. The question being

raised in the study presented in this report is, to what extent can a developmental theory of classification, in terms of the usage of perceptual as compared with abstract rationale for equivalence groupings, be applied in non-Euro-American cultures?

If a developmental theory has universal application it would mean that young children (ages 4 - 6) will use perceptual criteria with greater ease than abstract criteria. Older children (ages 7 - 11), on the other hand, should be able to use abstract criteria for eqivalence as easily as they use preceptual bases for creating groups. In essence, this pattern should appear regardless of the cultural environment of the child. However, if there is no universal developmental usage of perceptual and abstract criteria, it could be hypothesized that children in other than a Euro-American culture could use either criteria with equal ease at any age or that some other sequence in the usage of the two criteria would appear. The purpose of this study is to look at non-Euro-American children's use of the perceptual and abstract criteria.

To do that the Evans-Segall Concept Discovery Task and related classification tasks were administered in Uganda and Colombia. In particular, the study was designed to ascertain the ease with which children use color (a perceptual criteria) and class (abstract criteria) and to see if other variables such as age, grade in school, school attendance, and degree of urbanization play a part in determining the way children respond to specific classification tasks. Before discussing the Evans-Segall task and

the protocol utilized in Uganda and Colombia it is necessary to review the cross-cultural literature related to the cognitive process of classification. After reviewing the literature it will be possible to see why and how the task was developed. Thus, in Chapter II the major research projects which have been undertaken to study equivalence grouping in non-Euro-American cultures are reviewed, providing further data to be utilized in developing the hypotheses included in this study.

C H A P T E R II

CROSS-CULTURAL RESEARCH ON CONCEPTUAL DEVELOPMENT

It has been observed that young children operate in their world from an egocentric perspective. The forces that move a child from the egocentric viewpoint to a more objective view are not as well understood as the fact that it does occur. At the present time our understanding of the classification process is at the egocentric stage in that the research has been approached by Euro-American researchers who have developed tasks to be applied within their own culture. The resulting theories are based on assumptions, procedures and interpretations provided by Euro-Americans. It is only recently that Euro-Americans have become aware of sub-cultures within the so-called American culture, that, in fact, may not be fairly represented in current testing practices.

Also, increasingly better communication systems have meant that people from all cultures are becoming aware of the world's cultural groups, many of which are markedly different from their own. As cross-cultural contact has increased so have research efforts designed to compare sub-cultures within a culture and to compare apparently divergent societies. Anthropologists have noted the differences in social organization that exist throughout the world, economists note different systems for the exchange of goods, psychologists have seen that the types of mental illness within a culture reflect how the culture reinforces people and what it requires of

them, and philosophers recognize that cultures foster a world-view that may be unique to a given culture, a view which may or may not be understood by someone from outside the society.

Thus, within the various academic disciplines, researchers have come to realize that theories developed within a given culture may or may not be relevant for members of other social groups. This is true within the field of educational psychology as well. Euro-American psychologists involved in studying cognitive processes no longer assume that theories developed within their culture automatically explain development within another context. As a result, existing theories are being tested in a variety of cultural settings, both overseas and within the U.S.A. to see to what extent they can be applied universally.

As the interest in cross-cultural research develops, articles are being written suggesting considerations to be made in the pursuit of cultural comparisons (Berry, 1969; Fridja & Jahoda, 1966; Sears, 1961; and Witkin, 1967). In essence the articles speak to the following four concerns:

A. Purpose. -- The purpose of the research should be clearly specified. According to Sears (1961), there are at least two legitimate purposes for cross-cultural research: (1) to gain access to a population exhibiting greater extremes on a given variable or broader variation among seemingly irrelevant variables, and (2) to provide the researcher with conditions for the systematic variance of factors that cannot be varied within a single culture. Given that the researcher has one of these purposes, precautions B, C and D must also be met.

B. Conceptual Equivalence. -- In the transference of any concept from a Euro-American culture to another setting the researcher should be certain that the concept, as identified in his task, has an equivalent within the second culture. As Sears states:

> We presume that when a given kind of organism has to interact with a given kind of environment, all organisms having the same general property will develop behavior repertories that can be conceptualized in the same way. This reasoning rests explicitly on the assumption that not only are there universal biological qualities in man, but that the basic characteristics on the learning process... are universal. (Sears, 1961, p. 448)

In fact, there is no evidence to support these assumptions. Therefore, whatever the task to be transferred, it must exist and be operationally defined within the culture where it is to be applied.

C. Methodology. -- Methodological issues are of constant concern to those operating within only one culture. They are of equal importance when applied in another cultural setting. The researcher must know the population well enough to select a sample, design a task and utilize a procedure appropriate to the culture. To gain an adequate understanding of any cultural group the techniques used by anthorpologists are of great value to researchers in all of the social sciences. (See the works of Cole et al., 1971.)

D. Interpretation. -- When doing research in Euro-American cultures and reporting the results to readers from the same culture, implicit assumptions are made about the value structure of the population sampled, the reader and the researcher. None of these assumptions are stated since it is assumed that they are common to all three groups. However, in doing cross-cultural research it is

not possible to make these assumptions. What is being accepted as given in the situation must be clearly specified and discusssion of the data must extend from an understanding of the culture tested, not interpreted from a framework outside the cultural system sampled.

To a greater or lesser extent these precautions are met by those involved in cross-cultural research. While the authors may describe how they have addressed the various concerns, it is more often the task of the reader to ascertain the extent to which the researchers have seriously considered the unique problems involved in pursuing cross-cultural research. In the review of research in Africa which follows an attempt has been made to note specific considerations made by the various researchers in designing, administering and evaluating their study.

Cross-Cultural Research on Classification

Investigators interested in studying variables not found within one culture or looking for extreme examples of a given variable frequently use Africa or Southeast Asia for comparison with Euro-American cultures on the assumption that these continents contain cultures which differ markedly from Western European culture. In the field of educational psychology Africa has often been a focus of interest. In particular, studies on equivalence grouping have been carried out in both East and West Sub-Saharan Africa.

In two studies on equivalence grouping among Africans, children were asked to perform free-sort tasks in which the two dimensions that could be utilized were both external, physical

attributes of the stimuli: color and form. Suchman (1966) had children in Zaria, Nigeria, between the ages of three and fifteen years perform three sorting tasks and found a preference throughout this age range for color over form as the basis for sorting. Serpell (1966) worked with a sample of children in Primary Grade 2 in Zambia, and another sample matched for age, sex and socio-economic levels, but unschooled. He, too, found a preference for color over form and no significant difference between his schooled and unschooled groups. Together these studies suggest the high salience of color as a basis for equivalence grouping. In neither study were age trends nor schooling effects found.

Two other studies done in Africa employed stimuli in which perceptual and abstract criteria were possible bases for sorting. In one of these studies Price-Williams (1962) presented Tiv (Nigerian) children, aged 6-11 years, with a number of tasks involving sorting and classifying models of familiar animals and plants. He found that children, whether schooled or unschooled, followed the developmental trends described by Inhelder & Piaget, in the sense that there was a tendency for Ss to be less dependent on the concrete as they were older. However, the children in Nigeria reached the various stages at later ages than the Swiss children whom Inhelder and Piaget studied.

Greenfield performed a series of experiments on equivalence grouping with Wolof children and adults in Senegal. Her main sample included three age groups (6-7 years, 8-9 years and 11-13 years)

within three different levels of urbanization and included schooled and unschooled children. She found that schooling was a significant factor in whether or not children of various ages used color or class criteria for sorting. Her results indicated that rural, unschooled children relied on color regardless of their age. However, with school experience the children tended to use other types of sorting, especially form. After discovering this emphasis on color grouping by unschooled children, Greenfield added a sample of nonliterate adults to discover whether grouping by color persisted into adulthood. She found that it did. The sole difference between children and adults was that adults were more consistent in their grouping by color (Greenfield, 1966).

The only point on which the four studies in Africa agree is that color is more likely to be chosen as the basis for sorting than form. In the two studies where abstract criteria were a possible basis for sorting, it was least often used. In the three studies where age trends were a possibility they were found to be significant in only two instances. In sum, the results are ambiguous, except for the finding of a strong preference for sorting by color. This ambiguity may be due to the fact that the findings reported come from widely divergent cultural groups within Sub-Saharan Africa. The variables studied in Africa may have a greater or lesser effect on concept learning in cultural groups on other continents. Within Latin America, Mexico appears to be the only country in which equivalence grouping tasks have been employed. A study designed

to compare the results of classification behavior across cultures was conducted by Asch & Zimiles (1969). They compared scores on the Bank Street Matrix Test administered to high and low class children in New York City (Grades 1-3) with the performance of comparable grade groups in a middle-class school in Mexico City and a school for lower-class children from an impoverished area just outside the city. Children from both socio-economic groups in New York City performed better than either of the socio-economic groups in Mexico. Also, the Mexican children sampled appeared to have greater difficulty than their New York City counterparts doing the task.

Another study in Mexico was more comprehensive. Maccoby & Modiano (1966) presented the verbal and pictorial tasks utilized by Olver and Hornsby (1966) to rural and urban Mexican children in two age groups (8-10 yrs., 12-13 yrs.). The results indicated that rural children continue to rely on external perceptual characteristics for their groupings as they grow older. Urban children, on the other hand, show a significant decrease in the use of perceptual bases and a marked increases in the use of intrinsic functional bases over time. While all children sampled were in school, there was no control for age within grade. As is true in many developing countries, there was considerable overlap of ages across grades in the rural setting; this was not true for the urban setting. Thus the relationship between age and grade in school were not the same within the two geographical locations.

In looking at their results Maccoby and Modiano describe the possible cultural factors which may have an effect on tasks of this type. They note features within the Mexican culture which foster the rural child's continual use of the concrete and the urban child's use of more abstract modes of classification. They conclude, "It would seem...that we are dealing here with a matter of culturally derived preference, preference which through habit becomes finally a personal style." (Maccoby & Modiano, 1966, p. 267).

For the most part free-sort tasks were employed in the studies cited, tasks which give the child an opportunity to choose a response from among a group of stimuli. Such a choice situation may well reveal a child's preference in a sorting situation, but may not, in fact, tap the child's ability to use various criteria for equivalence grouping. For this reason the author and Marshall Segall designed an experiment in learning to ascertain what children can learn to do in terms of equivalence grouping when presented with a particular set of stimuli at a particular stage in their lives (Evans & Segall, 1969). The study was designed and administered in Uganda, East Africa, and is discussed here in some length since it served as the basis for the study described in this report.

The Evans-Segall Concept Discovery Task

The Evans-Segall Concept Discovery Task was developed after reviewing the contemporary theories of classification described in

Chapter I and looking at the experiments carried out in Africa as discussed in this chapter. While all three theoretical constructs presented in Chapter I provided input into the design of the Evans-Segall Task, the sequence of studies completed by Irving Sigel suggested some very specific procedural considerations that should be made. For that reason it is necessary to review Sigel's studies in some detail.

Sigel designed a series of testing situations to ascertain the relative effect of manipulating three variables: mode of presentation, type of objects used, and what is required of the subject. For example, in terms of mode of presentation, Sigel found that preferences in categorization vary as a function of how well the stimulus represents the real object. While lower-class Black children in nursery school and kindergarten had considerable difficulty classifying pictures, they were able to classify the real objects that the pictures represented. This was true even though the children could identify the objects depicted in the pictures. On the other hand, middle-class Black children of the same age could sort using pictures (Sigel & Olmsted, 1967, 1968, Sigel, 1971).

In varying the object class groups used in the sorting situation, Sigel found that for middle-class elementary school children there was more use of descriptive and relational-contextual groupings with human figures than with either objects or animals. In general, with an increase in age the use of the

descriptive category increases regardless of the type of materials presented, and there is a decrease in the use of relational-contextual sorting with a concomitant increase in the use of the categorical-inferential criteria (Sigel, 1965).

With reference to response requested of subjects within testing situations, Sigel found more descriptive labels were given when the children had a constant reference point to be matched with a choice card that could be picked up and placed next to the referent. In another task the referent was within an array of cards and fewer descriptive groupings were made. Sigel hypothesized that the latter situation provided greater opportunity for distraction; the child had to continually search for the referent in trying to make a choice (Sigel, Jarman & Hanesian, 1967, p. 12-13).

Given these findings and the results of work already done in Africa, the choice was whether to use real objects or represent them in two dimensions. Also a decision had to be made as to the type of perceptual criteria and class groups to include and what was going to be required of the subject in response to the stimuli. To determine the answers to these questions a series of pilot studies were run.

Pilot Studies on the Evans-Segall Concept Discovery Task. -- The materials tried in the pilot studies included textbook illustrations, real objects, and an artist's interpretation of the objects, one set in color and another in black and white. Children in nursery school,

Primary Grades 1 through 7 (7th grade is the final grade of primary school in Uganda), and unschooled children of comparable ages were included in pilot studies. A free-sort task was employed to permit comparison with previously published African research.

The first pilot study was designed to determine free-sort preferences among children ranging in age from four to fifteen years. Forty pictures of objects which could be sorted by color or class were extracted from commonly used primary school textbooks. After being shown all the pictures children were told, "Put together the ones which are alike." It was found that children in the early primary grades and unschooled children of all ages chose overwhelmingly to sort the pictures by color. Beginning with the 3rd grade children, many pictures were grouped on an association basis: objects which are typically used together were seen as "alike". The stated reasons for the latter grouping included such responses as, "You use a pencil to write in a book." and "You sit on a chair when you eat at the table." The task was too difficult for nursery school children, who responded by piling all the pictures together after they had been spread out before them by the experimenter.

Since some of the pictures were not recognized by all of the children it was decided to use real objects in the next pilot study. Sixteen objects in which there were equal possibilities for grouping by color, form and class (pineapple, papaya, sweater, hat, button, banana, lantern, book, pencil, matches, soap, tomato, bottle, cup and umbrella) were employed. With these, unschooled

children grouped almost exclusively by color and did not change from this choice, even when class possibilities were shown to them. Among schooled children the number of color responses was even greater for objects than it had been in the previous study with pictures. This last finding may have been due to the fact that the colors of the objects were more distinctive than the colors of the pictured objects, and thus color may have appeared to be a more obvious basis for sorting.

In a subsequent pilot study two sets of pictures representing the objects used in the previous study were employed. One set was multicolored, and the other was black and white. All children in the study saw both sets, with the order of presentation of the two sets varied randomly. The Ss responses were affected by which sequence they received. The younger children who had the black-and-white to color sequence grouped the second set exclusively by color after having reported that they could see no way of sorting the black-and-white sketches. The older children made functional and class groupings for both sets. When the colored set was shown first children from all age groups responded predominantly with color sorts. Older children could switch to class groups on the black-and-white pictures while younger children switched to form or functional associations although many saw no way to form groups of like objects with the second set of pictures.

With another sample different requirements were made of the Ss. Within a group of 20 first graders, ten were assigned

randomly to each of two testing situations. Each subject was given an array of 20 objects and told to "Put together those which are alike." Within Group I the children were asked why they made a grouping immediately after one group appeared to be complete. In the other situation the children completed the grouping of all the objects before being asked why they sorted as they did. While some of the Ss in Group I made conceptual sorts initially, if they could not verbally give a reason for their grouping, their subsequent groups tended to be on the basis of color, an equivalence they could easily verbalize. Frequently the initial group was changed to color as well so that the child could explain it. In Group II, where there were instances of both perceptual and conceptual sortings, the children explained the color groups and avoided explaining their conceptual groups until directly asked to do so. While some children could do analytical abstract sorting, if they were requested to give a reason and lacked the verbal ability to explain the sorting, they tended to rely on the easier, perceptual criteria of color for subsequent equivalence grouping.

The pilot studies clearly indicated a general preference for color as the basis for a free sort, particularly for younger and unschooled children. They could also easily express verbally why they had sorted by color; When they did choose an alternative basis for grouping, they had great difficulty expressing the criteria for equivalence. The pilot work thus supported the results of the other cross-cultural studies reviewed above, but left

unanswered the question of possible differences in ease of learning or discovering various bases of equivalence grouping. Thus, the learning of criteria was the focus of the Evans-Segall Concept Discovery Task.

In its final form the Evans-Segall Concept Discovery Task was administered to children from three parts of Uganda: urban, semi-urban and rural. Children from grades one, three and five were included as well as a group of unschooled children and adults with varying levels of education. Within the task Ss were given the opportunity to learn to use two different rules of equivalence grouping: perceptual and abstract.

The two criteria chosen were selected in an attempt to ascertain the child's ability to use criteria within theoretically different developmental levels. Since the relative developmental position of functional criteria is somewhat unclear (see Chapter I), it was not included in the task. Color was chosen for inclusion at the perceptual level and abstract classes at the other end of the developmental continuum. Each S performed both tasks, either perceptual first then abstract (Co/Cl) or vice versa (Cl/Co). In general, the results from Uganda indicated that:

1. Learning to sort on perceptual criteria was learned with equal ease by all groups of Ss regardless of age, schooling or degree of urbanization; learning to sort using an abstract framework was easy only for children in Grade 5, the oldest schooled group sampled, who learned class as easily as they learned color. For all other groups of Ss, it was considerably more difficult, with some not learning class at all.

2. In general, both tasks were more difficult for rural children than for urban children.

3. Unschooled children, and adults with minimal formal school experience did as poorly on the class aspect of the task as the children in the lower school grades (Evans & Segall, 1969).

These findings support the view that experiential factors associated with school attendance, rather than maturation, are the critical factors in the development of conceptual equivalence involving certain types of abstract stimulus attributes. These findings are similar to those found by Greenfield (1966), Suchman (1966), and Goodnow & Bethon (1966).

In general, the studies reviewed in this chapter indicate a developmental trend in terms of a movement away from perceptual bases for equivalence to the use of abstract criteria as children are older, although color appears to remain a salient criteria for grouping, even for some adults. The findings suggest that the type of task utilized and what is required of the subject play an important part in how individuals perform. When the task employs materials and concepts found within the culture, developmental trends are evident. On the other hand, when subjects are asked to manipulate what may be unfamiliar objects in unique ways then those children attending school seem to have an advantage over their unschooled age-mates in that the school group performs better on the tasks.

As noted earlier, many cross-cultural experiments have been done in Africa because it is seen as quite different from Euro-American cultures. To address the question, what would happen if a concept learning task were presented in a culture more closely linked

through tradition with Euro-American culture, the Evans-Segall Concept Discovery Task was administered in Colombia, South America. Chapters III - V contain a description of the Colombian study where the Evans-Segall and related classification tasks were utilized.

CHAPTER III

THE RESEARCH SETTING, METHODS AND PROCEDURES

Colombia, a South American country of 22 million inhabitants, was chosen as the country where the Evans-Segall Concept Discovery Task would be administered for the purposes of replicating the Uganda study. Basically it was chosen because it represents a different culture from that found in Uganda. Thus, in terms of classification, the relative importance of variables such as age, schooling and urban/rural environment may be different from their importance in Uganda. One thing which contributes to cultural differences is the fact that much of Colombian culture is derived from the Western European tradition and Colombians have greater contact with Euro-American ideas. Another set of factors which influence the culture are those related to economic development. In comparing Colombia and Uganda, Colombia is further along a general economic development continuum. Clearly it is of little value to be aware of this relative ranking unless the variables involved in such a ranking are defined.

Researchers have attempted to rank-order countries of the world on various dimensions. One such ranking was created by Ralph Harbison and Charles Myers (1964). From data collected in 75 countries they derived a Human Resource Development Scale. In each country the following information was gathered:

1. The number of teachers for primary and secondary schools/ 10,000 people.

2. The number of engineers and scientists/10,000 people.

3. The number of physicians and dentists/10,000 people.

4. The percentage of the estimated population aged 5 - 14 that attends primary school.

5. The adjusted school enrollment ratio for primary and secondary school. (This takes into account the fact that countries vary in the number of years included in primary and secondary levels. For example, Colombia has five years of primary education while Uganda has seven.)

6. The percentage of the estimated population aged 15 - 19 enrolled in secondary school, adjusted for the number of school years at the secondary level.

7. The percentage of the population aged 20 - 24 enrolled in higher education. This includes enrollment in higher technical schools, training colleges and theological schools. (Harbison & Myers, 1964, p. 27-30).

A composite index of variables 6 & 7 yielded four levels of Human Resource Development: Level I, underdeveloped; Level II, partially developed; Level III, semiadvanced; and Level IV, advanced. According to Harbison & Myers' analysis most Latin American countries (Level II) are considered more advanced on this scale than countries found in Africa South of the Sahara (Level I). The relative position of Levels I and II generally means that industries are better developed, the percentage of people involved in subsistence farming is less, and more consumer goods and services are available for the populations of Level II countries.

In comparing the relative development in Uganda, a Level I country, and Colombia, Level II, it is found that the per capita GNP exceed $300 in Columbia while it is below $100 in Uganda. Also, about 90% of the Ugandan population is involved in agriculture

compared to 50% in Colombia where well developed industries provide a variety of employment opportunities (Harbison & Myers, 1964, p. 45-46). The relative rankings of Uganda and Colombia do not provide information on the daily life of an individual within the country but do suggest that there is a greater cash flow in Colombia and that more goods and a greater variety of experiences are available to the average person.

Besides occupying different points on an economic continuum, Latin America and Africa South of the Sahara represent diverse cultural heritages. For example, while the languages found in Uganda are Bantu in origin, and differ from one tribe to another within the country, the first language for the great majority of Colombians is Spanish, a Latin derived Romance language. Also, within Latin America and Africa, customs and belief systems have developed along different lines as a result of historical forces operating in a wide diversity of environments.

Given the economic and cultural differences which characterize Latin America and Africa, Latin America provides another theater in which to examine the universality of a theory of concept development. This chapter and the one which follows present the findings of a cross-cultural replication of the Evans-Segall Concept Discovery Task. The task as designed and implemented in Uganda was modified for administration in Colombia, South America.

