year-olds who did not attend school, and 12- to 14-year-olds in the fourth to sixth grades. This selection allowed comparisons of performance as a function of age and education.

Figure 5-4 shows the results for each of the groups given three problems in which the same dimension remained correct. The figure is divided into three graphs, one for each group. The data points in each graph represent the average number of trials needed to learn a given problem. For example, the 6- to 8-year-old non-educated children learned their first color problem in an average of 8.5 trials, their second in 7.2 trials, and their third in 6.9. The other graphs are to be interpreted in the same way.

The influence of stimulus preference is very clearly evident: for all three groups, color is learned in fewer trials than number, and form is most difficult of all. Moreover, older children learn more rapidly than younger ones, and the educated children learn more rapidly than the noneducated children.

The second important feature of these data is that the older children seem to *improve* from one problem to the next, but for the 6- to 8-year-olds there is little improvement from problem to problem.

The source of problem-to-problem improvement was investigated by looking at the performance of the children for whom the correct dimension was changed from one problem to the next. (These data are not shown.) If the problem-to-problem improvement was the result of some general factor (such as increased familiarity with the task), we should expect improvement even when the particular dimension changed. However, no problem-to-problem improvement was observed; it took just as long to learn the third problem as it did to learn the first.

Taken together, these results strongly suggest that for the amount of practice given (three problems is by no means a lot of practice), improvement from one problem to the next (often termed *learning to learn*) occurs only if subjects learn to attend to a particular dimension. There is no generalized learning to learn. It appears that the older subjects must be doing something like saying to themselves, "if red was correct last time, one of the colors must be correct this time." This strategy works only if the correct dimension remains the same from problem to problem.

This plausible analysis leaves an unanswered question: How do the younger, noneducated children learn these problems if they do not select out a particular dimension and then learn what

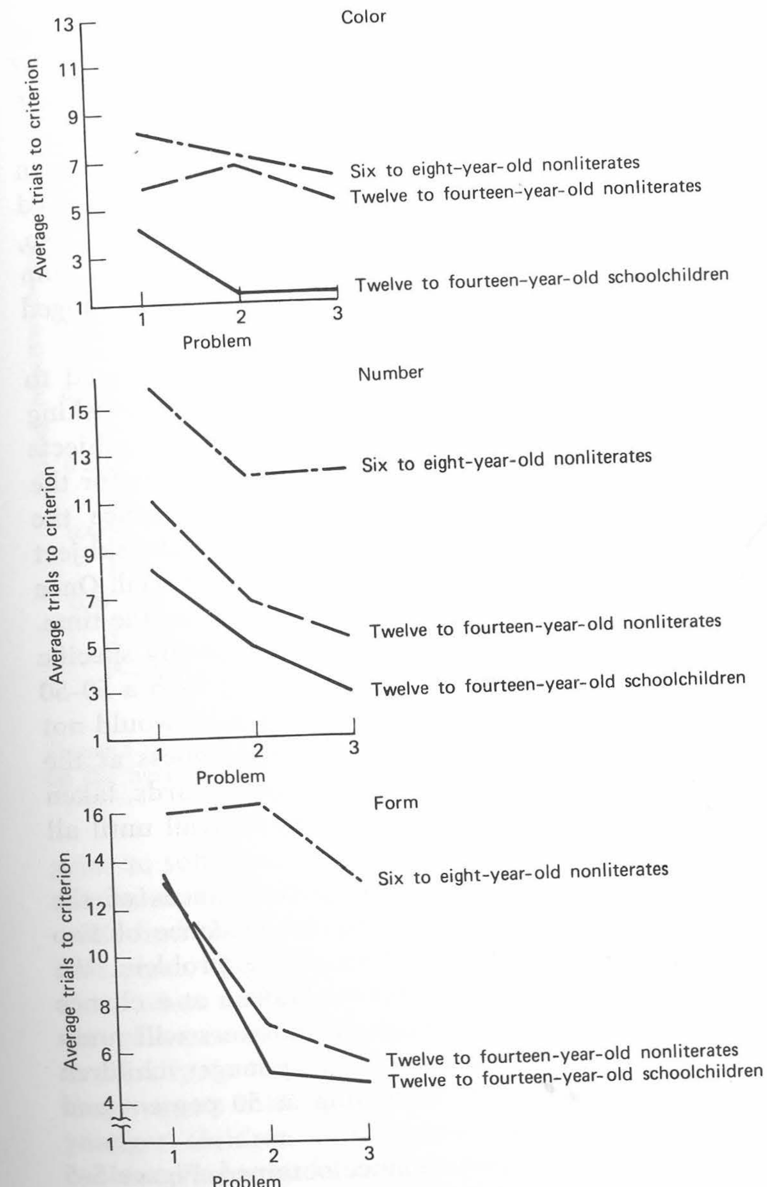

Figure 5-4. Problem-to-problem improvement in classification among Kpelle children. Each panel of the figure shows learning scores for children trained to classify on a different dimension (color, number, or form).

the correct value on that dimension is? These children learn more slowly than their educated brethren, but *how* do they learn?