General questions being asked in transferring the African derived task to Latin America were: (1) Does the cultural environment affect performance on equivalence grouping and suggest or mitigate a

universal theory of concept development? Given that the Latin American culture of today is derived from the same European tradition which provided the setting for the current theory of concept development, how does performance on a concept learning task by Latin American children compare with that of Ugandan children? Hypothetically, if there is a universal theory of concept development, it would be predicted that children in Latin America would perform like subjects in Africa. (2) Does the relative development of the country's human resources affect classification learning? (3) Does the urban to rural difference found in Africa exist in a country which is considered more advanced economically? In Mexico, a Level III country, a significant rural/urban difference on sorting tasks was found by Maccoby & Modiano (1966), suggesting that degree of urbanization affects specific classification tasks regardless of the country's level of human resource development. The study reported explores the question further.

Given these general concerns, the research reported was designed to explore the following specific questions in Colombia by utilizing a task previously administered in Uganda:

1. Is it generally easier for children to learn perceptual criteria for sorting than it is to learn to sort using abstract categories? If children in Colombia perform like the children in Uganda, it would provide further evidence that it is realistic to propose a universal theory of classification development. Since the African data indicated that it is easier for young children (ages 4 - 7) to employ perceptual criteria, with older children (ages 9 - 13) utilizing abstract criteria with ease, the Colombian data should indicate the same pattern in order to support a universal theory of classification development. It should be remembered however, that the systems of classification may be culture specific and that on a given classification task performance may not indicate a developmental change for all sub-populations.

2. Is the ease of learning either of the tasks related to age? Of most interest here is a possible interaction between task and age; for example, one task may be more easily learned than the other at a particular age. That difference might be diminished, eliminated, or reversed at higher ages.

3. Does the child's environment (urban, semi-urban or rural) have an effect on his ability to learn the task?

These questions were addressed by asking urban, semi-urban and rural Colombian children in grades 1, 3 and 5 to complete the Evans-Segall Concept Discovery Task and related classification tasks. Within the following section of this chapter the research design employed to implement the study is discussed in greater detail.

The Setting

Colombia, South America, is a spectacular country which presents a diversity of geography and peoples not to be found in many countries of the world. Located in the northwest corner of South America, Colombia serves as a gateway from Central to South America and is the fourth largest country on the continent. Its borders touch both the Caribbean Sea and the Pacific Ocean as well as five Latin American countries: Panama to the northwest, Venezuela and Brazil to the east, and Ecuador and Peru to the south. While Colombia covers 440,000 square miles of land, its 22 million inhabitants live almost exclusively in the Western half of the country where the Andean mountains extend three ranges into Colombia.

Within Colombia there are four distinct types of geography: (1) dense tropical forest where it rains nearly every day, providing an annual rainfall of nearly 300 inches, (2) dry desert lands where little or no rainfall is recorded, (3) the mountain regions where snow capped peaks reach an altitude of 19,000 feet, and, (4) two major river valleys, the Cauca and the Magdalena, which provide fertile soil for extensive agriculture.

Within the geographical diversity there is also a diversity of races. Populated by various Indian groups in pre-Colombian times, during the 16th Century Colombia was inundated with Europeans who brought African slaves with them. Today's population is thus composed of Indians (Indios), Blacks (Negros), and Whites (Blancos), with the greater part of the population being a mixture of the three. While the percentage of Indians is very small (2.2%), some Indian communities exist in the more inaccessible mountain areas. By and large the Black population (6.0%) lives in the coastal regions while the Mestizos (47.8%), Mulatos (24.0%) and Blancos (20.0%) inhabit the fertile valleys and mountain lowlands (Atlas Basico de Colombia, 1968, p. 11).

It is possible for an individual studying in Colombia to select from among a number of variables if he wishes to replicate a study done elsewhere. While a traditional Indian culture can be studied, it is also possible to work with an exclusively Black community, but to sample in a population representative of the greatest percentage of the population it is necessary to work in an area where there are large numbers of Mestizos and Mulatos. Since the study reported is a replication

an attempt was made to change as few variables as possible when using a Colombian rather than Ugandan population. One variable easily replicated in Colombia was geographical climate. In Cali, the Colombian city selected for the study, the vegetation, rainfall patterns and general climate are similar to those found in Kampala, Uganda. At the same time, the racial mixture in Cali is as representative of Colombia as is to be found anywhere in the country.[1]

Located at the base of the Western Cordillera of the Andean mountain chain, Cali, Colombia is a city of nearly one million people. At an altitude of 3500 feet, it is the bustling capital of the Departemento del Valle del Cauca and the economic center for a region which produces sugar cane, soy beans, corn, coffee and cotton as its major crops. A fast growing modern city, Cali is known throughout Colombia for its excellent climate and lively social life.

The educational system within Cali reflects the structure of national education. Elementary school consists of five grades, beginning at age seven, with an additional six years of education available at the secondary level. According to figures collected by the Educational Planning Office in Cali, 75% of the eligible children within the city are attending primary school. This is divided among public and private schools, with three times as many students attending public as compared

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[1]It should be noted that due to the wide diversity of climates within Colombia, climates which provide a variety of agricultural crops and industries and facilitate differing life styles, no claim can be made that Cali is representative of the total country. Therefore, the results of this study should be seen as applying to a very specific population within a small region of Colombia, not as descriptive of the country.

to private institutions. At the secondary level 40% of the eligible age group is attending school; for this group an equal number of students are attending public and private schools (Oficina de Planeacion, 1970, p. 4-6).

As in Uganda, sampling in Colombia was done in three different locations, representing different levels of urbanization: urban, semi-urban and rural. In Africa the urban city selected was Kampala, a city which serves as the hub or support center for the other two areas sampled. This relationship was replicated in choosing the areas to be included in Colombia. Thus, Jamundi, the semi-urban area, and Pance and Villacarmelo, the rural settings, are all within the sphere of influence of Cali.

The Testing Situation

Task.--The task was essentially one of concept-discovery and learning, with two variations. In one instance objects were equivalent based on a perceptual criteria and in another they were related abstractly. The perceptual criteria was represented through color and the abstract by class groups which required that an individual relate objects on other than functional or perceptual criteria.

The child was required to "discover" the criteria in the sense that he was asked to indicate which two were alike from among four pictured objects. After he responded he was told whether or not he was correct. If he was correct he had, in a sense, discovered the appropriate criteria. He then had to successfully employ that criteria

in subsequent trials which meant that he was involved in a learning task. Also of interest was how readily the child was able to shift from using one criteria to another since each child was asked to learn to utilize both the perceptual and the abstract criteria.

Half of the subjects had to discover color as the basis for alikeness first and, then, on a second run through the 20 sets of pictures, had to identify abstract class relationships. The other half of the Subjects performed the two tasks in the reverse order; assignment to the two sequences was random.

Materials. -- Twenty sets of four pictured objects were hand drawn and colored, based on the stimuli used in Africa. In each set two objects were of the same color with one of these objects related to a third on the basis of an abstract classification. The fourth card in the set was not related to any of the other cards. For example, Set I was composed of a cup, book, bottle and clock; the cup and book were both blue, thus providing a color match, while the cup and bottle were related in terms of both belonging to a class identified as "containers." The clock was not equivalent to any of the other objects. In choosing the four objects to be included in each set of cards an attempt was made to minimize any possible matches on the basis of form or functional relationships or any matches other than the dominant one specified.

The order of presentation of the sets, and hence of the characteristics which served as signs of equivalence, were randomly determined

and then fixed for the entire experiment. Also, within each set the objects were presented to all Ss in the same order. Thus for Set I, beginning from left to right, each child saw the cup (a), the book (b), the bottle (c), with the clock (d) being on the right hand side.

The four stimuli within each set were arranged so that objects in every position (a, b, c, and d) would equally often be involved in a match. So while in Set I color equivalence was found by specifying card a and b, in Set II, c and d were color matched. For class, Set I utilized cards a and c, while in Set II b and d contained the correct objects for class groupings. (See Appendix A for a complete description of all objects used within the 20 sets.)

In transferring the task from Africa to South America it was found that only a few of the items had to be changed. The availability of the object and its frequency of use were used as criteria for selecting items to replace those used with African children. In all sets of cards the original colors were maintained and the class groups remained constant although the exemplars of the class may have been modified. (See Appendix A and B.)

Procedure. -- Each child was tested individually with only the child and examiner present. The subject was told that he was going to be shown a set of four pictures and that he was to find two of them which were alike. As each set of four was spread before him the S was asked to name each pictured object. If he could not name the object he was told what it was. This was to insure that the child knew what the objects were before he performed the task.

After naming the object the S was told, "Put together two which are alike." He responded either by piling two together, pointing to two, or verbally indicating his choices. A child assigned to the Color-Class (Co/Cl) sequence was told that he was correct if he selected two objects of the same color when the cards were presented the first time. The second time through the cards the S was verbally reinforced for making a class group. This was reversed for the children in the Class/Color (Cl/Co) treatment groups. Whenever a child made an incorrect choice he was told which one was incorrect and given a second opportunity to make the correct match. He was again told if his response was correct or incorrect. In calculating the results, however, only correct first attempts were scored as correct trials.

Children either completed 20 trials with one or the other matching rule in effect before beginning the second 20 trials, or they were moved to the second task after trial 15 if they had reached the criterion of four successive correct trials before or by trial 15. After reaching the end of the first half of the task the child was told, "You have done well. Now I am going to show you the same pictures again. This time I want you to put two together in another way." The child began the second half of the task with Set I and was reinforced verbally for making a sort on the basis of class if he had been reinforced for color the first time through the cards (Co/Cl) and vice versa under the (Cl/Co) treatment.

The Spanish protocol used was as follows:

Voy a mostrarle algunos dibujos. Primero, dígame como se llama la cosa en el dibujo. Después, vamos a jugar algo con ellos.

Que es esto?

Ahora, quiero que me muestra dos que vayan juntos y yo le digo si está bien.

Repuestas: - Si, muy bien. Ensayemos otro.
- No, no está correcto. Ésta es correcto, pero ése, no. Puede mostrarme alguno que vaya con éste?
- Ninguno de esos sirve. Muéstreme otros dos que vayan juntos.

Lo hizo bien. Ahora vamos a empezar otra vez, y quiero que me muestra dos que vayan juntos pero de una otra manera.

Lo hizo muy bien, Muchas gracias.

Additional tasks. The author's affiliation with various institutions in Cali resulted in some additions being made to the protocol. In its final form the Colombian protocol included two pages to gather sociological background information and ascertain children's psychological time orientation and perception of sociological status as well as three tests designed to tap the child's development of classification skills (See Appendix C for the complete protocol). While one test was a direct replication of the Evans-Segall Concept Discovery Task (E-SCDT), the second test was the Graham-Ernhart as adopted by Rae Ragland and the third was a free-sort test devised by the author and Ragland (Rae-Eva).

Pilot Study.--In order to determine the order in which the tests were to be administered to the main sample a pilot study was run in an elementary school which drew its population from one of the poorest barrios (districts) within Cali. All children in grades 1, 3 and 5 were included and were randomly assigned, using a table of random numbers, to different treatment groups. In this case the treatment groups

were defined according to the order in which the three tests were presented to the child. The groups were as follows:

I.	a.	E-SCDT (Co/Cl)	G-E	Rae-Eva
	b.	E-SCDT (Cl/Co)	G-E	Rae Eva
II.	a.	G-E	E-SCDT (Co/Cl)	Rae-Eva
	b.	G-E	E-SCDT (Cl/Co)	Rae Eva
III.	a.	Rae-Eva	E-SCDT (Co/Cl)	G-E
	b.	Rae Eva	E-SCDT (Cl/Co)	G-E
IV.	a.	Rae-Eva	G-E	E-SCDT (Co/Cl)
	b.	Rae-Eva	G-E	E-SCDT (Cl/Co)

A 4x2 analysis of variance was computed (treatment group I, II, III, and IV by order a or b on the Evans-Segall Task) to see if the relative position of the tests significantly affected criterion scores on any of the tests. While the ANOVA did not indicate significant differences for any of the tasks a look at the scores on the Evans-Segall Task within the four treatment groups indicates that, indeed, there are several trends that cannot be ignored in a replication study. One is in relation to the mean number of trials to criterion on the learning of class groups (See Table 3.1 and Figure 3.1). For example, compare the scores for learning class criteria on the Evans-Segall task when it is presented first and third (Treatment Groups I & IV). When abstract learning criteria are presented first the scores are not significantly different (Treatment Ib class mean = 11.22; IVb class mean = 10.33), but when Ss are presented with perceptual criteria and then shifted to abstract (Co/Cl), those who have had the other two tests before performing on the Evans-Segall have much lower scores on class learning,

TABLE 3.1

Pilot Study: Mean Number of Trials to Criterion on Evans-Segall Concept Discovery Task

Treatment Groups		Order Within Evans-Segall Task			
		(a) Co/Cl		(b) Cl/Co	
		Color	Class	Color	Class
I	E-S 1st	6.78	21.0	11.89	11.22
II	G-E 1st E-S 2nd Rae-Eva 3rd	8.33	12.43	10.2	14.87
III	Rae-Eva 1st E-S 2nd G-E 3rd	8.6	13.75	6.67	11.0
IV	E-S 3rd	7.0	9.67	8.3	10.33

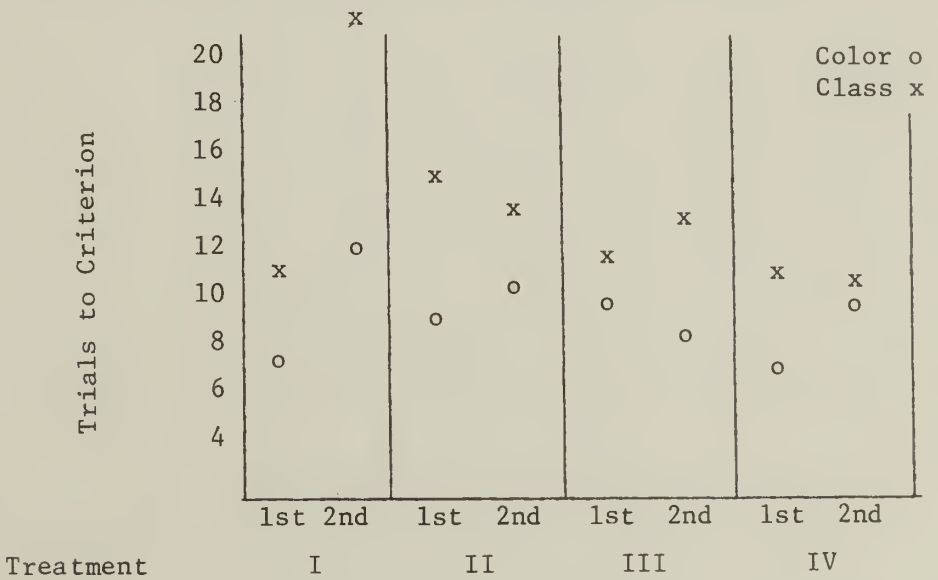

Figure 3.1. -- Mean number of trials to criterion on the Evans-Segall Concept Discovery Task: Data on color and class learning when they are presented first and second within the four Pilot study treatment groups.

it is easier, than for those who did the Evans-Segall task first (Treatment Ia class mean = 21.0; Treatment IV_a class mean = 9.67).

Due to this trend and the additional finding, illustrated in Figure 3.1 that following the G-E (treatment II and IV) mean scores on class learning under condition a (Co/Cl) were lower than when class was presented first in condition b (Cl/Co), the interaction effects of the ordering of the three tests had to be looked at further. In other words, although the findings indicate that there are no significant differences in mean scores when all groups are compared, means within specific groups illustrate interactions that cannot be ignored, especially in a replication study. For this reason the Evans-Segall Concept Discovery Task was presented first to all Ss in the main sample in order to best replicate the African study. The order of presentation of the three tasks was set as follows and maintained throughout the testing of the main sample: Evans-Segall, Graham-Ernhart, Rae-Eva. Within the Evans-Segall task the variations in presentation order for color and class learning were maintained as described above.

Main Sample

Within all the schools sampled the procedure for obtaining subjects was the same. Teachers provided a list of all children in their class. Using a table of random numbers a series of numbers were drawn and matched with the listed names. Where children were absent the next random number was used. Numbers were drawn and

children tested until all treatment cells were filled. At the completion of all the testing for a class the teacher was asked to rate the children sampled on a four-point scale according to the child's performance in class: 1 = very good (muy bueno); 2 = good(bueno); 3 = average (regular); 4 = poor (mala). Where it was available, data given by the children were verified by records kept by the school. The amount of information which the schools could provide varied considerably and will be noted in the discussion of the specific schools sampled.

One difference between the sampling in Colombia and Uganda occurred within the urban setting. At the time of sampling in Kampala, children from all social classes attended public schools together. Thus a random sampling within a public school included children from different socio-economic levels. Quite a different situation exists in Cali where it is extremely rare for an upper-class child to attend a public school; it is even becoming unusual for middle-class children to partake of the public school system. Thus to sample only from a public school would be to leave unsampled a large percentage of the primary school population. For this reason children were sampled from two distinct socio-economic strata within Cali: Upper-class private school children and lower-middle-class public school children. Also, with few exceptions, public and private schools within Cali and Jamundi, the semi-urban area, are segregated by sex. Therefore, two schools were used in each sociological location to obtain a sample of boys and girls.

Urban Upper-Class. -- According to the perceived status, school fees, and academic records of Spanish language schools in Cali, two upper-class schools were selected for inclusion in the sample: Liceo Benalcazar for girls and Pios XII for boys. Both of these schools begin with kindergarten and continue through the Baccalareaute, a degree equivalent to a High School Diploma in the U.S.A. Due to an unfortunate testing history in Liceo Benalcazar the counselling staff was reluctant to have us work within the school. Thus we were allowed to test only a minimum number of children. Also, a very casual record was kept on the children; for many girls the administrative office did not have a birthdate and additional material was non-existent.

On the other hand, the staff at Pios XII were most cooperative and a good working relationship existed during our association with the school. While there was little supporting data available, it was possible to validate the birthdate for almost all Ss. It is interesting to note that of the 48 children tested, six were born in the U.S.A., an indirect measure of the affluence of the school population.

Liceo Benalcazar is located in a wealthy section of the city and its large, well designed facilities fit into the surroundings. While Pios XII's buildings are not as elaborate, the classrooms are well constructed and adequate. In both schools educational materials are available to the teachers. In addition the two schools own their own buses which provide door-to-door transportation for all children to and from school.

Urban Lower-Middle-Class. -- Sampling within the lower-middle-class group took a different form. Rather than going to a school, random sampling was done by blocks within a set of Barrios, or districts, within Cali. The Barrios selected represented a population that was in transition; generally the residents had moved from the poorest section of the city and were becoming members of a fast growing middle-class. Fathers of the Ss within this group are generally employed in a factory or have a small store of their own. Likewise, it is not an uncommon for the mother to work as a seamstress, to be a maid in a home or an employee in a factory or store.

The Barrios chosen were also selected because they were a part of a large-scale nutritional/educational program (the Human Ecology Research Station) with which the author was affiliated. The families in the area were known to the social workers from the Station since they had previously made an extensive sociological survey of the area. From the data available a list of all children between the ages of five and fifteen within each of a total of twenty-five blocks was compiled. The social workers then went to all the homes within the randomly selected blocks and schedules were set up for the children to come to the Station offices to do the tasks.

It was originally hoped that by block sampling it would be possible to locate urban children who were unschooled and thus obtain a sample of children, corresponding in age to the schooled

children, who had received little or no schooling. However, after sampling from 350 children, only three were found who were not attending school.[2] Further inquiry led to the conclusion that most children within Cali attend some type of school, at least through the third grade. This finding is not in conflict with the figure of 75% of the school-age children attending primary school as indicated earlier. While close to 95% of the eligible first through third graders may be attending school, there tends to be a sharp decrease in the percentage of the age group attending grades 4 and 5 which accounts for an overall average of 75%. Where public schools are not available, private schools have been begun, and, as might be imagined, the quality of these schools varies tremendously.

While the abundance of schooled children did not allow for the collection of data on unschooled children, it was possible to run an ancillary experiment. Since circumstances prior to testing within the Barrios had meant that the author was doing most of the testing, rather than having a Colombian administering the tests, it was decided to set up an experiment to see if the nationality of the tester significantly affected test results. In order to do this the author tested a complete set of Ss (86) and the Colombian testers from the Human Ecology Research Station tested another group of 95 Ss.

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[2]This does not include those children who were five and six and therefore too young to attend school. These children were given a language screen, but were found to be too young for the battery of tests described in this report.

Semi-urban. -- Jamundi, a city of 10,000 people located 25 kilometers from Cali, was selected to represent a semi-urban area within the sphere of influence of Cali. While the great majority of the population is involved in agriculture, there is the beginning of small industry in the form of a flour mill. Sugar cane factories in the area also serve as employers of the local population. As is typical of cities in Colombia, there is a central plaza which serves as the hub of daily activities. On one side of the plaza is the church and on another is the local government office building. One block from the main plaza is the market place which operates daily on a small scale and flourishes on Saturday morning. Bus service is available to Cali every half hour, a ride of approximately an hour to the center of Cali.

Within Jamundi there are four elementary schools, two public and two private, as well as a secondary school for both boys and girls and a private nursery school for children five and six years old. The two public schools, one for boys and one for girls, were included in the sample since the majority of the school-age children attended these schools.

Manuela Beltran, the girls' school, consisted of seven classrooms: 2 for grades one and two and one for each of grades three, four and five. The average number of students per classroom was about 45.

The boys' school, Simon Bolivar, consisted of 15 classrooms, three for each grade level with the average class size close to 35 students. In both schools teachers were most cooperative and interested.

There was also extensive data available on the children's families in terms of parental education and occupation as well as the child's position in relation to siblings. In fact, the data in Jamundi were more complete than that found in any of the other schools included in the sample.

Rural. -- Due to the fact that rural areas contain such small populations it was necessary to test within two areas in order to complete the sample. One area, Pance, is in fact the same distance from Cali as Jamundi. However, it takes approximately twice the time to travel from Pance to Cali as from Jamundi to Cali. This is due to the fact that Pance is located at the end of a frequently impassable dirt road that is travelled only by buses and four-wheel drive vehicles. The community itself consists of a dozen houses, a police post, health station and a few small stores. Pance is unusual in that its school goes through the fifth grade. It is more common for rural schools to have only grades one through three; those children who want to continue their education must go to a more urban area to study.

The school in Pance consists of three classrooms: 45 pupils in first grade; 10 in second and 12 in third in another classroom; with 12 in fourth and 11 in fifth in the third room. None of the teachers live in the community. Living in Cali, they commute to Pance on Monday morning and return to their homes Friday afternoon. The schedule for classes could only be described as flexible. Classes meet when the teacher is there and it is not frequent for

at least one of the classes to be closed for the day, with the teacher going to the doctor or running numerous errands.

Many of the children walk for more than an hour in order to arrive at the school; they live in isolated houses along trails that wind through the mountains. It was observed that the children have a great desire to learn and are very self-directed in their learning but lack materials and guidance to help them in their pursuit of knowledge and skills.

The second rural community was Villacarmelo, at the end of another road that leads from Cali into the mountains. In the area there is a school for the first three grades, but one teacher handles all the children, a total of 60, more or less. During the five week period of contact with the school, the school was not in session for one reason or another. Rather than continuing to wait for the nebulous opening date, children in the immediate area were gathered together and all within the appropriate grade groups were tested. Table 3.2 contains a summary of the number of Subjects within each location, grade, treatment cell within the main experiment.

TABLE 3.2

The Number of Subjects in the Main Sample

School Grade		Location of School			
		Urban		Semi-Urban	Rural
		Upper-Class	Lower-Middle Class		
First	Co/Cl[a]	13	18	18	8
	Cl/Co	13	16	18	8
Third	Co/Cl	14	13	18	9
	Cl/Co	14	12	18	8
Fifth	Co/Cl	13	15	18	11
	Cl/Co	14	12	18	12

a. Co/Cl = Color/Class. The perceptual task is presented first, followed by the Class task. Cl/Co = Class/Color. In this instance the Class learning precedes color learning.

In chapter III the background information on both the setting and methodological considerations have been presented. The results of various statistical analyses on the Evans-Segall Concept Discovery Task as well as supporting data are the subject matter for Chapter IV and V.

CHAPTER IV

COLOMBIA: RESULTS ON THE EVANS-SEGALL CONCEPT DISCOVERY TASK

The stage has been set. In Chapter I theoretical positions in terms of classification behavior were presented. Within Chapter II cross-cultural research efforts which addressed the process of classification in various cultural settings, particularly in Africa, were described and related to the development of the Evans-Segall Concept Discovery Task. Also the results of the Evans-Segall Task as administered in Uganda, East Africa, were described briefly. In Chapter III a rationale for replicating the study in another cultural setting was presented and the culture to be included, Colombia, South America, was described; a part of this description was a profile of each school group sampled, providing the reader with a framework for understanding the results of the research done in Colombia. Within this chapter the results of the main experiment in Colombia are presented.

When the Evans-Segall Task was administered in Uganda, analysis of variance (ANOVA) was utilized as the statistical tool for looking at the results. This same technique was the main analysis employed with the Colombian data for the purposes of cross-cultural comparison. Before presenting the data on the ANOVA for criterion scores on color and class learning, however, it is necessary to present the results of some preliminary analyses which provide information on the age composition of the sample. These data are important in the interpretation of the results.

Preliminary Analysis

As noted in the brief discussion of the African results, there was a considerable overlap of age-groups within the three grades included in the Ugandan sample. For example, there are 9 year-olds in the first grade, a more typical age for third graders, and 11, 12 and 13 year-olds are not infrequently members of a third rather than fifth grade class. Thus the relationship between age and grade in school is not simple; there are many children in the older grades who are clearly overaged for the grade they are currently attending.

The overlapping of age groups across grades may or may not produce a problem when the results are considered. If the age profiles in terms of means and standard deviations are the same in all the schools sampled then it can be assumed that the grades sampled represent roughly the same age groups within each school, regardless of whether or not there is an overlapping of ages across grades. If, on the other hand, there is a significant difference in the age composition of any given grade across the schools sampled, then the age populations being described may be quite different when the results for a specific grade are considered.

To test the hypothesis that there were no significant age differences between school/grade/order of presentation groups a three-way analysis of variance was calculated. The ANOVA for age is presented in Table 4. 1. As might be expected the grades included in the study represent significantly different age groups. Secondly,

there is a significant difference when school groups are compared, the average age of the Ss tested within the urban upper-class group is two years younger than that of the rural sample (see Table 4.2: UUC mean age = 105.3 months; R mean age = 129.88 months).

TABLE 4.1

Analysis of Variance for Age Within the Colombian Sample

Source	M.S.	D.F.	F-Ratio	P
Total	712.23	330		
Between	7935.06	23		
School	8895.30	3	51.99	.001
Grade	76415.82	2	446.59	.001
Order	0.26	1	.00	.97
School x Grade	285.59	6	1.67	.13
School x Order	152.21	3	.89	.55
Grade x Order	144.10	2	.84	.56
School x Grade x Order	88.36	6	.52	.79
Within	171.11	307		

Within the urban setting there is more than a one year difference between the upper and lower class children, with the semi-urban group about 6 months older than the ULC children and 6 months younger than children sampled in the rural setting. Clearly, within the different schools included the children sampled in grades one, three and five do not represent the same age groups.

Data on the third main effect, order of presentation of class and color, indicate that within the total sample there was

essentially no difference in the age composition of the two treatment groups (mean Co/Cl = 120.11; mean Cl/Co = 120.17).

In Table 4.2 the data for each of the school/grade/order of presentation cells are presented. Within each cell the number of Ss, mean, and standard deviation are data to be considered. For example, it is possible to compare children who had the same treatment, but who are within different location and/or grade cells. When comparing the mean age of fifth graders across locations who learned the tasks in the same order (Co/Cl), the following data are available: UUC mean = 137.85 mos.; ULC mean = 142.0 mos.; SU mean = 147.89 mos.; and R mean = 162.09 mos. These data reflect the fact that the more rural groups represent older age groups within a given grade level.

By using Table 4.2 it is also possible to ascertain if children who had different treatments (Co/Cl or Cl/Co) within a given school/grade group have similar age profiles. As an illustration, a look at the data indicates that the 13 UUC first graders who were in the Co/Cl treatment group had a mean age of 75.54 months; the range of ages for the group was from 70-84 months, standard deviation being 4.37. The children within the same location and grade who were assigned to the Cl/Co treatment group had a mean age of 79.85 months; however the range (70-98 months) and the variance (10.41) was much greater.

In this latter instance the data indicate that the two treatment groups represented somewhat different age groups within a given school by grade cell. It should also be remembered that within any

TABLE 4.2

Age Data for Colombian Subjects by School, Grade and Order of Presentation

		Schools								
		UUC[a]		ULC		S-U		R		Total
Grades	Order	Co/Cl[b]	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Grade
1	N	13	13	18	16	18	18	8	8	112
	$\bar{X}$	75.54[c]	79.85	92.89	92.87	99.33	97.72	98.75	97.75	91.84
	S.D.	4.37	10.41	12.03	11.93	15.33	11.70	17.96	13.49	11.94
3	N	14	14	13	12	18	18	9	8	106
	$\bar{X}$	103.5	103.57	121.0	126.0	126.28	131.94	134.22	132.38	122.36
	S.D.	7.78	6.12	13.68	14.78	11.29	17.88	17.06	17.63	12.35
5	N	13	14	15	12	18	18	11	12	113
	$\bar{X}$	137.85	131.50	142.0	143.42	147.89	150.94	162.09	154.08	146.22
	S.D.	13.62	9.11	14.29	13.75	12.29	11.24	21.27	9.76	12.91
Total School	N	81		86		108		56		
	$\bar{X}$	105.30		119.70		125.68		129.88		
	S.D.	8.54		12.58		13.29		16.02		

[a] UUC = Urban Upper-Class; ULC = Urban Lower-Class; S-U = Semi-urban; R = Rural

[b] Co/Cl = Color first followed by class; Cl/Co = Class first, followed by color

[c] age data are presented in months

given school/grade group children were assigned randomly, using a table of random numbers, to the two learning groups. So the fact that there was a difference in the range of ages encompassed in an order of presentation group was a chance factor.

In summary, the findings of the ANOVA for age suggest the following in terms of the age distribution of the sample: (1) In terms of assignment to order of presentation group, the children sampled represent roughly equivalent age groups; (2) As sampled, grades one, three and five represent significantly different age groups, with older children found in the higher grades; and (3) The age profile for each of the degree of urbanization locations is quite different. The latter finding indicates that children within each of the three grades do not represent the same age group within the four school locations. Why is this the case?

National policy within Colombia dictates that children begin school at age seven. If across schools the policy of admitting children at age seven was consistent, it would be expected that the mean age for all the first graders tested, regardless of school location, would be about seven and a half years. This is, in fact, the case (See Table 4 .2). However, when the mean ages for first graders within each sociological location are compared, it is apparent that they are very different; the mean age for first graders in the UUC schools is 6½ years, while the mean in the R schools is closer to 8 years. This difference is due to admission policies and repeating patterns in the various schools.

Upper class private schools, as exemplified by the UUC schools in the sample, generally have classes for children as young as 5 years of age. Theoretically the children have 2 years of kindergarten before beginning grade 1. What in fact happens is that those 5 and 6 year olds who seem "ready" for 1st grade by-pass one or two of the kindergarten years. Readiness in this case is determined by the school and has meant that, in reality, the first grade classes are for the most part composed of six year olds.

In the rural public schools conditions are very different. There are seldom funds available for all the children of an age group to begin school when they should at age 7. While part of the age group is admitted, a proportion of that group must wait until the following year to begin school. Thus, some start at age 8 rather than 7 and occupy places that should be available to the then correct age group. It is also more common for children in rural areas to repeat grades. While this affects the average age within 1st grade to some extent, it has a much greater effect on the age composition in the upper grades.

In both the semi-urban and rural areas it is quite common for children in 5th grade to have repeated at least one grade. Repetition occurs either as a result of a student's poor academic work, or extensive absenteeism, or lack of space in upper grades, or some combination of these and other factors. School attendance in all but the UUC schools is erratic. In rural areas children stay home to help harvest crops or because they are needed for some

other chore which provides maintenance for the family. If there is not enough money to keep two children in school, children will attend school on alternate years. A girl attending school may have to stop her education when a younger brother reaches school age. Later she may attend school if additional funds become available. All of these factors contribute to the significant differences in age among the schools included in the study.

Because of the significant difference in age between the schools a correlation was computed between age of subject and score on both the color and class learning tasks. Age correlated with color learning at -.17 and with class at -.36. (The negative correlation comes from the fact that low scores indicate better performance. As children are older the task is easier and mean scores decrease.) Thus age accounts for only a minimal percent of the variance in color learning and accounts for about 15% of the variance in the class learning.

An immediate response is that the correlations are suprisingly low, given a developmental theory of concept development. It should be remembered, however, that the children tested in Colombia represent an age group where Inhelder and Piaget found considerable ability to use abstract classification systems, although the children would not necessarily have reached Stage III. Thus, the relatively low correlations between age and the learning of the two criterion scores would indicate that the discrepancies in age profile across the schools sampled would not be a major factor in predicting

comparative performance across schools. From this it can be concluded that any differences in performance on the two tasks across schools are largely due to factors other than age discrepancies. The differences which do obtain in terms of color and class learning are described in the next section of this chapter where the results from the main experiment are reported and discussed.

Main Experiment

The data discussed in this section of Chapter IV were generated from analyses of variance for the criterion score on the learning of color and the criterion score on the learning of class on the Evans-Segall Concept Discovery Task. The main effects tested were: school location (urban upper-class -- UUC; urban lower-class -- ULC; semi-urban -- S-U; and rural -- R), grade (1st, 3rd and 5th), and treatment condition (color first followed by class -- Co/Cl; class first, followed by color -- Cl/Co), yielding a three-way analysis of variance (4 x 3 x 2). The results of each of the ANOVAs are presented separately and then summarized and compared.

However, before presenting the ANOVA data, terms need to be clarified. Throughout the discussion of children's performance on the color and class sort, reference is made to "learning" the task. This means that the S reached criterion on the relevant sort; he sorted 4 consecutive sets of stimuli correctly on the first trial. Low scores indicate that it took the child fewer trials to reach criterion. Thus, the lower the score, the better. The minimum score is four, the maximum twenty-two. Although there were only 20

sets of cards included in the task, children who made correct responses on trials 19 and 20 were given two extra sets of pictures to see if they could reach criterion within 22 trials. Those who did received a score of 22. Those Ss who correctly identified the sort on trials 18, 19, and 20 were given one additional set and thus could receive a score of 21. If children did not achieve criterion they were assigned a score of 22, the maximum score, and the ANOVAs were thus calculated using all the Ss tested.

For some of the school/grade/order of presentation groups this meant that only one or two people had to be assigned the score of 22. In other instances, however, the majority of the children failed to reach criterion and were thus assigned the maximum score. The number who actually achieved criterion within any given group was dependent upon two things: the order in which the children were required to learn the two tasks and the grade the group represented. For example, for the total sample there was a significant difference between the number of people who achieved criterion when the task was presented first as compared to second; those who had to learn a given task second took more trials to reach criterion. The significance of order was calculated by doing a chi-square on the number who did and did not learn the task with the criterion when it was presented first as compared with when it was presented second. Thus 2 x 2 contingency tables were utilized. For both color and class learning there was a significant difference in the number of people who reached to learn the task first or second. (Color: $\chi^2 = 6.68$, df = 1, $p < .01$;

Class: $\chi^2 = 9.44$, df = 1, $p < .01$). In other words, more children reached criterion on the color and class task if they learned the task first rather than having to learn it after they have learned to use another criterion. (See Appendix D for the contingency tables and formulas utilized.)

As noted above, the second way performance was compared was in terms of grade differences in the number of children who achieved criterion. To see if there were significant differences by grade in the learning of the color and class tasks four different chi-squares were calculated. One for color in the Co/Cl condition, color when it was second (Cl/Co); class when it came first (Cl/Co) and class when it followed color (Co/Cl). For each of the four tables the number of subjects who achieved criterion and who failed were noted for each grade level. The results indicated that in three instances there was a significant difference in performance across the three grades: Color learning in Cl/Co ($\chi^2 = 15.74$, df. = 2, $p < .01$); Class learning in both conditions (Co/Cl, $\chi^2 = 49.49$, df. = 2, $p < .001$) and Co/Co, $\chi^2 = 32.54$, df. = 2, $p < .001$). It is only when the color task is presented first that the number who achieve criterion is not related to the child's grade in school. (See Appendix E for the chi-square calculations.)

Thus whether or not a child is able to achieve criterion seems to be related to the order in which he is required to learn the task and what grade he is attending. In the data presented below the ease with which children learn the color and class tasks are assessed in another way, by comparing mean scores for the school/grade/order of presentation groups.

Color learning. -- In Table 4.3 are presented the results of the ANOVA on criterion scores in the learning of the color criterion. Significant differences were found for the main effects of grade and order of presentation. There is, in fact a significant interaction between grade and order of presentation, indicating that regardless of grade, color is learned with ease when it is presented first. However, when first graders are presented with class criterion first and then asked to choose another criterion for equivalence, the learning of the color criterion is difficult. Children in the higher grades, however, have less trouble learning color when it comes second, although it is generally harder to learn it second than first (see Table 4.4). In comparing the results across schools it is possible to see that school location on the urban/rural continuum does not play a significant role in children's learning of the color sort, regardless of whether color is the first or second criterion to be learned.

TABLE 4.3

Analysis of Variance on Color Scores Within the Colombian Sample

Source	M.S.	D.F.	F-Ratio	P
Total	45.43	330		
Between	149.033	23		
School	55.39	3	1.47	.22
Grade	507.51	2	13.47	.001
Order		1	33.81	.001
School x Grade	39.80	6	1.06	.39
School x Order	24.04	3	.64	.59
Grade x Order	185.14	2	4.92	.01
School x Grade x Order	48.60	6	1.29	.26
Within	37.67	307		

TABLE 4.4

Data on Color Learning for Colombian Subjects by School, Grade and Order of Presentation

		Schools								
		UUC		ULC		S-U		R		Total
Grades	Order	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Grade
1	N	13	13	18	16	18	18	8	8	112
	$\bar{X}$	7.77	15.69	12.83	18.31	8.94	18.00	12.25	16.87	13.83
	S.D.	6.38	6.13	7.76	4.87	5.54	5.69	8.26	7.06	6.30
3	N	14	14	13	12	18	18	9	8	106
	$\bar{X}$	8.14	9.64	8.31	16.00	9.0	10.33	6.33	11.87	9.95
	S.D.	6.16	5.06	6.87	6.04	4.89	5.76	5.52	6.75	5.74
5	N	13	14	15	12	18	18	11	12	113
	$\bar{X}$	10.54	10.00	8.07	10.67	8.67	12.56	10.00	9.67	10.02
	S.D.	7.04	4.82	4.41	6.05	5.46	7.33	7.59	6.41	6.09
Total School	N	81		86		108		56		
	$\bar{X}$	10.30		12.36		11.25		11.17		
	S.D.	5.91		5.57		5.78		6.90		

Thus, in terms of color learning, it was equally easy for the children sampled to learn the color criteria for equivalence grouping when it was first, regardless of grade or degree of urbanization as defined by the schools included. On the other hand, when color was presented second, grade tended to be a good predictor of mean number of trials to criterion with those in higher grades reaching criterion in fewer trials. The data on the class task reveal somewhat different learning patterns.

Class learning. -- Presented in Table 4.5 are the results on the ANOVA for class. As in the data on color learning the main effects of grade and order of presentation are significant. Data on color and class learning differ, however, in that the location of the school is a variable which is related to how quickly children are able to achieve criterion on the class task although this was not true for color learning. As can be seen by comparing the means in Table 4.6, the class task is increasingly more difficult moving from the urban upper-class setting to the rural population sampled. The differences across grades are also linear with children in grade one having more difficulty with the task then third graders who, in turn, take more trials to reach criterion than fifth graders. Also, it is more difficult to learn the class task when it follows the learning of the color basis for equivalency.

In comparing the data on color and class learning one thing is apparent: for the population sampled, the class sort is more difficult to learn than the color sort within the Evans-Segall Concept Discovery Task. Fewer children reach criterion on class

TABLE 4.5

Analysis of Variance on Class Scores Within the Colombian Sample

Source	M.S.	D.F.	F-Ration	P
Total	41.00	330		
Between	189.76	23		
School	96.73	3	3.24	.02
Grade	1268.22	2	42.48	.001
Order	945.95	1	31.68	.001
School x Grade	22.47	6	.75	.61
School x Order	72.41	3	2.42	.06
Grade x Order	2.07	2	.07	.93
School x Grade x Order	39.25	6	1.31	.25
Within	29.86	307		

and for those who do, it generally takes more trials than the learning of the color sort. In most instances class learning, even when it comes first, is more difficult than the learning of color, regardless of whether color came first or second.

In summary, it is apparent that there is no consistent relationship between age and criterion scores. In looking at schools under the Co/Cl treatment there is essentially no difference in number of trials to criterion for color sorting although the school/grade groups differ significantly in age. A possible explanation is that it is easy for the very youngest children to

TABLE 4.6

Data on Class Learning for Colombian Subjects by School, Grade and Order of Presentation

		Schools								
		UUC		ULC		S-U		R		Total
Grades	Order	Co/C1	C1/Co	Co/C1	C1/Co	Co/C1	C1/Co	Co/C1	C1/Co	Grade
1	N	13	13	18	16	18	18	8	8	112
	$\bar{X}$	18.08	17.15	21.11	16.06	20.33	17.0	22.0	18.12	18.73
	S.D.	5.33	6.01	3.53	7.27	4.02	6.25	-0-	6.96	5.72
3	N	14	14	13	12	18	18	9	8	106
	$\bar{X}$	15.50	10.07	20.31	11.83	16.06	16.17	16.0	16.25	15.27
	S.D.	4.60	5.04	3.25	5.72	5.38	5.97	6.52	5.80	5.24
5	N	13	14	15	12	18	18	11	12	113
	$\bar{X}$	13.61	8.71	12.73	7.83	13.78	10.22	14.36	12.42	11.71
	S.D.	4.61	5.08	6.40	3.88	6.89	5.04	6.87	5.25	5.55
Total School	N	81		86		108		56		
	$\bar{X}$	13.86		14.98		15.59		16.53		
	S.D.	5.43		5.04		5.59		6.24		

learn color; they are able to do so in a minimum number of trials. Therefore, the task cannot be easier for older children; they cannot learn color in less than four trials. In other words, color learning under the Co/Cl condition is relatively easy for all Ss and does not serve to discriminate between the various school/grade groups sampled.

When presented second, the mean scores for color learning are significantly different between grades 1 and 3 (see Table 4.4. When school location is considered irrespective of grade and treatment groups, differences are not significant; the lowest scores are found within the UUC and the rural schools, groups whose age composition determine the lowest and highest points respectively on the age continuum in the sample. Thus, it appears that grade is a better predictor of color scores under the Cl/Co condition than either age or school location.

In terms of learning the class sort there is a rural/urban difference in performance; on the average, rural children's scores are higher than those of the urban Ss when class is presented first. When class comes second performance is similar across schools. This means that essentially it is difficult to learn class when it comes second regardless of school. The learning of class under the Cl/Co condition, however, became increasingly easy for older children within the urban setting. For the semi-urban and rural sample the task remained difficult regardless of order of presentation or age.

The data indicate that for class as well as color age is not a consistent predictor of performance. Clearly other variables exist within the environment of the children sampled--perhaps within the school, but more likely within the total environment--which interact with age to affect performance on equivalence grouping as defined within the Evans-Segall Concept Discovery Task.

As noted, analysis of variance was chosen at the appropriate tool for looking at the results of the Evans-Segall Concept Discovery Task. Further manipulations of the data were not specified in the design of the study. However, alternate ways of looking at the data yielded information that is not reflected in the criterion scores on color and class learning within the Evans-Segall Task. For this reason other analyses of the data were employed, leading to the generation of hypotheses which need to be investigated. In the following section of the chapter additional data, data which further explains children's performance on the Evans-Segall Task, are reported and discussed.