A major alternative to learning about dimensions was to learn which particular cards were called "correct."

Instead of learning "it's the red ones," the younger children may have been learning to choose four specific cards (one red circle, one red square, two red circles, two red squares). If so, there would be no basis for improvement in performance from one problem to the next, since the particular cards were changed for each problem.

To determine whether this was actually the case, we need to examine the trial-by-trial learning rate. We can begin by asking ourselves: What kind of data would be produced if subjects learned to solve these classification problems by searching for the correct attribute ("two" or "black," for example)? Since the correct attribute is present on exactly half the cards, the subject ought to have a 50–50 chance of identifying it on any trial. Once he has identified it, he ought to be correct 100 percent of the time.

However, what if the subject learned by remembering specific "correct cards"? At first he, too, would be guessing with a 50–50 chance of being right. But when a card reappeared, he would not have to guess if he remembered it. He would only guess at the unlearned cards. Thus, his performance on the set of cards, taken as a whole, would improve gradually from trial to trial until all the cards were learned.

With this in mind, let us examine the performances of the younger and older Kpelle children, looking for evidence of two patterns of performance *prior* to *solution* of the problem. We expect to find the performance of the older children at a chance level prior to solution, at which point correct answers will jump to 100 percent; but the performance of the younger children should show gradual improvement, beginning at 50 percent and slowly approaching 100 percent.*

This is exactly the pattern of performance obtained. Figure 5–5 shows examples of the *pre-solution* performances of noneducated 6- to 8-year-olds and groups of educated and noneducated 12- to 14-year-olds solving a form problem. Consistent with our analysis, performance of the 6- to 8-year-old children improves gradually

*See Cole et al., 1971, chap. 5, for a full account of the techniques of data analysis used in this evaluation.

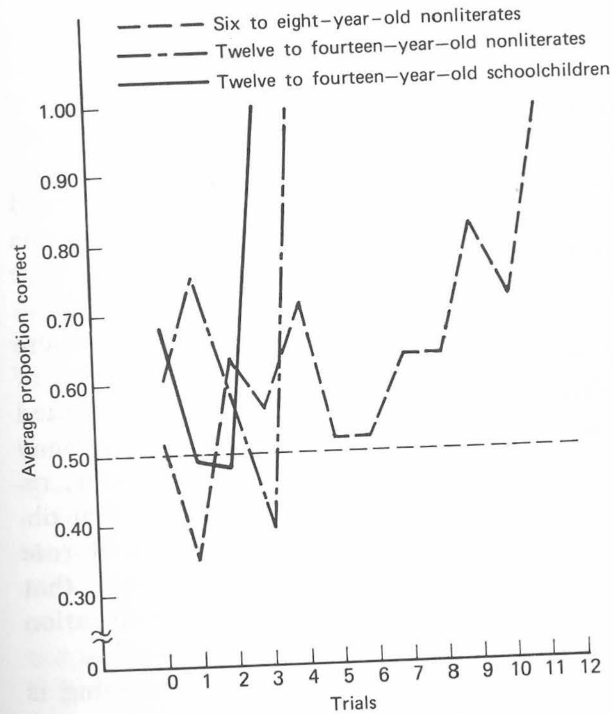

Figure 5-5. Presolution performance of children learning to classify on the basis of form.

prior to solution, while the two groups of older children respond at random until the point of solution.

We find these data interesting for a variety of reasons. In the first place, they illustrate the need to consider stimulus *preferences* when making comparative judgments about issues like the rate of learning. They isolate the basis of improvement in learning to classify, in those cases where improvement occurs. And, third, they suggest that the source of the difference between older and younger children is the tendency of the latter to learn these problems as a set of specific instances, while the older children learn by selecting out the relevant attribute.

These results bear on the larger issue of cultural differences in learning, because, among other reasons, the performance of the younger children is a classic case of rote learning (i.e., memorizing specific instances) in a problem the older children treat conceptually.

But is this rote learning, which is so often castigated in discussions of education and so often attributed to African children, a poor way to learn this problem (poor in the sense of inefficient)? Is it the only way these children *can* learn a classification problem? Almost certainly not.