The Criterion for Color and Class Learning

In the design of the Evans-Segall task four consecutively correct trials was arbitrarily set as criterion, the point at which it was assumed that the child had learned the appropriate sort. To what extent was this a realistic measure of the Ss' learning of either the color or class criteria? An analysis of the Ss' performances on the first half on the task provides some insight into the adequacy of the criterion.

Each S was required to respond to a minimum of fifteen sets of pictures on the first half of the task. For example, if a child reached criterion on trial 6, he was presented with trials 7 through 15 and requested to continue selecting the correct sorts. If the criterion of four consecutive correct trials was adequate to indicate that the child had learned the basis for equivalence, it would be expected that performance on subsequent sorts would be correct. Thus, in the example, the child should choose the correct basis for equivalence in trials 7 through 15. Since the S's responses on each trial were recorded it was possible to calculate the percentage of appropriate selections after the subject reached the arbitrary criterion. These percentages were calculated for the learning of color in the Co/Cl treatment condition and class learning for those in the Cl/Co group. Since Ss did not receive any subsequent trials after reaching the set criterion on the second half of the task, the percentage of error cannot be calculated for color learning for the Cl/Co treatment groups or class learning for Ss who learned color first (Co/Cl).

For each subject who reached criterion in less than fifteen trials on the first half of the task his criterion score was subtracted from 15, providing the number of trials beyond the point of learning. Thus, for a S whose criterion score was nine, the number of additional responses was six (15 - 9 = 6). For a subject who took 13 trials to reach criterion there were only two additional sets of cards. The percentage of correct trials after criterion

was calculated by dividing the number of errors by the number of possibilities. If the child with six additional trials missed one he had 17% (1/6) error. Rather than calculating percentages for individual Ss, percentages were calculated for the 12 school/grade groups. The data on percentage of error for color learning (Co/C1) is presented in Table 4.7. Although there is a slight

TABLE 4.7

The Percentage of Error on Additional Trials on Color Learning (Co/C1) by School/Grade Groups

	Schools			
Grade	UUC	ULC	S-U	R
1	2%	16%	4%	9%
3	3%	6%	4%	
5	6%	5%	2%	1%

decrease in the percentage of incorrect responses as children are older the difference is not great. The percentage of error is relatively low for all school/grade groups. It would appear, therefore, that the assumption that a criterion of four consecutive correct trials did indicate that the subject had learned to use color as a basis of equivalence in the Co/C1 treatment groups.

Quite a different picture emerges from the data on class learning in the C1/Co treatment groups. The data in Table 4.8

indicate that for first graders who achieved criterion in less than fifteen trials, 43% of their subsequent sorts were incorrect, a very high percentage of error. Although there was a decrease in the percentage of error across grades, fifth graders still make many errors. Thus, while four consecutive correct trials may be considered an adequate indication of color learning at all grade levels, it is clearly inadequate for first graders and only marginally so for third and fifth graders.

TABLE 4.8

The Percentage of Error on Additional Trials on Class Learning (Cl/Co) by School/Grade Groups

	Schools				
Grade	UUC	ULC	S-U	R	Combined
1	42%	47%	44%	31%	43%
3	14%	27%	8%	33%	18%
5	12%	16%	7%	16%	12%

These results lend further support to the notion that the learning of class is more difficult than the learning of color. The means for color and class learning, when each is learned first, indicated that class was more difficult (see Tables 4.4 and 4.6), and the data in Tables 4.7 and 4.8 suggest that those who reached the criterion originally set could not consistently use the class basis for equivalence. Thus it would appear to be incorrect to say

that all those who achieved criterion on the class sort had in fact learned the appropriate basis of equivalence.

The Evans-Segall Concept Discovery Task and Children's Preferences

As indicated in Chapter I and II, many studies of classification have involved free-sort tasks where it can be hypothesized the subject responds with his preferences in terms of creating groups. Whether the preference is explored further, reinforced, or alternative bases for equivalence sought from the subject has been a function of the type of classification task utilized. While the Evans-Segall task has been described as one where children have the opportunity to learn two different bases for equivalence, it is possible to look at the child's initial response within a limited set of stimuli. On the first trial the child sees four pictured objects -- cup, book, bottle and clock -- and is told to put together those which are alike. At that point the subject has no information from the examiner about what is correct. Thus his first choice can be regarded as a preference.

Children's responses for each set of stimuli were recorded by noting the two cards which the child selected. By analyzing the responses it is possible to know if Ss responded by making a color or class match or any other combination of the four cards. To look at children's preferences the number of children who, on Trial 1, responded to each of the possible combinations within each school and grade group were calculated regardless of treatment condition. The results are presented in Table 4. 9 in terms of the percentage

of Ss whose initial responses were color or class. There was no other combination of cards which drew a high percentage of responses. (This is an important finding and suggests the validity of the first card sort.) The data are presented in two ways in Table 4.9: by grade and by school location.

TABLE 4.9

Preferences for the Color and Class Criteria on the Evans-Segall Concept Discovery Task: Percentages by Grade and by School

Grade	Color	Class
1	63%	13%
3	49%	23%
5	30%	50%
School	**Color**	**Class**
UUC	33%	40%
ULC	46%	31%
S-U	54%	27%
Rural	57%	12%

Several interesting patterns are quite clear. First, in terms of grade there is a significant difference in preferences across grades. (In a chi-square calculation $\chi^2 = 41.27$, df = 4,

$p < .001$. See Appendix F.) There is a consistent decrease in the percentage of Ss whose first response is color as children are older and a marked increase in the choice of class as a basis for equivalence. While a greater percentage of the children in grades 1 and 3 choose color first rather than class, the opposite was true for fifth graders who show an initial preference for class.

Secondly, there are significant differences when preferences by school location are compared regardless of grade. (The chi-square calculation yielded $\chi^2 = 12.74$, df = 6, $p < .05$. See Appendix F.) Across grades there is a greater preference for color, with the exception of the UUC schools where the predominant initial response is to create a class group. Also of interest is the fact that a clear pattern exists along the urban to rural continuum; the more rural the group, the greater the percentage of initial color responses and the fewer preferences shown for class.

This data is very limited since it involved a choice from among only four objects and there is only one trial. Yet it does lend support to previous studies which suggest a preference for color over more abstract equivalences as a negative function of degree of urbanization (Asch & Zimiles, 1969; Maccoby and Modiano, 1966; Greenfield, 1966).

Looking at the Evans-Segall Task for preferences and comparing the results with criterion scores illustrates an important difference between a study designed to elicit preferences and one which attempts to tap the child's ability. Had the task been designed soley to ascertain preferences the findings would probably

have supported a degree of urbanization theory of classification. On the task as administered, however, the child's ability to use various sorts was explored, and the results indicated no significant difference by degree of urbanization on color learning, but it was evidenced for the learning of class.

What can be concluded is that the child's preference on a specific task represents a response to a unique situation and may or may not give an accurate picture of the child's general preferences and/or abilities. Clearly what the child is required to do within the framework of a given task plays an important part in how the child responds. The Evans-Segall Task was designed to ascertain what children can do in terms of learning two very specific kinds of classification systems. Within that task a pattern of responses was elicited which suggest that:

1. Color is easier to learn than class for children in grades 1, 3, and 5 in the schools sampled.
2. The order in which children are required to learn the two criteria affects the ease with which they reach criterion on the color and class basis for equivalency.
3. There are grade differences in performance on several aspects of the task:
    a. The number of children who reach criterion on the color task when it is presented second, and how quickly they do so.
    b. The number of children who reach criterion on the class task, regardless of whether it is presented first or second, and how quickly they do so.

4. Differences along an urban/rural continuum were evidenced in the results on class learning, but not for color equivalence.
5. Age does not correlate with color performance. Regardless of the age of the children sampled, the color basis of equivalency was learned with relative ease.
6. Age correlated to a somewhat higher degree with performance on the class task, but can be said to account for no more than 15% of the variance.

As noted, these are the results which obtained from a concept-discovery and learning task. Because the results are limited to a very specific aspect of classification other classification tasks were included in the battery administered to children in Colombia to provide alternate sources of input into an understanding of the classification process. While these tasks were outside the main focus of this study, they do provide data related to the results from the Evans-Segall Task. Thus, the results of an alternative approach to understanding classification are presented in Chapter V.

CHAPTER V

COLOMBIA: ADDITIONAL DATA

One very real problem in terms of understanding the research on classification accrues from the fact that very few researchers use either the same materials, protocolo or techniques of data analysis to study the process of classification. It is only when a researcher methodically changes only one variable within the setting that the effects of given variables can be hypothesized. In the work of Sigel this systematic changing of variables is evident and helps isolate some factors which affect performance. Within this study an attempt was made to look at different aspects of children's classification behavior by utilizing three different tasks within the protocol administered in Colombia: The Evans-Segall Concept Discovery Task, the Graham Ernhart, and the Rae-Eva. The Graham-Ernhart is a task consisting of shapes (circles, squares and triangles) which differ in terms of size and color so that children have the possibility of selecting equivalencies on the basis of form, color or size. Generally the test is utilized with young children (2½ to 5). It was included in the battery to see how older children would respond to the task.[1]

The Rae-Eva was designed as a free-sort task to supplement the data obtained on the Evans-Segall Concept Discovery Task. Stimuli

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[1]The results of the Graham-Ernhart are not included in this report since the data are being analysed by Dr. Rae Ragland who worked with the author in Colombia.

were selected to represent five class groups: work items, toys, tools for learning, humans and animals. Each of these groups contained four exemplars with the exception of the work category where four work objects were included for women and four for men. In an attempt to include a work item for other than manual labor, a typewriter was also included, thus yielding nine work items. In all, the children were presented with a total of 25 objects correctly proportioned to one another, the largest being five inches high (See Appendix G for a complete description of the objects included). In selecting the objects color and form bases for equivalence were minimized as much as possible.

The Rae-Eva consists of three parts. In Part I, the child was asked to put together those objects which were alike from among the items scattered haphazardly on the table in front of him. The child then proceeded to make his groups. When the S indicated that he was through, the examiner began with the first group the child made and asked the S why the objects were alike. After proceeding through the groups, the examiner gave the child a verbalization score. Also noted was the total number of objects that the child used and the number of objects in each group as well as the specific objects included in the group.

When Part I was completed the objects were once again mixed. For Part II, the child was asked to indicate the items that he liked best. This was done in an attempt to ascertain the child's orientation toward each of the five classes. The items the child selected were

noted in the order in which he chose them; each S was encouraged to choose at least four items.

Part III was set up to provide only a limited choice. Within the set of humans there was a doll representing a boy and one of a girl. The doll matching the sex of the S was put on the table in front of the S and the child was told, "This is a boy/girl like you." Three other objects were then put on the table, one from each of the work, play and learn class groups. The child was asked, "Which one of these goes best with the boy/girl?" After the S's choice had been indicated the three objects were removed and the same question was asked with another set of three objects. In all, the child responded to three different sets of three objects. The objects representing work, play and learning in each of the three instances were chosen to minimize any color or form response and were presented to all Ss in the same order. (See Appendix C for the items used.) Thus, while Part II was created to ascertain a child's orientation, in that it asked what he liked best, Part III provided an opportunity to see what a child would choose as being the most appropriate for a child of his sex and age. In looking at the results, each part of the Rae-Eva was analyzed separately, and then the three parts were compared in an attempt to understand their interrelationship.

Part I, Results

Several types of data were looked at within Part I: the number of objects used within each group, the total number of objects

that the S utilized, the basis of equivalence for each group and the child's ability to verbalize a rationale for his equivalences. These data are presented in Tables 5.1 - 5.3.

In Inhelder & Piaget's (1964) discussion of Stage II in classification development they note the child's progression from the use of two object groups to inclusion of all the objects which can be included under one criteria, regardless of how many this might be. They also note that children move from an apparently arbitrary exclusion of some items, an exclusion in the sense that the child does not include the items in any of his collections, to a grouping of all objects presented to him. Both of these hypotehsized progressions are supported by the data in Part I of the Rae-Eva.

In Table 5. 1 are presented the data on the percentage of Ss who created two object groups and those whose groups contained three or more objects. Within all schools there is a marked decrease in the number of two object groups as children are older and an increase in the use of three or more objects in a collection. It would appear that there is also a difference between the UUC and other schools in the sense that the percentage of first graders in the UUC schools who use two object groups is similar to the percentages for third graders in the other three school types. Also, by third grade 90% of the UUC children create groups of three or more objects; the performance in other schools does not indicate this great a use of larger groups, even by fifth graders. In fact, fifth grade ULC Ss

used two object and three or more object groups with nearly equal frequency (48% compared to 52%).

Since the Ss were presented with 25 objects it could be predicted that those creating two object groups would not include all the objects; even if they attempted to use all the objects they would be left with one which had no mate. Thus, the data should indicate an increase in the percentage who include all objects as children move to creating groups containing more than two objects. Such an increase is evident in the data presented in Table 5.1. As children are older there is an increase in the percentage who assign all the stimuli to equivalence groups.

Once again there appears to be a difference between the UUC schools and those representing other sociological settings. While only 10% of the first graders in all schools sort all the items, third graders in the UUC schools perform like fifth graders in the other schools. The UUC children show a greater increase in percentages between grades 1 and 3 than is found in other schools between grades 1 and 5. Further, by 5th grade nearly 2/3 of the Ss in the UUC schools sort all the objects; this is true for only 1/3 of those in the ULC and R schools and 44% of those in the SU schools.

Another question explored was, what are children using as criteria for equivalence? There are at least two different ways to look at the data. One way is to calculate the total number of sorts made by all the Ss in a given cell and determine what percentage of those groups were created using the various criteria. For example,

UUC subjects created a total of 609 sorts. Of that total, 156, or 26%, were work groups while only 69 out of 609, or 11%, were groups containing toys. In comparing percentages it should be remembered that there were twice as many work objects as items representing toys, learning tools, humans or animals. If children used only the class criteria, and used them all correctly, then about 17% of their responses would represent each of the class criteria with the exception of the work class which would represent 33% of their groups.

TABLE 5.1

Use of Objects in Free-Sort--Average Number of Objects in each Group and Total Number of Objects Used: Percentages by School/Grade Groups

		Number of Objects in each group		Total Number of Objects Used		
School	Grade	2	3 or more	25	20-24	Less Than 20
UUC	1	69%	31%	11%	69%	20%
	3	10%	90%	39%	61%	0
	5	8%	92%	63%	37%	0
ULC	1	85%	15%	9%	7%	18%
	3	53%	47%	22%	66%	12%
	5	48%	52%	33%	59%	8%
SU	1	85%	15%	8%	69%	23%
	3	67%	33%	19%	72%	9%
	5	28%	72%	44%	50%	6%
R	1	93%	7%	6%	70%	24%
	3	69%	31%	17%	77%	6%
	5	35%	65%	31%	48%	21%

The relative use of various criteria by school location and by grade are presented in Table 5.2. Besides the class criteria, which served as the basis for choosing the objects presented to the Ss, children used other bases to create equivalence groups: functional criteria, where objects used by an individual or used together were grouped; color; form; proximity, where objects that were next to each other in the array were put together; linear arrangements; and unclear groups, groups where the child could not verbalize his sorts and the criteria for equivalence were unclear to the examiner.

TABLE 5.2

The Relative Frequency with which Criteria are Used to Create Groups, by School and by Grade

Criteria	School				Grade		
	UUC	ULC	SU	R	1st	3rd	5th
Total Class Groups	81%	68%	70%	65%	60%	72%	83%
Work	26%	23%	26%	22%	23%	26%	25%
Toys	11%	9%	5%	5%	5%	7%	10%
Learning	15%	11%	10%	11%	9%	12%	15%
Humans	15%	14%	16%	15%	13%	16%	17%
Animals	14%	12%	12%	11%	10%	12%	15%
Total of other Groups	19%	32%	30%	35%	40%	28%	17%
Functional	10%	13%	11%	13%	15%	11%	9%
Color		2%	2%	1%	3%		
Form		1%	1%			1%	
Proximity	1%	2%	3%	4%	4%	3%	
Linear				1%			
Unclear	8%	14%	13%	16%	18%	11%	8%

Several interesting patterns emerge from the data. In terms of school differences it would appear that children within the ULC, SU and R schools all created similar types of groups. The UUC children, particularly those in the fifth grade, came the closest to matching the hypothetical percentage of correct class responses (work = 30%, toys = 15%, Learn Items = 15%, Humans = 17%, Animals = 15%, Functional Responses = 5% and Unclear = 3%). It is notable that of the groups made by the SU and R Ss, only 5% were toy groups.

The low percentages may reflect the fact that the Ss were unable to distinguish "toys" as a criteria for equivalence when obviously all the objects presented to them could be called toys. In a sense the S had to see a set of toys within a group of objects already known as toys. Going on the assumption that this distinction could be made, an alternate hypothesis regarding the relatively low use of Toy groups by SU and R children can be entertained, a hypothesis related to the relationship between a child's exposure to toys and his ability to use the toy criteria.

In general the environments of the SU and R children lack objects which are used exclusively as toys, whereas the urban child is acquainted with toys and the UUC class child certainly has many toys of his own. The SU and rural child's relatively low level of experience with toys may mean that an exclusive toy group has little salience. This hypothesized relationship between toys in the environment and the willingness to create toy groups is somewhat supported by

the fact that UUC fifth graders consistently included toy groups among their sorts, while their rural grade-mates did not.

In terms of grade differences, children, as they are older, make more class groups. While 60% of first graders' groups were based on the class criteria, abstract groups were used by 73% of the third graders and 82% of the fifth graders tested. Along the grade continuum from youngest to oldest there was also a decrease in the percentage of unclear and functional groups created. Thus it would appear that the older children were able to use the class criteria for equivalence, as defined in the task, better than younger children. Even by fifth grade, however, other bases for grouping were salient; children did not use the abstract class criteria exclusively.

A second way to look at the data in Part I of the Rae-Eva is to ascertain what percentage of the children within each school and grade group included each of the various criteria. This is calculated by dividing the number of children who used a given criteria by the total number of children in the cell. For example, of the 108 Ss in the SU group, 91 or 84% created at least one sort which included human figures. On the other hand, within the same sample cell, 7 Ss (6%) used color as a basis for equivalency. The data for schools and for grades are presented in Table 5·3.

TABLE 5.3

The Percentage of Subjects who Create a Group Based on the Various Criteria, by School and by Grade

Criteria	School				Grade		
	UUC	ULC	SU	R	1st	3rd	5th
Work	96%	93%	95%	80%	93%	93%	91%
Toys	82%	64%	42%	41%	43%	57%	68%
Learning	89%	72%	75%	64%	69%	81%	82%
Humans	91%	81%	84%	73%	75%	87%	85%
Animals	91%	87%	87%	80%	78%	92%	92%
Functional	42%	53%	56%	54%	57%	57%	41%
Color		3%	6%	4%	8%	1%	
Form	1%	3%	5%		1%	4%	3%
Proximity	5%	12%	18%	18%	20%	18%	2%
Linear			2%	14%	1%	1%	3%
Unclear	28%	62%	54%	80%	71%	47%	40%

Following an urbanization continuum the data indicate a difference in the relative use of the various criteria. For each of the abstract class criteria a greater percentage of the urban children included work, toy, learning, human and animal groups among their sorts than were included by the SU children who, in turn, more often included each of the class groups than the R subjects sampled. The continuum in reversed in terms of unclear groups, and to a lesser extent for the use of functional criteria, linearity, and proximity, with a greater percentage of the rural subjects using these criteria.

Examples help to illustrate the differences. In terms of work groups, 96% of the UUC children, compared with 80% of the R sample, related the work objects to one another and created a work group. A more striking finding appears in comparing the use of the toy criteria. While 80% of the UUC children set aside a toy group, only 41% of the rural Ss employed the toy criteria. In relation to the percentage of Ss who created unclear groups, only 28% of the UUC children created at least one group where the bases for equivalence was unclear while 54% of the SU and 80% of the R children created such groups. Also, the UUC group, as compared with the ULC, SU and R children, had relatively fewer subjects who created groups on the basis of functional equivalence, although the difference was not great. Since nearly 50% of the children in the total sample made at least one functional group, the use of functional criteria was obviously salient.

There are several patterns in terms of grade differences. The percentage of Ss who created at least one work group did not change across grades; the work groups were obvious to children of all ages within the sample. The greatest difference across grades in terms of an increase in usage was found for the toy criteria (first grade = 43%; third grade = 57% and fifth grade = 68%). For the other three class criteria there is an increase in the percentages between first and third grades, but no change between third and fifth. Thus it would appear that the children who are going to employ the learning tools, human, and animal criteria do so by third grade. The use of functional criteria decreased between third and fifth grade, but there were still 41% of the fifth graders who saw functional relationships as a criteria for equivalence. There was a sharp decrease across grades in the percentage of Ss who used proximity to create equivalence groups and whose sorts were unclear. Thus, within the sample, as children were older they created more class equivalences and used perceptual and essentially extraneous criteria less.

To what extent was the child able to explain his grouping? To develop some hypotheses about the relationship between the child's actions and his ability to explain the sorts, children were questioned when they had completed all their groups. The examiner began with the first group the S made and asked, "How do you know that these go together?" When the child had stated his reasons for creating the various groups his responses were categorized. Subjects responses

fell within one of the following categories:

1 = Verbalization is the same as the grouping

2 = Verbalization is the same as the grouping, but the child has great difficulty giving the reason

3 = The child only names the objects

4 = The child says, "They are the same." No further verbalization

5 = Groups are by class, verbalization is on the basis of size

6 = Groups are by class, verbalization is on the basis of color

7 = Groups are by class, verbalization is on the basis of function

8 = The child was unable to provide any verbal reasons for his sorts

The categories do not imply a scale. They simply indicate a composite of the responses given. The assignment to a category was based on the majority of the S's responses. Thus, if a child created six class groups and four of his stated bases for equivalence were color, with one class reason and one group he could not explain, he was assigned to category six, a category for responses when objects are grouped together on the basis of class but the child says they are alike because they have the same color.

In Table 5.4 are presented the percentage of Ss whose verbalizations fell within one of four combined categories (Correct = 1 & 2; Fiat = 3 & 4; Action ≠ Verbalization = 5, 6 & 7; No Verbalization = 8). While some age trends are consistent within the UUC,

TABLE 5.4

Children's Ability to Verbalize Their Sorts: The Percentage of Ss Whose Verbalizations were Within Each of Four Categories by School and Grade

Schools	Grades	Verbalization Categories: Correct	Fiat	Action ≠ Verbalization	No Verb.
UUC	1	31%	11%	8%	50%
	3	78%	4%	7%	11%
	5	92%	4%		4%
ULC	1	34%	27%	12%	27%
	3	52%	31%	13%	4%
	5	52%	27%	14%	7%
SU	1	27%	29%	25%	19%
	3	67%	14%	19%	
	5	89%		8%	3%
R	1	38%	31%	6%	25%
	3	64%	18%	12%	6%
	5	73%	18%	9%	

SU and R schools, verbalization for the ULC children does not follow the pattern. For example, as the UUC, SU and R subjects are older there is an increase in the percentage who can give a class label for class groups, a functional label for functional sorts and/or a color rationale where appropriate (category labelled "correct"). While there is an increase in the percentage who gave correct responses between grades one and three for the ULC Ss, there is no further increase by grade five; only 52% of both third and fifth graders can give a reason for their grouping that is consistent with the type of group actually made.

Further, while the percentage who simply named the objects, or who stated they were the same, decreased across grades for the UUC, SU and R children, it remained the same for the ULC sample. Thus, while the performance of the children from the lower-middle-class urban area indicated that they had little difficulty making class groups -- they were within an urbanization continuum in terms of types of groups created as presented in Tables 5.2 and 5.3 -- their ability to verbalize their grouping was more erratic than for any of the other socio-economic groups sampled.

In summary, the different ways of looking at the data from Part I of the Rae-Eva yielded results indicating both age and school location differences in the way the children sampled approached the free-sort task. As children were older they were able to make more complete groups in the sense that they included all the exemplars of the class within a group rather than creating a series of two-object groups. Also, older children tended to utilize abstract criteria as a basis for grouping more consistently than younger

children, who created many groups using perceptual or unclear criteria. While the use of functional relationships decreased slightly across grades, function remained a relatively important criteria regardless of grade or degree of urbanization.

The data presented on the free-sort task clearly does not contradict current understanding of classification behavior. It lends support to the notion that older children are better able to use class criteria and rely less on perceptual cues such as color and form as bases for equivalence. Another hypothesis suggested by the data is that there is a difference between urban and rural children in terms of their performance on a free-sort task such as the one presented. This is suggested by the fact that not as many rural children utilized the class criteria and by fifth grade many were still creating groups whose basis for equivalence was unclear. A degree of urbanization difference was also found to obtain in terms of the S's ability to explain the basis for his sorts. However, the performance of the ULC children clearly did not fall within the continuum. The verbalization ability of first graders was similar in all schools. While the UUC, SU and R children's verbalization became more correct in the third and fifth grades, as did their performance, the ULC children's verbalization did not improve with their performance from third to fifth grade.

Part II, Results

In Part II of the Rae-Eva children were asked to select four objects they liked best from among the 25 used in Part I. The

subject's responses were noted in the order in which selections were made. To look at the data percentages were calculated. For each of the various school and grade cells the number of times an item from each of the five classes (work, toys, learning, humans and animals) was chosen was divided by the total number of responses. (The total number = the number of children in the cell x 4 since each child made four choices.) The resulting percentage represents the degree to which exemplars from a given class were found among the choices of the Ss within a given sample group.

For example, 78 of the 324 (81 Ss x 4 responses) choices by UUC children were work objects, 24% of their total responses. On the other hand, only 6% of the rural Ss total responses included exemplars of the toy class (13 divided by 56S x 4 choices.).

The percentages do not indicate how many Ss included objects from a given class. Some children may have chosen all work items and another may not have included any. The percentages represent only the relative frequency of the different class objects among the total number of possible choices. Thus, the pattern of individual responses is not reflected by the data as presented. The percentages calculated are found in Table 5.5 and are presented by school location and by grades.

In the discussion of the 25 items used in the Rae-Eva it was noted that a typewriter was included in the hopes of finding a work object for women that involved work outside the home. Children's use of the typewriter in the free sort, however, indicated that it

was more frequently included with school associated objects. In Part II it was chosen as a "liked" object so frequently that the percentage of choices for the typewriter were calculated separately; it was not included in the calculations for the work or learning tools groups.

The data in Table 5.5 reinforce the findings on Part I in terms of the low usage of toys, especially by SU and R children who seldom chose play items. Toys represented only 5% of their choices. On the other hand, the urban children chose humans and animals less frequently than their SU and R counterparts. Perhaps these differences reflect the environment of the Ss; the rural child has few commercial toys and in the urban environment the children do not have frequent contact with the animals included among the items; the one exception is the dog. (The other animals included were a horse, chicken and pig.) Although the urban children created animal sorts in Part I of the Rae-Eva, animals were not chosen as best liked. Thus, frequency of contact may have affected the child's choice of an object as something he likes.

Another difference by schools was in terms of selecting learning tools. The UUC Ss, compared with the other schools, included more learning tools as best liked. Within the learning tools category there were further school differences when responses were looked at by grade. As children are older there is an increase in the percentage of choices representing learning tools for the ULC, SU and R Ss. In the UUC schools, however, the trend is reversed; older children are less likely to include learning tools among the

TABLE 5.5

The Relative Representation of each Class Category among the Best-Liked Items: Percentages by School and Grade

Criteria	School			Grade			
	UUC	ULC	SU	R	1	3	5
Work	24%	17%	16%	20%	19%	16%	21%
Toys	19%	12%	5%	6%	13%	9%	9%
Learning Tools	29%	19%	20%	20%	18%	22%	26%
Humans	14%	18%	22%	20%	19%	22%	15%
Animals	13%	15%	22%	22%	22%	17%	15%
Typewriter[a]	0[b]	18%	16%	12%	10%	12%	14%
Animate	27%	33%	44%	42%	41%	39%	30%
Inanimate	73%	67%	56%	58%	59%	61%	70%

[a]Although the typewriter does not represent a class, it was chosen with sufficient frequency to be of interest. Thus it was included in this table.

[b]At the time the UUC children were tested the typewriter was not included among the items. Therefore, it could not be chosen as one of the best liked objects.

items best liked. (UUC 1st = 36%, 3rd = 30%, 5th = 29%; ULC, 1st = 15%, 3rd = 19%, 5th = 29%; SU, 1st = 18%, 3rd = 35%, 5th = 33%; R, 1st = 9%, 3rd = 10%, 5th = 26%).

There is another way to look at children's choices. If the five class groups are divided in terms of animate (human, animal) and inanimate (Work, Toys, Learning tools) an urbanization difference is apparent; 27% of the UUC children's choices were animate objects while 42% of the R children's choices reflected the animate category. In terms of grade differences irrespective of school location, 41% of the 1st graders choices included animate objects. This decreased to 39% for 3rd graders and 30% for 5th graders. With an increase in age there appears to be a decrease in the choice of animate items. Along the grade continuum there is a slight decrease in the selection of play objects and an increase in the number of school related items. Further data on the Ss use of the various objects are provided in a discussion of Part III of the Rae-Eva.

Part III, Results

While Part II was designed to elicit a child's preference, Part III asked for the child's perception of what is most important for a child of his age and sex. Among the options available were work items, toys and learning tools. The subject was asked to select a work, toy or learning item as "going best" with a child of his age and sex. The child was given three trials with different items included in each trial. Once again percentages were calculated to look at the data. The number of times a work, play or learn item was chosen was

divided by the total number of possibilities (the number of Ss x three) for each cell. Thus 68 out of 243 (81 Ss x 3 trials) choices for UUC children were work objects (28%) and 66 out of the 168 responses (56 Ss x 3 trials) or 39% of the R Ss choices were related to work. The percentages by school location and grades are presented in Table 5.6.

The data on school location indicate several consistent trends. Following an urbanization continuum from urban to rural there is an increase in the selection of work and learn items and a decrease in the selection of toys as being appropriate for the children sampled. While the difference in percentage for each of the three types of items is minimal for the UUC groups (range = 11%) the more rural groups clearly distinguish between the different classes (range = 31%). The rural Ss see school related items as important to a child in their position; toys play a minimal role.

For both school location and grade, the relative position of each of the three abstract classes is the same regardless of grade; school related objects are seen as most appropriate, followed by work then play items. The variance is greater in the 5th grade than in first. As children are older they attach greater importance to learning and slightly less to work items.

It is interesting to compare the results of Part II with those of Part III. As noted in the discussion of Part II, the UUC Ss included a greater percentage of learning tools among their choices of best liked than did any of the other school groups. However, in

TABLE 5.6

The Relative Representation of the Work, Toys, and Learning Tools Categories as Most Appropriate: Percentages by School and Grade

	School			Grade			
Category	UUC	ULC	SU	R	1	3	5
Work	28%	31%	38%	39%	36%	35%	31%
Toys	33%	25%	18%	15%	24%	23%	22%
Learning Tools	39%	44%	44%	46%	40%	42%	47%

Part III, where children indicated what they saw as most important for children like them, a lower percentage of the UUC children chose school related items as compared with other school children.

A possible explanation for this may come from the children's expectations for education. To the UUC child school is part of the projected life-style. They expect to enter school at the age of seven and to progress from one grade to the next with little or no interruption. Parents are interested in the child's accomplishments at school and follow the child's progress closely. The UUC child is given books of his own and is read to by adults. Thus the tools of learning are a part of the child's life long before he enters school. Thus, it is not surprising that the UUC child "likes" the learning tools included in the Rae-Eva; he has had experience with them.

On the other hand, the more rural child relates to the school and formal education in a different way. His parents have minimal education and generally do not have high expectations for their children in terms of education. Thus attendance for the rural child is sporadic and children repeat grades frequently. At school the child is told how important it is to receive an education and he begins to value education, increasingly so as he is older.

This relationship to the educational system may account for children's choices in Parts II and III of the Rae-Eva which are as follows: Few children in rural first grades select the objects for learning as best liked. In the third and fifth grades a greater percentage of the choices are school related items. In terms of assessing the relative importance of work, toys and learning tools the choices of the rural Ss indicate that they are very aware of the importance of education; nearly half of their choices were school related objects. The rural fifth grader has had to work much harder than the UUC fifth grader to attain the status of a fifth grader. This may be reflected in his choice of learning tools as appropriate to a child of his age.

Summary

Classification means many things, and the results of a classification test have to be looked at within the parameters of the task given to the subject. The Rae-Eva was designed to look at children's performance under three different testing conditions using one set of 25 objects, a set of objects selected to

exemplify five abstract classes--work tools, toys, learning tools, human and animals. In reality, only Part I is a classification task. Parts II and III provide information on other ways children handle the same materials and thus the results may provide some explanations for the way children chose to group the materials in Part I.

When the Rae-Eva was designed, it was hoped that enough data could be obtained to generate some hypotheses about a defined set of classification behaviors within the population sampled. The use of the task in Colombia was clearly exploratory. The results do lend credence to current theories on the development of classification behavior. Results which support the theories enunciated by Inhelder and Piaget and by Bruner and his associates include the following:

1. As they are older children progress from the use of exclusive two-object groups to three or more object inclusive sorts.
2. As they are older children are more likely to sort all the objects presented to them into a group. In other words, each object is considered and then assigned to a group.
3. Younger children (first graders) are able to use abstract class criteria to create groups, but they have difficulty verbally defining the relationship between the objects. Older children (fifth graders) are able to provide a rationale which relates to their actions.

In terms of preferences, the data indicate differences related to degree of urbanization and grade. If the objects utilized are divided into two groups--animate and inanimate--there is a trend for urban children to prefer inanimate objects, with the more rural children sampled preferring animate objects. In terms of grade differences, older children show a greater preference for inanimate objects than younger children who appear to be more oriented toward the animate.

These findings need to be explored further and related to other things known about the population sampled. This will be done to some extent in Chapter VII where the results of the Evans-Segall Task, as utilized in Colombia and Africa, will be discussed and considered in light of supporting data from each country. In Chapter VI the results of the administration of the Evans-Segall Task in Uganda are presented in greater depth, providing a base for the comparative discussion in Chapter VII.

CHAPTER VI

AFRICA: A FURTHER LOOK AT THE DATA

In Chapter II the Evans-Segall Concept Discovery Task was presented as an example of a cross-cultural classification experiment. As noted, the task was developed because it was felt that there was considerable ambiguity in the results of concept-equivalence tasks previously used with various African populations. The task is described in enough detail in Chapter II to provide the framework for the study carried out in Colombia, as discussed in Chapters III and IV. However, in order to compare the results of the task as administered in two different cultural settings, the African data need to be more fully explicated. Thus, within this Chapter the results of the Evans-Segall Concept Discovery Task as administered in Uganda, East Africa are presented and discussed.[1]

The questions which served as a base for the design and implementation of the Evans-Segall Task and related experiments were as follows:

1. Is it generally easier for children to learn to sort using perceptual criteria than it is to sort on the basis of abstract characteristics? If one accepts the results of previous studies as showing that color is preferred over class in free-sorting tasks, one must still ask whether comparable results would occur in a learning task.

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[1]A portion of the material in this chapter is taken from an article written by the author and Marshall Segall for the Journal of Social Psychology, 1969, 77, 35-53.

2. Is the ease of learning either color or class criteria related to age? Of most interest here is a possible interaction between task and age; for example, one task could be more easily learned than the other at a particular age. That difference may be diminished, eliminated, or reversed for older children.

3. Is schooling a factor in the concept-equivalence process? Again, of most interest is a possible interaction with tasks.

4. If schooling is found to be a factor in the performance of children, will performance by adults on the same tasks show comparable effects?

5. How does the discriminability along a particular stimulus dimension affect the relative ease of learning to sort on the basis of that dimension? If in the present study superior performance on one task was found to hold over more than one set of stimuli, with the sets varying in discriminability among the individual exemplars, any cross-cultural difference could not be due solely to differential discriminability.

Throughout the following discussion of the tasks used in Africa results are related to the questions listed above and, where appropriate, comparisons are made with the results from Colombia.

In Uganda a total of 302 Luganda-speaking children served as subjects. Luganda is the mother tongue spoken by the Ganda people, one of the largest Intra-Lacustrine Bantu groups who make up a part of the population of Uganda. Most Ganda live in rural areas, as is typical of East African peoples, but many live in close proximity to a large cosmopolitan city, Kampala, the capital of Uganda. Some amenities of modern life are available to those in touch with Kampala, but there is a wide diversity of life-styles, with variations best thought of as falling along a rural/urban continuum.

Sampling was done along that continuum. One group of 90 subjects were school children enrolled in a primary school located in the center of Kampala. Many of their parents lived and worked in the city. A second group of 90 children were attending a primary school located 12 miles from Kampala on an important, paved road. While the area in which this school was located was predominantly rural, the majority of the fathers of the children in this group commuted daily to Kampala where they were employed in a variety of jobs. A third group of 90 subjects were enrolled in a primary school located 55 miles from Kampala, 15 miles off the nearest paved road. There was no bus service from this location; one privately-owned taxi covered the 15 miles to the main road, where a bus connection to Kampala could be made once a day. Practically all of the parents of children in this group worked their own farms or were paid laborers on a nearby tea plantation.

In each of the three school-going groups, children were selected from each of three grades--grades one three and five. Thus, a total of nine school-going groups including three grades in school and three degrees of urbanization was obtained.

In addition to the 272 school-going children, two groups of 16 non-school-going children were tested. One group had never attended school and the other children had between one and three years of school. No one in the sample had been in school during the past three years. Both of these groups of children lived in the rural area where the rural school children were included.

The performance of the 272 schooled children is described in the context of the results of a three-way analysis of variance (school by grade by order of presentation). ANOVAs were calculated for age, criterion scores on color learning, and the scores on class learning, as computed for the Colombian sample.[2] Before looking at the results of the ANOVAs for color and class learning a preliminary analysis of the age composition of the sample groups was made. These data are presented before the analysis of variance on the criterion scores.

Preliminary Analysis

As in Colombia, a preliminary analysis of the age composition of each of the groups was done before the results of the ANOVA for criterion scores were considered. In Table 6.1 the ANOVA for age is presented and in Table 6.2 are presented the number of Ss, mean ages in months, standard deviations and range of ages for each of the eighteen school/grade/order of presentation groups.

In the ANOVA for age the main effects of school and grade are significant and can be partially described in terms of the school by grade interaction. As indicated in Table 6.2 there is considerable overlap in age across the various grades, so that grade in school and age are less highly correlated than would be the case in North American or European schools. Still, mean ages do increase as higher grades are considered. Also, the rural school children tend to

[2]It should be noted that the materials, task and procedure utilized in Uganda were identical to the materials, task and procedure used in Colombia, with one exception: the task in Uganda was administered in Luganda while in Colombia the protocol was given in Spanish.

TABLE 6.1

Analysis of Variance for Age Within the Ugandan Sample

Source	M.S.	D.F.	F-Ratio	P
Total	794.62	271		
Between	9482.40	17		
School	4828.39	2	22.69	.001
Grade	73612.93	2	345.99	.001
Order	0.13	1	.00	.98
School x Grade	665.36	4	3.13	.01
School x Order	73.11	2	.35	.71
Grade x Order	496.13	2	2.33	.10
School x Grade x Order	129.52	4	.61	.66
Within	212.77	254		

TABLE 6.2

Age Data for Ugandan Subjects by School, Grade and Order of Presentation

		Schools						
		Urban		Semi-Urban		Rural		Total Grade
Grade	Order	Co/Cl[a]	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	
1	N	15	15	15	15	15	15	90
	$\bar{X}$	75.60[b]	80.80	80.80	87.20	88.00	86.40	83.13
	S.D.	12.79	9.59	14.50	14.67	18.52	14.48	14.09
	Range	60-96	60-99	60-114	72-108	72-132	72-120	
3	N	15	15	15	17	15	15	92
	$\bar{X}$	113.60	102.67	104.00	100.59	124.80	123.20	111.48
	S.D.	8.01	11.26	13.35	11.91	18.03	21.01	13.90
	Range	96-120	84-120	84-132	84-120	96-168	96-168	
5	N	15	15	15	15	15	15	90
	$\bar{X}$	135.60	137.20	133.60	136.80	148.06	149.60	140.14
	S.D.	7.79	10.36	14.25	15.58	19.71	18.07	14.29
	Range	120-144	120-156	120-168	108-156	120-181	132-192	
Total School								
	N	90		92		90		
	$\bar{X}$	107.58		107.16		120.01		
	S.D.	9.97		14.04		18.30		

[a] Co/Cl stands for order of presentation with color first followed by class; Cl/Co stands for order of presentation with class first followed by color.

[b] Age is in months.

be older than their grade peers in the urban and semi-urban schools. In terms of order of presentation, children within the two groups do not differ significantly when the total sample is considered (Mean age in Co/Cl = 111.56 months; Mean age in Cl/Co = 111.60 months). In general the two order of presentation groups present a similar age profile within the school/grade cells as well.

In comparing the African and Colombian samples it is apparent that the total African sample represents an age group at least half a year younger than those sampled in Colombia. While the age profile for the urban schools in the two cultures is similar, the rural schools represent older age groups in Colombia than in Africa. While the African urban and rural populations' mean ages differ by about a year in Africa, a similar comparison in Colombia indicates a two years difference in age (See Table 4.2 and 6.2).

Main Experiment

As noted in Chapter II analysis of variance was the primary statistical tool utilized to compare scores for color and class learning. The calculation of the ANOVA was based on the number of trials which it took for children to reach criterion, the point at which the child had made four consecutively correct sorts. In order to include all the subjects in the analysis of variance, those children who had not achieved criterion were assigned a score of 22, the maximum score possible. For many of the school/grade/order of presentation cells this meant that only one or two scores had to be added. In other instances, however, many of the children did not achieve criterion and

the cell had as many as 50% of the children with the assigned score. The number of children who achieved criterion was related to two things: the grade the child attended and whether or not he was required to learn the given criterion first or second. To look at the different patterns of achievement chi-squares were calculated as was done for the Colombian sample. The results of these statistical analyses were the same for both Uganda and Colombia.

For example, in both Colombia and Uganda grade was related to the number of children who achieved criterion for those learning color when it was second ($\chi^2 = 20.03$, df = 2, $p < .001$) and for the learning of class when it was presented first as well as when it was presented second (Co/Cl Class $\chi^2 = 34.60$, df = 2, $p < .001$; Cl/Co $\chi^2 = 23.39$, df = 2, $p < .001$).

In terms of color learning when color was the first criterion to be learned there was no difference across grades. The learning of color in the Co/Cl order of presentation is very easy, 98% of the Ss achieved criterion on color when it came first and there were no differences in performance as a function of grade in school. (See Appendix E for chi-square calculations.)

In terms of the effect of order of presentation, there was a significant difference between the number who achieved criterion when they learned a given task first as compared to second. This was true for the learning of color and class (Color $\chi^2 = 15.50$, df = 1, $p < .001$; Class $\chi^2 = 8.15$, df = 1, $p < .01$, see Appendix D for the calculation of the 2 x 2 contingency tables).

In summary, whether or not a child achieves criterion on a given task is related to the order in which he learns the given task and what grade he is attending, with the exception of color learning in the Co/Cl learning groups. Under this format almost all children achieve criterion on color regardless of what grade they are attending. Looking at the pattern in terms of the number of children who achieve criterion under different orders of presentation and by grade groups provides some information on the difficulty of the two tasks. An analysis of variance utilizing mean scores for the various school/grade/order of presentation cells provides further data. The ANOVA's for color and class learning are presented below.

Color Learning. -- In Table 6.3 the ANOVA on color learning is presented. Significant main effects were found for grade and order of presentation, with an interaction between the two also being significant. This means that when the color task is presented first it is learned with relative ease by children in all grade groups (see Table 6.4). However, when it is presented after the child has been required to learn the class criterion, color is difficult for first graders to learn, but it is increasingly easier to learn for the third and fifth graders.

What did in fact happen for many of the first graders under the Cl/Co condition was that their initial response was to apply the color bases for equivalency. They consistently utilized color throughout the first twenty trials. By the end of that time

TABLE 6.3

Analysis of Variance on Color Scores

Within the Ugandan Sample

Source	M.S.	D.F.	F-Ratio	P
Total	41.43	271		
Between	199.68	17		
School	9.10	2	.29	.75
Grade	305.29	2	9.90	.001
Order	1806.85	1	58.58	.001
School x Grade	47.66	4	1.54	.19
School x Order	23.62	2	.77	.53
Grade x Order	325.20	2	10.54	.001
School x Grade x Order	17.67	4	.57	.69
Within	30.85	254		

TABLE 6.4

Data on Color Learning for Ugandan Subjects by School, Grade and Order of Presentation

		Schools						
		Urban		Semi-Urban		Rural		Total
Grade	Order	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Co/Cl	Cl/Co	Grade
1	N	15	15	15	15	15	15	90
	$\bar{X}$	7.2	18.0	8.13	16.0	5.4	14.6	11.56
	S.D.	5.14	5.37	6.26	6.99	1.84	7.14	5.46
3	N	15	15	15	17	15	15	92
	$\bar{X}$	5.67	11.07	5.53	10.41	7.2	9.93	8.30
	S.D.	4.61	7.02	3.68	7.48	6.29	6.03	5.87
5	N	15	15	15	15	15	15	90
	$\bar{X}$	6.27	7.87	7.4	11.27	8.9	9.0	8.46
	S.D.	2.34	4.90	4.92	6.20	5.97	3.18	4.58
Total School								
	N	90		92		90		
	$\bar{X}$	9.34		9.79		9.18		
	S.D.	4.90		5.92		5.08		

they generally understood that color was not the correct criterion, but they were not able to focus on an alternative. Thus, when they began the second half of the task they had learned that color was not the right answer, but they did not know what was correct. Thus they were not able to see that now color matching was a correct response.

It should be noted that the pattern of performance in Africa is very similar to that found in Colombia in terms of the learning of the color task (see Tables 4.4 and 6.4). This was also true in terms of performance on the class aspect of the task.

Class Learning. -- The significant main effects in the learning of class indicated by the ANOVA are grade and order of presentation (see Table 6.5). As in the learning of color these two variables interact with one another in a way indicating that the task becomes easier as children are older, and that it is easier to learn color when it is presented first than when the child learns color first and then is asked to learn class equivalency (see Table 6.6).

On one dimension the performance of the children in Africa is different from comparable children in Colombia and that is in terms of the relationship between school location on the rural/urban continuum and performance on the class task. In Africa the data indicate that the task is somewhat more easily learned by urban than rural children, but in Colombia the urban/rural differences are even more apparent. Thus there would appear to be a greater

TABLE 6.5

Analysis of Variance on Class Scores Within the Ugandan Sample

Source	M.S.	D.F.	F-Ratio	P
Total	46.07	271		
Between	317.89	17		
School	61.45	2	2.20	.11
Grade	2230.18	2	80.00	.001
Order	319.02	1	11.44	.001
School x Grade	43.75	4	1.57	.18
School x Order	14.39	2	.52	.60
Grade x Order	76.74	2	2.75	.06
School x Grade x Order	36.14	4	1.30	.27
Within	27.88	254		

TABLE 6.6

Data on Class Learning for Ugandan Subjects by School, Grade and Order of Presentation

		Schools						
		Urban		Semi-Urban		Rural		Total
Grade	Order	Co/C1	C1/Co	Co/C1	C1/Co	Co/C1	C1/Co	Grade
1	N	15	15	15	15	15	15	90
	$\bar{X}$	20.13	18.47	20.60	17.13	19.40	17.27	18.83
	S.D.	4.19	5.42	2.92	5.76	4.52	5.81	4.77
3	N	15	15	15	17	15	15	92
	$\bar{X}$	15.6	13.13	16.00	16.76	16.40	17.47	15.89
	S.D.	6.84	7.22	6.49	4.91	5.83	5.67	6.14
5	N	15	15	15	15	15	15	90
	$\bar{X}$	8.33	7.00	12.07	5.53	12.87	9.13	9.16
	S.D.	4.24	2.42	7.10	1.96	5.73	4.17	4.27
Total School	N	90		92		90		
	$\bar{X}$	13.78		14.68		15.42		
	S.D.	5.06		4.86		5.29		

difference between the urban and rural groups in Colombia than there is in Uganda. This might be explained in two ways. One hypothesis would be that the environmental differences between the lives of children in rural and urban settings is in fact greater in Colombia than in Uganda. This hypothesis can be supported from the standpoint of the two countries' ranking on the developmental continuum described in Chapter III. What happens, in essence, is that those who live in very rural situations in many countries have basically the same kind of environment. Where the differences in developmental ranking are more likely to be evident are in the urban settings since these are the hub of the economy and provide the most contact with other cultures. Therefore, it would be reasonable to suggest that the difference between the life style of the rural and urban Colombian in the geographical area sampled is greater than the difference in the life-style of the urban and rural Ugandans sampled.

A second factor which may have accentuated the urban/rural difference in Colombia results from the types of schools sampled in Colombia in the urban setting as compared to Africa. As noted, there were marked socio-economic differences between the schools in the urban setting in Colombia and for this reason two school types were included in the urban Colombian sample. In Uganda, on the other hand, the urban school included children from all social classes. Thus it may be that the urban/rural differences in Colombia are more the result of the type of schools sampled in the urban area than any real difference between the majority of the urban and rural populations in the performance of the classification tasks presented.

In terms of the questions asked at the beginning of this chapter, the results provide data related to questions 1 and 2. On the Evans-Segall Concept Discovery Task, a learning task, the color criteria were easier to learn than the class rationale to create equivalence groups. From the data presented it is also possible to say that grade, a correlate of age, is associated with the learning of the abstract class task but only minimally related to the learning of the color criteria. These results are parallel to the findings in Colombia.

In order to parallel some of the analyses done on the Colombian data, the African results were re-examined in a similar way. Two things not originally looked at in Africa were children's rate of error after having reached criterion and their preferences. To make cross-cultural comparisons possible the results of these data for the African sample are presented in the next part of this chapter.

The Criterion for Color and Class Learning

As noted, the criterion of four consecutively correct trials was set when the task was developed. The task was designed in such a way that children were asked to respond to fifteen sets of cards on the first half of the task regardless of whether or not they had reached criterion before the designated fifteenth set. Thus, there were additional trials for many children, trials that should have been responded to correctly if the child had indeed learned the relevant basis for equivalence at the earned criterion point.

To look at the pattern of errors in terms of learning the color sort in the Co/Cl order of presentation group the number of trials to criterion was subtracted from 15 and divided into the number of errors made between the criterion set and Trial 15. Thus a child who reached criterion on Trial 4 had 11 additional trials (15 - 4 = 11). If the child missed one trial his error rate was 1/11. The rate of error on color learning was calculated for each of the school/grade cells and is presented in terms of percentages in Table 6.7.

The error rate is highest for the first graders and decreases as children are older. In general the percentages are low and would suggest that the criterion of four consecutively correct trials is realistic; it can be assumed that the color equivalence is learned when the child reaches the criterion. These data follow essentially the same pattern indicated in the Colombian sample (see Table 6. 7).

TABLE 6.7

The Percentage of Error on Additional Trials on Color Learning (Co/Cl) by School/Grade Groups

	Schools		
Grade	Urban	Semi-Urban	Rural
1	5%	5%	14%
3	3%	4%	2%
5	3%	4%	7%

In terms of the learning of class there are clearly problems in assuming that when the child reaches the criterion he has in fact learned to use the abstract basis for sorting. The percentage of error presented in Table 6.8 indicates that at least one-fourth of the trials presented after the criterion point were incorrectly sorted by first graders. The rate of error decreases as children are older, but it is questionable if all the children who reached the criterion point actually had an understanding of how to consistently use the abstract basis for creating equivalence groups.

Once again the pattern of errors is similar to that found in the Colombian sample. The only exception is that the Colombian first graders made a greater percentage of error on the use of class than their African counterparts (see Table 4.8).

TABLE 6.8

The Percentage of Error on Additional Trials on Class Learning (Cl/Co) by School/Grade Groups

	Schools			
Grade	Urban	Semi-Urban	Rural	Total
1	25%	27%	36%	30%
3	20%	30%	29%	24%
5	19%	11%	14%	15%

The Evans-Segall Task and Children's Preferences

As in the Colombian study the data from Africa were examined in terms of children's preferences for color or class as evidenced by their initial response to the first set of four stimuli presented to them. The percentage of color responses was calculated by dividing the number of times color was the first choice for equivalence by the total number of subjects within a given cell. The same was done for those who chose to use the class criteria. The resulting percentages are presented in Table 6.9 by grade and by school.

The percentages indicate there was no decrease in a preference for color as children are older. In fact, an increase in the choice of the color criteria is evidenced between grades one and three with a decrease for fifth graders. Thus, the percentage of first and fifth graders whose initial response is to create an equivalence group on the basis of the perceptual color criteria is essentially the same. In other words, color is very salient for all the African children; at least half of the children sampled, regardless of school or grade, used color when asked to put together two stimuli which were alike.

There was, however, a grade difference in children's preference for the class criteria. While only 11% of the first graders chose to select two cards related in terms of class, 46% of the fifth graders made this choice; there was little difference between the preferences of the first and third graders. By the fifth grade the number of children who made a color or a class sort on their first response was nearly equal.

Quite clearly the use of the perceptual or abstract criteria is not related to an urbanization continuum for these children. The choices of the urban and most rural school children are essentially the same; there are twice as many initial color responses as sorts made on the basis of class. The semi-urban children used color even more frequently. In all three locations the abstract criteria was the preference for about one-fourth of the children.

TABLE 6.9

Preferences for the Color and Class Criteria on the Evans-Segall Concept Discovery Task: Percentages by Grade and by School

	Criteria	
Grade[a]	Color	Class
1	51%	11%
3	78%	14%
5	47%	46%
School[b]	Color	Class
Urban	54%	26%
Semi-urban	67%	20%
Rural	54%	26%

[a]Differences are significant $\chi^2 = 68.89$, df = 4, $p < .001$.

[b]Differences are not significant $\chi^2 = 4.86$, df = 4, p n.s.

Thus, the grade and school location differences found in Colombia were not replicated in the African data (see Table 6.9 and Appendix F). While the choices of the Colombian children sampled clearly showed a decrease in the use of color as children were older, the African children maintained a high preference for color across grades. However, within both samples there was an increase in the use of the class sort along the grade continuum. Also, the choices in Colombia reflected school differences; there was a clear pattern of preferences for color as one moved from the urban to rural environment and the more urban children used class more frequently than their more rural counterparts. In Africa the sociological environment as defined by the schools sampled did not relate to the children's preferences for either color or class. In all the schools sampled the perceptual criteria of color was clearly preferred. A chi-square comparing the use of color in Colombia and Uganda by the three grade groups indicated that the Africans prefer color throughout the three grades while the use of color decreases from first to fifth grade in Colombia. By grades, the differences in the two cultures in the preference for color is significant ($\chi^2 = 9.47$, df = 2, $p < .05$. See Appendix F).

The Relationship Between Age, Grade and Environment

Since significant age differences between schools were found the correlation between age and both color and class learning was calculated. While the correlation between age and color was not

significant ($r = -0.165$), for class learning there was a significant negative correlation ($r = -0.464$, $p < .001$, $N = 272$), meaning that the older the child, the lower the criterion score, and thus the better the performance.

Thus, although there were significant differences between the schools in terms of age, color scores were relatively unaffected by these differences since age played a minimal role in predicting color scores. On the other hand, mean scores on class learning should be reconsidered in light of the correlation between learning the class sort and age, a correlation indicating that 20% of the variance is explainable by age. Given the direction of the correlation it would be predicted that older children should find the task easier than those who are younger. Following this line of reasoning, children in the rural sample should have lower mean scores than Ss in the urban setting since rural children are, on the average, older than their urban grade mates. In fact, the opposite trend exists. This suggests that there may be a significant urban/rural difference on the class learning task, with African children in the rural area having more difficulty learning the class sort than urban children. This finding is in line with the results of the Colombian study where a school difference in terms of class scores was found to obtain.

The data from the African sample suggest that the subject's age and his environment as well as his grade in school relate to his performance on the class learning task. A further look at the data, however, reveals that the relationship between these variables is complex.

When the performance of children of various ages within each grade is examined it is clear that the within-grades relations of age to performance is not linear. Within each grade the poorest performances occurred among both the younger and the older children, while the better performances were given by children nearer the median age for their grade. Children of 13 to 16 years of age, most of whom were in grades three and five in the rural school, had particular trouble with the sorting-by-class task, doing as poorly as children who were only six or seven years of age in grade one. It may be, of course, that the children who are above the median in age for their grade are generally less able. It was ascertained that a number of the older children in the rural school had repeated grades. However, many of the factors affecting school attendance as described for the Colombian sample are applicable in the African situation and appear to affect the age composition and repeating within the African classroom in much the same way (see the discussion in Chapter IV).

To further study the relationship between age, school attendance and performance the Evans-Segall Task was administered to a sample of unschooled Ugandan children in an ancillary experiment. Thus the performance of schooled and unschooled children of similar ages could be compared.

The First Ancillary Experiment

As noted earlier, 32 unschooled children were given the Evans-Segall Task. The children were divided into two groups:

those that had received no schooling and those who had from one to three years of schooling. The effects of schooling, both in terms of grade in school and school attendance per se, can be seen by comparing Table 6.10, where trials to criterion are shown for the unschooled group, with Tables 6.4 and 6.6. The unschooled children clearly performed as well as the school children on the sorting-by-color task, but much more poorly on the sorting-by-class aspect of the task. Regardless of amount of schooling, color was relatively easy for all groups sampled, schooled and unschooled. Class learning, on the other hand, appeared to be related to schooling, and to a lesser extent, order of presentation.

TABLE 6.10

Performance on Color and Class Learning by Unschooled Subjects

Amount of Schooling	Order	Age	Color Co/Cl	Color Cl/Co	Class Co/Cl	Class Cl/Co
none	X	= 12.1 yrs.	7.2	7.2	20.0	
	N	= 16	%[a] 100	100	12.5	0
	R	= 9-18				
1-3 yrs.	X	= 12.9 yrs.	5.3	8.7	20.3	16.28
	N	= 16	% 100	100	37.5	87.5
	R	= 9-17				

[a]This indicates what percentage of those sampled learned the relevant task.

The Second Ancillary Experiment

After having found evidence in the main experiment that the ability to learn to sort by class was improved by schooling (and to a lesser extent by presence in an urban environment) and that age *per se* could not account for this improvement, an experiment was conducted with 61 adults, 30 in an urban and 31 in a rural setting. Some adults had received less than four years of primary education, others had between four and seven years of schooling, but all of them had received their schooling many years prior to the testing. The same materials and procedures as in the main experiment were employed.

The most striking finding was that none of the adults, neither rural nor urban, who had had less than four years of education could learn to sort by class. Moreover, neither could some of the rural adults who had had between four and seven years of education. On the other hand, nearly all adults reached the criterion on the color-sort task. Of the 28 adults with less than 4 years of education, all failed to reach criterion on class sorting, while only two failed on color sorting. Of the 33 with 4-7 years of schooling, eight failed on class sorting and one failed on the color part of the task.

The mean trials-to-criterion scores, presented in Table 6.11, also indicate the importance of education and urbanization. In addition, they show sequence effects as in the main experiment. For all subgroups of adults, sorting by color was easier than

sorting by class. Sorting by color was equally easy for all subgroups, with the one exception of the urban adults with 4-7 years of education, for whom a sequence effect was found. Within this group those who sorted by color first did significantly better on color sorting than did those who first sorted by class ($p. < .05$). Rural Ss did slightly, but not significantly better than urban Ss in learning to sort by color.

TABLE 6.11

Mean Trials to Criterion by Adults of Two Educational Levels and Environment for Color and Class Learning

			Color		Class	
Area	Schooling	Order	Co/C1	C1/Co	Co/C1	C1/Co
Urban	0-3yrs. N = 14	$\bar{X}$ =	8.33	8.25		
		%[a]	100	100	0	0
	4-7yrs. N = 16	$\bar{X}$ =	6.44	10.37	13.13	11.22
		%	100	100	75	87.5
Rural	0-3yrs. N = 14	X =	7.66	8.71	0	0
		%	100	71.4		
	4-7yrs. N = 17	X =	6.50	7.88	17.25	13.25
		%	100	88.9	62.5	77.8

[a]This indicates the percentage of those sampled who learned the task.

On sorting by class, as noted, only those Ss who had at least four years of school attained criterion. Among these the urban Ss performed slightly better than the rural Ss, particularly when class sorting was the first task. For Ss exposed to the tasks in the Cl/Co sequence the difference between the scores of the urban and rural Ss was significant at the $p < .05$ level of significance.

The data in Table 6.11 clearly indicate that ease of learning to sort by class was enhanced by education. Neither rural nor urban adults who had less than four years of education could reach the criterion, whereas those who had more than four years of schooling performed almost as well as the schooled children (overall mean = 14.64) and considerably better than the unschooled children (overall mean = 19.36). Thus the results of this experiment lend further support to the view that education, rather than age *per se*, is the factor relevant to performance on the class task. As for the color task, no effect of education on learning to sort by color was found other than the sequence effect described in the preceeding paragraph.

The performance of the adult groups requires comment. It is difficult to believe that functioning adults, who attend regularly to objects, noting what they are for, are unable to learn to sort objects on a class basis. With the materials used in the experiment, however, it is quite possible that the difficulties they and the unschooled children experienced reflected a combination of an inability to "read" the pictures, and a relatively

naive misunderstanding that they had been instructed merely to select things that were physically alike. This explanation may also hold for the less well-educated children.

Ss with more schooling, on the other hand, were able, probably as a result of school-based experiences, to read the pictures easily, to entertain more interesting hypotheses, and generally to comprehend the class-sorting task more readily than the lesser educated children or the adults for whom schooling was a remote experience.

The Third Ancillary Experiment

This experiment dealt with a simple question: If color were drastically reduced in salience, would the ease of learning to sort by class be enhanced or would a change in performance occur only on the color-sorting task? The experiment set up to answer this question speaks to question 5 asked at the beginning of this chapter, and resulted from the fact that the saliency of the perceptual attribute may have been so high in the materials used in the main experiment that the difficulty of learning to sort by class was enhanced.

The materials used in the present experiment were identical to those in the main experiment, except that the color dimension was changed. Those pictures in each set which had shared a color were shaded and the other two were outline drawings. Subjects in this experiment were 30 third graders in an urban school. It

was an urban third grade group in the main experiment that had yielded results most typical of the overall performance of school-going children.) The procedure in the main experiment was repeated.

Whereas only two Ss out of 30 failed to reach the criterion on color sorting in the main experiment, 19 failed to learn to sort shaded vs. unshaded cards. However, about equal numbers in both experiments failed to reach criterion on class sorting. Trials-to-criterion were greater for shaded vs. unshaded than for color, but trials-to-criterion for class sorting in the present experiment were no lower than they had been in the main experiment. They were, in fact, slightly higher. Clearly the effect of the change in stimuli was to make the sorting by physical appearance harder to learn, but it did not make sorting by class any easier.

A detailed comparison of the performances of the two groups of urban third graders may be found in Table 6.12. It should be noted that the kind of primacy effect that had been found in the main experiment occurred again for class sorting, but this was not found for sorting by shaded vs. unshaded. Ss confronted with this as their first task found it particularly difficult. There can be no doubt that the change in stimuli made sorting by physical appearance very difficult, without concomitant effects on learning to sort by class.

TABLE 6.12

Mean Trials to Criterion for Color and Class Learning in the Main and Ancillary Experiment for 3rd Graders

Experiment		Color			Class		
		Co/Cl	Cl/Co	Comb.	Co/Cl	Cl/Co	Comb.
Main	Mean	5.67	9.38	7.4	9.90	11.33	10.6
	%[a]	100	87	94	73	60	67
	N = 30						
Ancillary	Mean	11.2	8.0	9.7	10.8	14.7	11.9
	%	40	33	37	100	60	80
	N = 30						

[a]This indicates the % of those sampled who learned the task.

Discussion

Despite the effects of age, schooling and environment (urban vs. rural) it is clear from this study that learning to sort pictures on the basis of their physical appearance was generally easier than learning to sort on the basis of the abstract attributes of the objects pictured. Learning to sort on physical appearance was easy for all Ss as long as the relevant physical attribute was salient. This simple fact may have a simple explanation. The Luganda word bifaanagana, like its English translation "alike," has the primary connotation "alike in physical appearance." While it may also mean alike in other ways, its use in the instructions may have suggested to most Ss that they should attend first to physical appearance. Moreover, because physical appearance is immediately obvious, whereas the detection of the abstract characteristics of a pictured object requires a fairly complex chain of mediating responses, matching on physical appearance should naturally be a much more potent response than matching on the basis of class.

On the other hand, levels of intelligence and type of experience (in some unknown multiplicative combination) were probably required to learn the sort-by-class task employed in the experiments. The findings suggest that the experience factor, as represented by years in school and to a lesser extent by urbanization, was a critical one. The relatively poor performances on class sorting of schooled children who were over-age for their grade and, less convincingly, of the unschooled children (some of whom may have not

entered school because of ability deficits) suggest that intelligence might also be considered a factor. The main facts which support the hypothesized role of experience are, of course, the effect of increasing years in school and the difficulties experienced by unschooled children and by rural adults who had attained only low levels of education.

The parallel analyses of the African and Colombian data reveal some striking similarities and contrasts between the two samples. For example, first graders preferences for color were evident in both cultures. While in Colombia the preferences for color decreased and a preference for class increased as children were older, the pattern in Africa was different. There was an increase in the use of class between the first and fifth grades, but color remained the preferred choice of half of the Ugandan children regardless of grade or school location.

In terms of rate of error, as determined by the number of sets incorrectly sorted after the child had reached criterion, both samples followed a similar pattern. A relatively small percentage of errors were made in the learning of color (Co/Cl). However, many children incorrectly sorted the sets of cards presented to them after they had theoretically learned to use the class criteria, suggesting that, in fact, many of the Ss credited with learning the class task did not have a clear understanding of how to consistently apply the criteria.

In both cultures it is clear that performance on the two tasks cannot be predicted on the basis of a child's age, grade in

school or degree of urban environment alone. For all children the learning of color is relatively easy. The learning of class, however, appears to be related to both grade and environment in Colombia, and age, grade and environment in Africa. A further explication of results, cross-cultural comparisons and their implications are to be found in Chapter VII.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The primary need of man is to adjust himself to the environment. Any group of human beings has to deal with how they can exist together in the environment to satisfy both their physical and social needs. Each tool, weapon, process of hunting or fishing, article of dress, and type of shelter is tentative, then gradually elaborated and adjusted to man's needs. Through time it is impossible to distinguish individual contributions to the culture and the whole web persists in as concrete and undeniable a form as the environment itself. Into this a child is born. The child becomes a member of his culture through formal and informal interaction with the tools of the culture and those who use the tools.

In the early 1900's when efforts were first made to compare the innate capabilities of people from different cultural groups, psychologists made some assumptions about the growth of mental processes. One assumption they made was that there is a best way to organize the world around us; those who did not hold the same world view were seen as lower than Western man on a cultural developmental continuum. When intelligence was defined by Binet and others, Western psychologists then had something against which to measure the mental development of people from various cultures. Not surprisingly, those from other than Western

culture groups performed poorly on the tests, which only reinforced the notion that people from the so called less developed cultures were also less developed mentally.

It is only recently that researchers have begun to suggest that the same cultural environment which fosters a diversity of abilities in terms of dealing with the physical world also reinforces differential cognitive skills.[1] Take for example the work of Cole and his associates who, using an approach known as experimental anthropology, studied a single culture using the tools of both anthropology and psychology (Cole et al, 1971). By doing an extensive ethnography of the Kpelle in Liberia they identified cognitive processes as used by the Kpelle. They then designed tasks to test out their understanding. As well as comparing different subgroups within the Kpelle culture, they also compared the results from the African experiments with results from similar groups in the United States.

The researchers concluded that, in fact, they could not identify processes that the Kpelle use that are not used by those in the U.S.A., but rather, their research indicated that the differences between the Kpelle and North Americans are in the way the two cultures choose to apply the processes. Upon completing a series of experiments relating to classification they conclude:

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[1]For more complete description of the change in the approach to cross-cultural research see Evans, 1970.

> The entire series of studies described...underlines the fact that it is very difficult to discuss "cognitive skills" in a context-free manner. In some of our experiments six to eight year olds were rote learners; in others they responded in terms of stimulus relations. Sometimes our twelve- to fourteen-year-old children responded differently from the younger children. But on other occasions, increases in age led to changes in the way in which learning occurred only if the child attended school. We have identified patterns that we can call rote and concept-based learning, but we do not know the laws determining which situations will evoke which kind of learning (Cole et al., 1971, p. 175)

The results from the Evans-Segall Concept Discovery Task as used in both Uganda and Colombia lead to a similar conclusion. In this chapter the data supporting that conclusion are presented in terms of comparing the two cultures sampled. Subsequent sections of the chapter deal with the implication of the findings and suggest further hypotheses that should be explored.

A Cross-Cultural Comparison

In order to make the results of a cross-cultural study interesting the temptation is to highlight the differences between the given populations. But, in fact, it may be more important to note the similarities. The use of the Evans-Segall Concept Discovery Task in Uganda and Colombia made it possible to look at the usage of an aspect of the classification process within two differences between the two cultures in their performance on the task, similarities largely overshadow the differences.

For example, in both cultures it is clear that on the Evans-Segall Task the color concept is easier to learn than the class

basis for equivalence, regardless of whether the children are required to learn it first or second. Color is learned with equal ease at all grade levels sampled when it is the criterion to be learned first. When it is presented after the child has learned the class task, grade in school becomes a predictor of how rapidly it is learned with higher grade children learning the color criterion more easily than lower grade children. Essentially this means that the older children are able to switch from the use of the class criterion to the color with greater ease that the younger children sampled. For the oldest group sampled (fifth graders), the color criterion is learned in the same number of trials whether it is presented first or second.

The class criterion, on the other hand, is difficult to learn for all but the fifth graders who learn class as rapidly as they learn to use the color basis for equivalence. Essentially in both cultures it becomes easier to learn the class task as children are in higher grades.

The general results cited above overlook some of the independent variables that were taken into consideration when the testing groups were created. The variables of grade in school and degree of urbanization were considered potentially important. Thus the samples were divided into three grade groups (1,3,&5) and the school population included three degrees of urbanization. The different grade levels were included to look at the relationship between the S's age and his performance of the task. As it

turned out, however, the variables of age and grade were not synonymous so the two variables were considered separately. In the following section of this chapter the relationship between age and/or grade, and performance on the task is explored, leading into the subsequent section which deals with the function of schooling in terms of the task utilized.

Age, Grade and Performance -- In the studies described in Chapters I and II a positive correlation between age and performance on classification tasks is hypothesized. Basically the theory states that as children are older they are better able to use abstract criteria for equivalence while younger children rely on the perceptual cues to guide them in creating classes of objects. In the research using the Evans-Segall Task in Uganda and Colombia, it is quite clear that there is no linear relationship between age and performance on the task for the age groups sampled.

In neither Uganda nor Colombia was there a significant correlation between age and the learning of the color sort. Also, there was no significant correlation between age and the ability to select out and consistently use the class criteria for the Colombian children, but in Africa the findings were somewhat different. For the African children sampled there was a significant correlation between age and class learning. The correlation was - 0.46, indicating that as children were older the task was learned in fewer trials, thus it was easier. Since the correlation is

relatively low, age can be said to account for about 20% of the variance, and it would have to be concluded that age is not a strong predictor of how children will respond on even the class learning aspect of the task.

The fact that age is not a good predictor of performance on the task may be due to several things. One explanation is in terms of the age range sampled. The youngest children sampled in Uganda and Colombia, basically seven-year-olds, were equivalent in age to some of the children whom Inhelder & Piaget describe as having reached the higher stages of classification development. In other words, the correlation between age and performance did not occur because the sample in Uganda and Colombia did not include the age group said to be dependent upon perceptual cues (2½ - five year olds). Originally the task was tried with younger children. But, given the structure of the task and what was required of the Ss, the younger children were unable to do the task. Thus they were not included in the main sample nor in additional studies.

Secondly, the relationship between age and grade was confounded. In neither Colombia nor Uganda was there a linear relationship between age and grade. There was an overlap of the ages of the children attending the three grades sampled (See Tables IV-2 and VI-2 in terms of the range of ages for the various grades). This is caused by the fact that children start school

at different ages--some when they are the correct age in terms of government requirements (7 years old), others when there is money available for their schooling (age seven and older), and others have the opportunity to attend two years of kindergarten before entering the first grade, but if they are "ready" they begin first grade at age five.

Other things which affect the age of any given grade group are the drop-out/re-entry patterns and the large proportion of the children who repeat grades. In both Colombia and Uganda repetition of a grade is very common, with some children having repeated as many as three years by the time they are in the fifth grade. All of these factors mean that within any of the grades sampled, a large proportion of the children are clearly older than others in the same grade group.

Thus, age as a variable in and of itself is not a good predictor of performance on the Evans-Segall Concept Discovery Task. A child's grade in school, however, is a fairly good predictor of how the child will handle the task.

Schooling and Performance -- The relationship between grade and performance on the task points to an important issue and that is the role of schooling in the learning of concepts. The fact that grade in school was found to be a better predictor of performance that the child's age is in line with other cross-cultural studies in Africa which suggest that schooling--whether children attend school and what grade level they have attained--

is an important variable in determining how children will perform on classification and other Western concept development tasks which are clearly outside of the traditional culture of the peoples tested (Gay & Cole, 1967; Greenfield, Reich & Olver, 1966; Kagan & Hall, 1972; Cole et al., 1971). Cole and his associates state: "Attendance at Western-style schools enormously speeds up the development of problem-solving skills." (Cole, et al., 1971, p.17) Further on they add: "Schooling represents the single most powerful institution for producing non-traditional, acculturated people...throughout Sub-Saharan Africa." (Cole, et al., 1971, p.26)

In the African study it was possible to include unschooled children in the sample to look at patterns of performance as related to school attandance. In Uganda children who were not attending school at the present time and who had less that three years of schooling, but who were the same age as those currently in school, were administered the Evans-Segall Task. For these children the learning of the color criteria for sorting was relatively easy. In fact, they learned it in the same number of trials as their school-going counterparts. However, it was extremely difficult for the unschooled children to learn to consistently use the abstract class criteria to create equivalence groups, and in most cases they failed to learn the class criteria. Thus it would appear that the class learning aspect of the Evans-Segall Task was affected by school attendance. This is not to say that the unschooled

children were unable to operate on an abstract level. What it says is that within the task as devised and administered, the children had difficulty using the abstract classification system employed; it was clearly outside their realm of experience.

To further follow-up this finding a group of adults were sampled. They were divided into two groups in terms of amount of schooling which they had received. One group had less than four years of education while the others had between four and eitht years of schooling. Once again the amount of schooling was a good predictor of performance. For those in the relatively uneducated group the learning of the class task was almost impossible, while those who had received more schooling learned the class task, although it took them more trials than it did for the children in the higher grades who were currently in school. Clearly for the Ugandan sample there was a relationship between amount of schooling and the ability to perform on the class task.

Unfortunately it was not possible to include a group of unschooled children or adults in the Colombian sample. While there were unschooled people in the geographic areas sampled, in general they did not represent the same sociological groups included in the main sample. Clearly school attendance in Colombia is determined by economic variables whereas in Africa going to school is often a function of where a school happens to be located; economics plays an important but secondary role. Thus it was difficult to gather a group of unschooled Ss in Colombia and make a case for their being equivalent, except for schooling, to the school children sampled.

Returning to the Uganda data, it is interesting to note that in terms of the color task, neither age nor schooling appeared to be an important variable in predicting performance for the ages and grades sampled. Regardless of whether or not the S had received schooling, or how much, color was a relatively easy task to learn. The salience of color was particularly obvious when the unschooled adults were tested. In one instance a second grader entered the room while his mother was attempting to learn the class task. The mother was consistently using the color basis for equivalence. When she was told that was incorrect she would look for more subtle color differences. Her child came over and showed her the class matches, but the mother rejected them even when the child explained why they went together. When this happened with several sets of cards it became quite obvious that the class grouping of the objects as employed in the task did not strike a respondent cord with the mother's understanding of how the world was organized. This seemed to be the case for those adults who had little or no schooling.

The fact that the unschooled children could learn the color half of the task with relative ease suggests that it was not the requirements of the task that made it difficult for the unschooled groups to learn class criteria. Rather, their inability to use the abstract groups as defined in the task seems to be a function of their inexperience with those groups. The school system, on the other hand, has provided an opportunity for the school-going children to manipulate the objects in the ways specified in the task.

This leads to another point in terms of the effect of schooling. Whether in Uganda or in Colombia it would appear that schooling provides children with greater flexibility in approaching a new problem. Children in the fifth grade approached the color and class learning tasks with nearly equal ease. The task presented first was learned more rapidly than the task presented second, but the fifth graders could switch from one orientation to the other within one or two trials. In essence, the older children could quickly identify what was being asked of them. They could learn a given criteria. Then, when they were told to choose two which went together in another way, they could rapidly identify an alternate criteria for equivalence and use it consistently. Children in lower grades, however, would learn one task and then tenaciously stick to the given criteria even though they were told to select another basis for equivalence in the second part of the task.

The unschooled subjects regardless of age, were even less flexible than the youngest school children. They were firm in their choice of color. Even when shown other matches the unschooled subjects could not understand how the two objects indicated could be called the "same". The description of the interaction between the mother and her child cited earlier illustrates the problem. Basically the schooling situation does two things: it leads to the acquisition of new intellectual skills and it provides children with an opportunity to apply those skills in a number of different situations.

So far two things have been noted: one, schooling is an important variable in the learning of some specific tasks, and two, grade in school is a better predictor of performance than is age. What needs to be explored further is the relationship between the child's age and his performance in the grade he is attending. As noted, many variables affect children's school attendance patterns. How does irregular attendance, caused by dropping-out and re-entering the system, and repetition of grades relate to performance on school related tasks? The importance of answering this question is suggested by the African data where the children who were over-aged for their grade group had the poorest performance within the grade on both of the tasks. This was ascertained by asking teachers to rank children on a four-point scale in terms of their general ability within the classroom. These rankings provided data on the relationship between the student's age, as compared with his grade-mates, and the teacher's perception of the individual as a student. The children who were two or three years older than those in their grade were seldom, if ever, the "star" pupils. The best students were usually those who were close to the correct age for the grade.

Another hypothesis is that the pattern of repeating is an economic problem. Those who start school late and have to drop out and later re-enter the system do so because the family does not have the resources to keep them in school. Their learning is sporadic and thus they have increasing difficulty

keeping up with their age group. The result is that they fall further and further behind educationally. They may perform poorly on tasks because they have missed the six months of school where a basic concept was begun and instead of being able to learn by proceeding from one concept to another, they are forced into trying to learn difficult concepts without an adequate conceptual base.

The patterns of learning for over-aged children need to be more fully explored. On the one hand current knowledge about human growth and development in terms of optimal time for learning different concepts must be considered. For example, what does it mean if children do not begin school until age eight or nine? One approach to cutting the cost of formal education is to wait until children are older before they start school. Such an alternative was suggested by Julius Nyerere in response to rising educational costs in Tanzania.

Another variable which affects the learning process is the relationship between the culture and the school system, particularly in terms of how the two reinforce one another. The importance of this variable is suggested by the fact that the children sampled in Uganda had greater difficulty with schooling if they were over-aged for their grade than the comparable children in Colombia. This may have been due to the fact that the gap between the school system and the culture is far greater in Uganda than in Colombia.

This can be illustrated by looking at some of the variables which determine how much of a gap is created and perpetuated, variables such as: (1) whether or not the language of instruction

is the first language for the child. If it is not, to what extent are the language of instruction and the child's language related? Are they derived from the same language group or unrelated and what does this imply? (2) the degree to which the curriculum is derived from the culture. This includes such things as the values and beliefs which serve as the base for the curriculum as well as the content in academic subject areas.

How are these questions answered in terms of the two cultures sampled? In terms of language the children in Uganda have a vary real problem. Their first language is Luganda, one of the Bantu-Lacustrine group, and it is unrelated structurally to the Latin-derived Romance languages. At the time of the study the Buganda children were introduced to English in the first grade and by the second grade it was the medium of instruction. The curriculum used in the elementary and secondary schools was devised by British expatriates and was designed to prepare children to contend for the scarce places within the British higher educational system. Examples of the ludicracy which resulted from some of the curriculum decisions are many. It is worth noting a few to give a sense of how wide the gap is between the indigenous culture and school expectations. Geography lessons assumed England as a starting point; examples were given by comparing places to various parts of England. Math problems were done in terms of the British monetary system, with its then base 12 and numerous coins which were totally unfamiliar to the Buganda. Nutrition was presented

in terms of food available in the Northern hemisphere, not in terms of anything the Buganda could provide for themselves, and on and on. Fortunately some curriculum changes have been made since the time when the Evans-Segall Task was administered, but the school experience is still essentially unrelated to the culture.

Thus, the Buganda child is required to deal with two major tasks when he enters school. First he has to deal with a totally new and different language and secondly he is asked to use that language to restructure his world and learn concepts foreign to his environment. The home environment does not reinforce the school learning because parents do not understand the concepts taught in school. What needs to be done is to study the relationship between concepts as defined in Luganda and in English. Then, if the decision is made to continue to orient the child toward the Western world, he should be taught the concepts he needs by beginning with the concepts which are already a part of the child's thinking processes. This sounds like an obvious approach to education, but, in practice, it has not been realized.

Turning from the African culture, is there a comparable gap between the schools and the culture in Colombia in terms of language and curriculum? The schooling in Colombia is all in Spanish, the first language of the children sampled, and the curriculum is more closely attuned to the culture. Here again, however, schooling is designed to prepare children for higher education even though the great majority of the children will not go beyond the fifth grade, the last grade of elementary school.

Thus the gap would appear to be much greater for the children in Uganda than for those in Colombia. This may explain why schooling is such an important variable in Africa in terms of learning certain Western concepts. In Africa the school situation essentially provides the only place where children learn about the concepts and how to apply them.

The results summarized above suggest several things which need to be explored and in this last section of the chapter they will be addressed. One area in which there needs to be considerable research is into the relationship between language and culture and the resulting pattern of mental processes which peoples use with facility and difficulty. The second has to do with current interest in non-formal or out-of school education. If countries decide to make their major trusts in education outside of the formal system, the study reported herein, as well as other cross-cultural studies, provide some data of which educational planners need to be aware.

Language and Culture

The continuing debate on the relationship between language and culture, which shapes which, is important in terms of some of the findings reported in this study. The differences which are found to obtain between the schooled and unschooled Ss in Uganda could be explained in two different ways, depending on the theory of language development employed. If a Whorfian

hypothesis is entertained, a hypothesis that argues that one's experience is determined by the language of the culture, then it would be hypothesized that the Buganda cannot experience abstract consepts as we use them if their education took place only in Luganda. It is possible that the culture may actually prevent the development of specific linguistic concepts (see Greenfield, Reich & Olver 1966). This would explain why uneducated adults were "unable" to perform the class aspect of the task; their language is not structured in such a way that the classes, as defined in the task, would provide for them to experience those classes. The school experience, on the other hand, has exposed children to another language, a language which allows for the classes as defined in the task to be experienced, thus they can learn to use the abstract criteria as defined in order to create equivalence groups.

Approaching the problem of language from the generative or transformational viewpoint, where it is given that any language can generate an infinite set of sentences, a discrepancy in performance between schooled and unschooled subjects would be viewed differently. This theory would suggest that even within Luganda it would be possible to generate an understanding of the abstract concepts as utilized in the task. It could be argued that the traditional experience base does not call for this type of cognitive organization so it has not been developed in Luganda, but that it could be.

The acceptance of either of these theories has implications

for how the teaching of concepts is approached within a given culture. Given the former theory children would continue to receive education in two languages with the concepts and constructs as utilized in the two languages being taught using the appropriate language. It also suggests that Luganda needs to be studied further to identify the usage of abstract thought within the culture and relate that usage to the way concepts are structured in English.

Given the latter theory, education should focus its efforts on working with a given language to make the language express the concepts which are seen as useful. The second language in this instance is not seen as a mechanism for teaching a different set of concepts but as a device for communicating using other concepts which have been developed within ones own language.

The problem of the relationship between language and culture has been touched on only very superficially. At this point it is sufficient to note that the different theories of language development do have implications for the educational process and should be considered when curriculum decisions are made. In part that decision has to be made in terms of whether or not the formal educational system as utilized today is to be continued or whether or not alternative systems should be developed and employed. This is the topic of the following section.

Non-Formal Education

What are the implications of the fact that schooling is a significant factor in the type of concepts used and people's flexibility in approaching problem-solving tasks? The answer to this question is of considerable import to those interested in the area of non-formal education. But before discussing the implications it is necessary to define what is meant by non-formal education. For the purposes of this report non-formal education is defined as "functional education for non-school populations" (Evans & Hoxeng, 1972, p. 1). Thus, adults who have little or no schooling as well as school-aged children who are not attending schools are included in the population to be served by non-formal education efforts.

Over the past five years there has been an increasing interest in the problems of illiterate people and what can be done to provide basic problem-solving skills to large proportions of the population not being served by the formal educational system and those whose education is poorly matched with their needs. As educational planners look at the cost of universal primary education it is realized that the formal school system cannot begin to educate the children of a given age group, let alone provide services to illiterate adults. Also, with the growing concern that what is provided through the existing system is not what the school population needs, other avenues for education are being sought. (See the works of Illich, 1970; Freire, 1970; and Reimer, 1971 for expansion of these ideas.)

An example of the problem comes from Ecuador where in rural areas less than one half of a given age group enters the first grade. Of those that do enter school, only one in five completes the sixth grade and most of those who drop out do so before the end of their second year. Thus the educational system which exists in rural Ecuador serves only a very small proportion of the population. Also, the materials which are available, and they are few, depict urban life and are totally unrelated to the life style of the rural Indian child. Those who complete the sixth grade do not necessarily have the skills necessary to improve their own life and few have the opportunity to pursue higher education (Evans & Hoxeng, 1972). In such a setting alternative forms of learning are clearly needed.

In designing alternative approaches two basic concerns need to be addressed: the first concern is in terms of the specification of goals. What should people be able to do? The second question that needs to be asked is, how are the goals to be attained? It is difficult to answer the first question, especially when the implications of the results from the African data are considered. It was quite clear from the Ugandan study that the abstract class groups defined in the Evans-Segall Concept Discovery Task were, for the most part, unrelated to the way the Buganda abstractly relate to the world. The children who were in school had been exposed to the Western ordering of the world and thus could quickly identify and use groups known as transportation, clothing, food, shelter, animals, and containers.

However, out-of-school subjects were unfamiliar with the school's manipulation of the items in the task. Therefore, the school situation was providing the children with something not found in their environment. Non-formal education projects would have to answer the question of how to relate to the discrepancy between school and culture.

Should the group become literate in terms of its own culture or should the people reorient their world to that of Western cultures? Clearly in Africa the fifth grade children had learned to operate well with Western concepts. Would they have performed as well on a task designed to tap the abstract concepts within their own culture? What effects does a totally Western education have on a person's ability to operate in his own culture? To what extent should they be expected to enter into Western streams of thought? These are difficult questions to answer given the emphasis on cross-cultural communication on the one hand and the concern that cultural diversity be respected on the other. Where do the two meet?

Once the decisions in terms of goals have been made, curriculum must be designed. In order to do this the strategies which a culture employs to make the world rational must be understood. In other words, the educational planner must be aware of how an individual views his world and how that world view relates to the goals of a given program. The task then becomes one of moving the individual from where he is in his understanding to the desired ends. For example, if

one of the goals is to make the population capable of dealing with abstract concepts as defined by Western culture, then those variables which foster that type of conceptual organization must be identified and experiences provided so that the concepts can be learned and applied in various situations.

While this may appear to be an obvious approach, in general, current non-formal education efforts do not reflect either an in-depth analysis of a given culture nor curriculum content and educational techniques appropriate for the population concerned. Part of this is due to a lack of understanding of concept development within any culture.

Conclusions

With the exception of the work by Cole and Gay and others working with them (Cole et al., 1971) cross-cultural research efforts reflect an interest in studying an aspect of cognitive development within various cultures rather than trying to understand a range of thought processes within one culture. This limits their applicability.

Clearly the findings of the Evans-Segall Task in both Colombia and Africa are very limited because of the fact that the task presupposes a system of thought consistent with Western man's organization of the world. What can be said is that the results indicate how a person is able to perform on a school-related task under the very artificial conditions of a testing situation.

However, if people are expected to operate in a Western society that uses the concepts as defined in the task, then it is of interest to know how well people relate to these concepts and how well they are able to use them. Once again, however, it must be emphasized that innate ability is not being explored in a task such as the Evans-Segall Concept Discovery Task, but rather, performance on a very specific task is examined. It is not the presence or absence of processes which is tapped in this type of cross-cultural testing, but the patterns of usage and the ability to manipulate the processes at a given time. The results suggest that perhaps there are some processes which are fostered and reinforced by a given culture and these will differ across cultures depending on the needs of the society in question.

If it seems that cross-cultural research produces more questions than it answers, think on the following African proverb:

> No one is without knowledge except him
> that asks no questions.

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APPENDICES

APPENDIX A

OBJECTS PICTURED IN THE EVANS-SEGALL CONCEPT DISCOVERY TASK: COLOMBIA PROTOCOL

Set		Order of Presentation				Color	Class
1	Obj.	Clock	Bottle	Book	Cup	Blue	Container
	Co.	Orange	Green	Blue	Blue		
2	Obj.	Dress	Banana	Hat	Matches	Green	Clothing
	Co.	Green	Green	Grey	Red/Bl		
3	Obj.	Bicycle	Watch	Car	Tree	Green	Transport
	Co.	Black	Purple	Green	Green		
4	Obj.	Bowl	Hen	Lightbulb	Goat	Brown	Domestic Animals
	Co.	Brown	Brown	Neutral	Black		
5	Obj.	Lightbulb	Umbrella	House	Book	Orange	Shelter
	Co.	Neutral	Orange	Br/yellow	Orange		
6	Obj.	Pail	Key	Pencil	Basket	Gold	Container
	Co.	Grey	Gold	Blue	Gold		
7	Obj.	Radio	Broom	Pants	Dress	Blue	Clothing
	Co.	Blue	Brown	Blue	Multi		
8	Obj.	Bus	Truck	Cup	Hat	Gold	Transport
	Co.	Gold	Bl/Br	Gold	Grey		
9	Obj.	Hoe	Blouse	Fish	Cow	Brown	Animals
	Co.	Brown	Red	Grey	Brown		
10	Obj.	Shirt	Bottle	Shoes	Bananas	Brown	Clothing
	Co.	Blue	Brown	Brown	Yellow		
11	Obj.	Candle	Lightbulb	Bananas	Radio	Blue	Light
	Co.	Blue	Neutral	Green	Blue		
12	Obj.	Watch	Box	Tree	Basket	Green	Container
	Co.	Orange	Green	Green	Yellow		
13	Obj.	Chair	Truck	Bicycle	Flower	Blue	Transport
	Co.	Blue	Bl/Br	Black	Red/Gr		
14	Obj.	Knife	Cow	Clock	Goat	Brown	Animals
	Co.	Brown	Brown	Blue	Bla/Grey		

15	Obj. Co.	Hat Blue	Cup Yellow	Hoe Brown	Shoes Brown	Brown	Clothing
16	Obj. Co.	Book Blue	Bottle Brown	Bowl Yellow	Key Yellow	Yellow	Container
17	Obj. Co.	Banana Yellow	Pail Grey	Hat Grey	Umbrella Purple	Grey	Shelter
18	Obj. Co.	Chicken Yellow	Dress Green	Fish Grey	Cup Yellow	Yellow	Food
19	Obj. Co.	Bus Blue	Car Green	Banana Green	Lantern Neutral	Green	Transport
20	Obj. Co.	Pencil Blue	Skirt Purple	Pot Grey	Shirt Blue	Blue	Clothing

APPENDIX B

OBJECTS PICTURED IN THE EVANS-SEGALL CONCEPT DISCOVERY TASK: AFRICA PROTOCOL

Set		Order of Presentation				Color	Class
1	Obj.	Clock	Bottle	Book	Cup	Blue	Containers
	Co.	Orange	Green	Blue	Blue		
2	Obj.	*Trad. dress	Banana	Hat	Matches	Green	Clothing
	Co.	Green	Green	Grey	Red/Blue		
3	Obj.	Bicycle	Watch	Car	Tree	Green	Transport
	Co.	Black	Purple	Green	Green		
4	Obj.	*Afr.Bask.	Hen	*Lantern	Goat	Brown	Domestic Animals
	Co.	Brown	Brown	Neutral	Black		
5	Obj.	*Lantern	Umbrella	House	Book	Orange	Shelter
	Co.	Neutral	Orange	Br/yellow	Orange		
6	Obj.	Pail	Key	Pencil	Basket	Gold	Container
	Co.	Grey	Gold	Blue	Gold		
7	Obj.	Radio	Broom	Pants	*Afr.dress	Blue	Clothing
	Co.	Blue	Brown	Blue	Multi		
8	Obj.	Bus	Truck	Cup	Hat	Gold	Transport
	Co.	Gold	Bl/Br	Gold	Grey		
9	Obj.	*Hoe	Blouse	Fish	Cow	Brown	Animals
	Co.	Brown	Red	Grey	Brown		
10	Obj.	Shirt	Bottle	Shoes	Bananas	Brown	Clothing
	Co.	Blue	Brown	Brown	Yellow		
11	Obj.	Candle	*Lantern	Banana	Radio	Blue	Light
	Co.	Blue	Neutral	Green	Blue		
12	Obj.	Watch	Box	Tree	Basket	Green	Containers
	Co.	Orange	Green	Green	Yellow		
13	Obj.	Chair	Truck	Bicycle	Flower	Blue	Transport
	Co.	Blue	Br /Blue	Black	Red/Gr		

---

* Indicates items which were changed from traditional African to their Colombian equivalents.

14	Obj.	*Knife	Cow	Clock	Goat	Brown	Animals
	Co.	Brown	Brown	Blue	Bla/Grey		
15	Obj.	Hat	Cup	*Hoe	Shoes	Brown	Clothing
	Co.	Blue	Yellow	Brown	Brown		
16	Obj.	Book	Bottle	*Bowl	Key	Yellow	Container
	Co.	Blue	Brown	Yellow	Yellow		
17	Obj.	Banana	Pail	Hat	Umbrella	Grey	Shelter
	Co.	Yellow	Grey	Grey	Purple		
18	Obj.	Chicken	Dress	Fish	Cup	Yellow	Food
	Co.	Yellow	Green	Grey	Yellow		
19	Obj.	Bus	Car	Banana	*Lantern	Green	Transport
	Co.	Blue	Green	Green	Neutral		
20	Obj.	Pencil	Skirt	*Pot	Shirt	Blue	Clothing
	Co.	Blue	Purple	Grey	Blue		

---

* Indicates items which were changed from traditional African to Their Colombian equivalents.

A P P E N D I X C

PROTOCOL ADMINISTERED TO COLOMBIAN SUBJECTS

RAE-EVA

CODIGO _____ FORM A B

1. Nombre _____ Grado ____ Posición en su clase ____
2. Repitió un grado? _____ Cuál?____ Cuántas veces?_____
3. Edad _____ Fecha de Nacimiento _____
4. Número de hermanas _____ Número de hermanos _____ Cuántos mayores_____
5. Quién más vive en la casa con Ud.? _____
6. Cuanto tiempo hace que Ud. vive aquí? _____
7. Educación del padre _____ Ocupación _____
8. Educación de la madre _____ Ocupación _____
9. Asiste a la Iglesia

   a. cada semana
   b. ocasiones especiales, fiestas
   c. no asiste

10. Si estuvieras con un grupo de amigos, te gustaría:

    a. ir a un sitio donde has estado antes
    b. ir a un sitio donde no has estado

11. Si estuvieras con unos amigos, te gustaría:

    a. hablar sobre donde fueron la semana pasada
    b. hablar sobre adonde van a ir el mismo dia

12. Preferirías jugar (estar) con:

    a. amigos nuevos
    b. viejos amigos

13. Te ayudaría más para charlar con tus problemas:

    a. que vas a tener pronto
    b. que tu tienes ahora

14. Si alguien te va a regalar un libro, te gustaría uno sobre:

    a. como vivieron los muchachos en el pasado
    b. como viven los muchachos hoy en dia

15. Cuando crezcas, te gustaría:

    a. vivir como estás viviendo hoy en dia
    b. tener otro tipo de vivir (modo de vida)

16. Cuál te gusta más:

    Televisión Radio Prensa Colegio

    Por qué? _____

17. En el año que viene, espero que pueda: _____

18. Cuando termine mis estudios aguí en _____

    probablemente yo voy a _____

19. Qué quiere ser ud. en la vida? _____

    _____

20. Aquí hay una escalera

    La gente rica del país está en la parte de arriba.
    La gente pobre está en la parte be abajo.

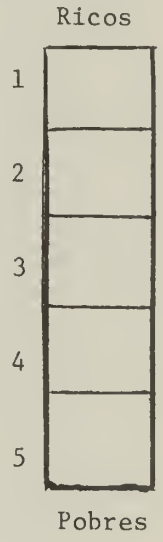
    a. Dónde están Ud. y su familia? _____

    b. Dónde están sus amigos? _____

    C. Dónde quiere estar Ud.? _____

    Explicación: Gente rica es gente que tiene carros, casas grandes y much dinero.

    Gente pobre no tiene dinero.



Prueba Evans-Segall Concept Discovery Task

Voy a mostrarle algunos dibujos. Primero, dígame como se llama la cosa en el dibujo. Después, vamos a jugar algo con ellos. Que es esto?

Ahora, quiero que me muestra dos que vayan juntos y yo le digo si está bien.

Repuestas:
- Si, muy bien. Ensayemos otro.
- No, no está correcto. Éste es correcto, pero ése, no. Puede mostrarme alguno que vaya con éste?
- Ninguno de esos sirve. Muéstreme otros dos que vayan juntos.
- Éste no sirve.

Lo hizo muy bien. Ahora vamos a empezar otra vez, y quiero que me muestre dos que vayan juntos pero de la otra manera.

Lo hizo muy bien. Muchas gracias.

Primero _____

	D	C	B	A
1 a	___	___	___	___
b	___	___	___	___
2 a	___	___	___	___
b	___	___	___	___
3 a	___	___	___	___
b	___	___	___	___
4 a	___	___	___	___
b	___	___	___	___
5 a	___	___	___	___
b	___	___	___	___
6 a	___	___	___	___
b	___	___	___	___
7 a	___	___	___	___
b	___	___	___	___
8 a	___	___	___	___
b	___	___	___	___
9 a	___	___	___	___
b	___	___	___	___
10 a	___	___	___	___
b	___	___	___	___
11 a	___	___	___	___
b	___	___	___	___

Segundo _____

	D	C	B	A
1 a	___	___	___	___
b	___	___	___	___
2 a	___	___	___	___
b	___	___	___	___
3 a	___	___	___	___
b	___	___	___	___
4 a	___	___	___	___
b	___	___	___	___
5 a	___	___	___	___
b	___	___	___	___
6 a	___	___	___	___
b	___	___	___	___
7 a	___	___	___	___
b	___	___	___	___
8 a	___	___	___	___
b	___	___	___	___
9 a	___	___	___	___
b	___	___	___	___
10 a	___	___	___	___
b	___	___	___	___
11 a	___	___	___	___
b	___	___	___	___

	D	C	B	A
12 a				
b				
13 a				
b				
14 a				
b				
15 a				
b				
16 a				
b				
17 a				
b				
18 a				
b				
19 a				
b				
20 a				
b				

Trials to Criterion _____

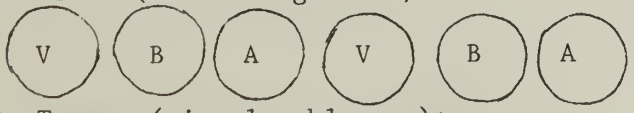
	D	C	B	A
12 a				
b				
13 a				
b				
14 a				
b				
15 a				
b				
16 a				
b				
17 a				
b				
18 a				
b				
19 a				
b				
20 a				
b				

Trials to Criterion _____

Prueba del Graham-Ernhart

Nivel III. 6 Objectos "Ahora voy a mostrarle algunas cosas. Ponga juntos los que sean iguales (se parezcan, vayan juntos)."

1. Color (circulos grandes):



2. Tamano (circulos blancos):

3. Forma (grandes blancos):

Si todos estan bien arreglado dice: "Muy bien, vamos a hacer otro."
Si pone amontonados, desamontonarlos y dice: "Si, estos son iguales, y estos son iguales, y estos son iguales."
Si tiene uno o dos bien arreglados dice: "Si, estos son iguales. Pero, tambien, estos son iguales."
Si no los pone con iguales dice: "Mira, estos son iguales, y estos otros tambien, y estos otros tambien son iguales."

Nivel II. 3 + 3 objectos: "Muestame el que sea igual con esta."

1. Color (circulos grandes): 

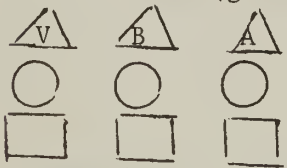
Muestra: A V B

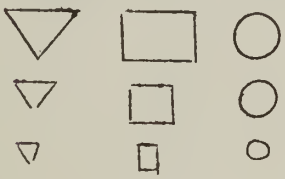
2. Tamaño (circulos blancos): 
Muestra: P M G

3. Forma (Grandes blancos): 
Muestra: 

Nivel IV. 9 Objectos: "Ahora vamos a usar muchas de las cosas (muchos de los juguetes)."
"Ponga juntos los que vayan juntos, y digame cuando acabe."
Puede decir: "Estan listos?" o "Eso es todo?" o "Ya?"

1. Color/Tamano (circulos)


2. Color/Forma (grandes)


3. Tamaño/Forma (blancos)


Prueba RAE-EVA

Parte I. Se ponen los objectos en un grupo desordenado diciendolos:

"Ponga juntos los que vayan juntos." Después de que el S haga lo ordenado, Ud. anota lo que el grupo ha arreglado y le pregunte: "Porqué sabes que van juntos?"

Arregla:

Numero de grupos para

Trabajar _____
Jugar _____
Aprender _____
Humanos _____
Animales _____
Función _____
Proximidad _____
Desconocido ____
Otros _____

Parte II. Reemplaza los objectos en un grupo diciendolos:

"Ponga juntos los que te gustan más."

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____
6. _____ _____

Parte III. Se sacan los objectos y se pone la figura con el sexo de acuerdo al S al frente de su lado y al lado izquierdo. Presente los grupos de objectos como jugetes, herramienta de trabajo y de entrenamiento. Va a presentarle cuatro grupos de objectos diciendole:

"Muéstrame la cosa que va mejor con el (ella)."

1. pelota	molinillo/serucho	abaco	_____
2. machete/canasto	lapiz	cometa	_____
3. libro	trompo/muñeca	escoba/pala	_____
4. hilo/pica	tablero	bolero	_____

A P P E N D I X D

CHI-SQUARE CALCULATIONS ON THE NUMBER WHO ACHIEVED CRITERION ON COLOR AND CLASS LEARNING BY ORDER OF PRESENTATION

The formula utilized to calculate the chi-square was as follows:

$$\chi^2 = \frac{N\left(\left|AD-BC\right| - \frac{N}{2}\right)^2}{(A+B)\,(C+D)\,(A+C)\,(B+D)}$$

Clark et al., 1965, p.350

Colombia

Color Learning

	Co/Cl	Cl/Co	Total	
Achieved	148	125	273	(A+B)
Failed	20	38	58	(C+D)
Total	168	163	331	(N)
	(A+C)	(B+D)		

Results $\chi^2 = 6.682$ df = 1 $p < .01$

Class Learning

	Co/Cl	Cl/Co	Total	
Achieved	106	127	233	(A+B)
Failed	62	36	98	(C+D)
	168	163	331	(N)
	(A+C)	(B+D)		

Results $\chi^2 = 9.44$ df = 1 $p < .01$

Uganda

Color Learning

	Co/C1	C1/Co	Total	
Achieved	129	108	237	(A+B)
Failed	6	29	35	(C+D)
Total	135	137	272	(N)
	(A+C)	(B+D)		

Results $\chi^2 = 15.50$ df = 1 $p < .001$

Class Learning

	Co/C1	C1/Co	Total	
Achieved	84	106	190	(A+B)
Failed	51	31	82	(C+D)
Total	135	137	272	(N)
	(A+C)	(B+D)		

Results $\chi^2 = 8.15$ df = 1 $p < .01$

A P P E N D I X E

CHI-SQUARE CALCULATIONS ON THE NUMBER WHO ACHIEVED CRITERION ON COLOR AND CLASS LEARNING BY ORDER OF PRESENTATION, GRADE AND BY LOCATION

The Formula utilized to calculate the chi-square was as follows:

$$\chi^2 = \Sigma \frac{(O - E)^2}{E}$$

Clark, et al., 1965, p. 332

Colombia

Color Learning by Grade and Order of Presentation

Co/C1

Grade	Achieved	Failed	Total
1	47	10	57
3	51	3	54
5	50	7	57
Total	148	20	168

Results:

$\chi^2 = 3.30$ df = 2 p n.s.

C1/Co

Grade	Achieved	Failed	Total
1	32	23	55
3	44	8	52
5	49	7	56
Total	125	38	163

Results:

$\chi^2 = 15.74$ df = 2 $p < .001$

Class Learning by Grade and Order of Presentation

Co/C1

Grade	Achieved	Failed	Total
1	15	42	57
3	41	13	54
5	50	7	57
Total	106	62	168

Results:

$\chi^2 = 49.49$ df = 2 $p < .001$

C1/Co

Grade	Achieved	Failed	Total
1	29	26	55
3	44	8	52
5	54	2	56
Total	127	36	163

Results:

$\chi^2 = 32.54$ df = 2 $p < .001$

Color Learning and Class Learning by School Location

Color Learning

School	Achieved	Failed	Total
UUC	70	11	81
ULC	68	18	86
S-U	91	17	108
R	44	12	56
Total	263	58	331

Results:

$\chi^2 = 3.72$ df = 3 p n.s.

Class Learning

School	Achieved	Failed	Total
UUC	64	17	81
ULC	57	29	86
S-U	77	31	108
R	35	21	56
Total	233	98	331

Results:

$\chi^2 = 4.66$ df = 3 p n.s.

Africa

Color Learning by Grade and Order of Presentation

Co/Cl

Grade	Achieved	Failed	Total
1	43	2	45
3	43	2	45
5	43	2	45
Total	129	6	135

Results:

$\chi^2 = 0$ df = 2 p n.s.

Cl/Co

Grade	Achieved	Failed	Total
1	26	19	45
3	40	7	47
5	42	3	45
Total	108	29	137

Results:

$\chi^2 = 20.03$ df = 2 $p < .001$

Class Learning by Grade and Order of Presentation

Co/Cl

Grade	Achieved	Failed	Total
1	14	31	45
3	29	16	45
5	41	4	45
Total	84	51	135

Results:

$\chi^2 = 34.60$ df = 2 $p < .001$

Cl/Co

Grade	Achieved	Failed	Total
1	29	19	45
3	35	12	47
5	45	0	45
Total	106	31	137

Results:

$\chi^2 = 23.39$ df = 2 $p < .001$

Color Learning and Class Learning by School Location

Color Learning

School	Achieved	Failed	Total
Urban	78	12	90
S-U	79	13	92
Rural	80	10	90
Total	237	35	272

Results:

$\chi^2 = .48$ df = 2 p n.s.

Class Learning

School	Achieved	Failed	Total
Urban	62	28	90
S-U	62	30	92
Rural	66	24	90
Total	190	82	272

Results:

$\chi^2 = .70$ df = 2 p n.s.

A P P E N D I X F

CHI-SQUARE CALCULATIONS ON PREFERENCES FOR COLOR AND CLASS BY SCHOOL AND BY GRADE GROUPS

The formula utilized to calculate the chi-square was as follows:

$$\chi^2 = \Sigma \frac{(O - E)^2}{E}$$

Clark et al., 1965, p. 332

Colombia

Preferences by School Groups

School	Color	Class	Other	Total
UUC	27	32	22	81
ULC	40	27	19	86
S-U	58	29	21	108
R	32	7	17	56
Total	157	95	79	331

Results:

$\chi^2 = 12.74$ df = 6 $p < .05$

Preferences by Grade Groups

Grade	Color	Class	Other	Total
1	71	15	26	112
3	52	24	30	106
5	34	56	23	113
Total	157	95	79	331

Results:

$\chi^2 = 41.27$ df = 4 p <.001

Africa

Preferences by School Groups

School	Color	Class	Other	Total
Urban	49	23	18	90
S-U	62	18	12	90
Rural	49	23	28	90
Total	160	64	48	272

Results:

$\chi^2 = 4.86$ df = 4 p n.s.

Preferences by Grade Groups

Grade	Color	Class	Other	Total
1	46	10	34	90
3	72	13	7	92
5	42	41	7	90
Total	160	64	48	272

Results:

$\chi^2 = 68.89 \quad df = 4 \quad p < .001$

Preferences for Color and Class by Country

	Color	Class	Total	
Uganda	160	64	224	(A+B)
Colombia	157	95	252	(C+D)
Total	317	159	476	(N)
	(A+C)	(B+D)		

Results:

$\chi^2 = 9.47 \quad df = 2 \quad p < .05$

APPENDIX G

ITEMS USED IN THE RAE-EVA

Work

Hoe
Shovel
Saw
Large Knife
Basket
Broom
Spool of thread
Beater
Typewriter

Toys

Kite
Ball
Top
Bolo

Learning Tools

Abacus
Blackboard
Pencil
Book

Humans

Man
Woman
Boy
Girl

Animals

Dog
Horse
Chicken
Pig