To begin with, learning by rote is an efficient way to learn if there are only a few instances. In such cases, searching for the correct attribute may require more trials than committing four instances to memory.

There are also studies of classification learning among these same groups of uneducated people that give clear evidence of conceptual learning. For example, Gay and Cole (1967) presented children problems similar to Sharp's except that there were many examples, so that a particular example was rarely, if ever, repeated. Since the examples were not repeated, the children obviously could not be responding correctly on the basis of rote learning of specific instances. We therefore must conclude that young uneducated Kpelle children *can* learn pictorial classification problems *conceptually.*

This brings us back to a reoccurring theme: how a thing is learned or perceived depends not only on the past experience of the subject (which is certainly a factor), but also on the demands of the task presented him. In this case we can expect simple rote learning by certain subjects in some circumstances, but not in others. American school children tend to abandon the rote strategy even for simple problems, while the young Liberian nonschooled child maintains it unless the conditions of the problem make it too difficult.

Influence of Content on Classification

One problem that arises in connection with all of the studies described is to determine how specialized the results are. Can we safely generalize from experiments with pictures on cards to the larger domain of real-life classification? To raise only a few questions: We know that nonschooled traditional Africans have difficulty in the perception of two-dimensional pictures. Does this difficulty affect the attributes that they choose for classification? Would the same classifications occur if we *said* the names of the objects instead of showing pictures of them? How does the way in which the pictures are classified relate to natural-language categories? For example, we suspect that an anlysis of the Wolof language would almost certainly reveal that cow, tree trunk, and mud are *not* classified together, although these things might well be classified together under the color category brown, if shown on picture cards. Almost certainly cow is part of a semantic category containing goat, sheep, and pig whereas tree, bush, vine, and grass might be part of another class. Exactly the same remarks apply to the Mayans in Yucatan or to any other cultural group.

Several investigations in recent years have been concerned with exactly these kinds of problems. Dominant in this research has been the question: To what extent is the classifying behavior specific to the materials being classified?

Some investigators have been very concerned with the *kind of materials* to be sorted. In Greenfield's work it did not seem to make much difference whether children were presented objects or pictures; nonschooled children still chose color. But this has not usually been the case.

For example, Deregowski and Serpell (1971) conducted a study using photographs and real objects in a comparison of the classifications of Zambian and Scottish school children and found that the pictures and objects were *not* identically classified. Their subjects were third grade students from the Scottish city of Aberdeen and the Zambian city of Lusaka.

Each subject population was divided into three groups. The first group was asked to name and classify eight toy objects consisting of four vehicles and four animals. Within each of these two main subclasses, the objects could be grouped into pairs. For the vehicles the subgroupings could be in terms of color or function (do they carry people or cargo). For the animals the pairing could be based on color or domesticity (domestic or wild). The second group of subjects was asked to name and classify color photographs of these toys, and the third group was asked to name and classify black-and-white photographs.

Since the two major classifications could be broken down into pair subclasses, Deregowski and Serpell asked each subject who produced groupings of three or more stimuli to further subdivide them. They also asked for the reason underlying the subject's final classification.

When the task was sorting pictures, the Scottish children showed a marked superiority. They spontaneously formed four subclasses without prompting, while many of the Zambian children produced subclasses only after they had explicitly been asked to break down their larger classes. However, when the task was sorting models, there were no differences in this regard between the children from the two populations—both groups spontaneously sorted the objects into two main groups with two subgroups in each. These results emphasize the fact that pictures and the objects they depict cannot be considered equivalent stimuli for the Zambian children, although they are roughly equivalent for the Scottish children.

Other differences between the two populations were observed, in addition to the number of subclasses the children produced. For one thing, the subgroups produced by the Zambian children were much more likely to be based on color than were the Scottish children's subgroups. The Zambian children were also less likely to give an adequate verbal explanation for the principle underlying the sorting they arrived at. For example, only 29 percent of the Zambian children adequately explained their separation of vehicles into passenger and cargo vehicles, while 95 percent of the Scottish children did so.

Deregowski and Serpell's research points out the relevance of the physical representation of the material (photograph or object) used in the classification task. A closely related problem is one of *familiarity*. The best-known study of this problem was conducted by Price-Williams (1962) among educated and noneducated children in Nigeria.

Price-Williams was unhappy with the fact that many studies of classification among African children employed stimuli such as those in Figure 5–3—triangles, squares, and other idealized forms that were unfamiliar and of no revelance to the children being tested. So he decided to carry out his work on classification using two familiar and easily identified domains—animals and plants that every Tiv child was familiar with. For this purpose, he picked ten different kinds of animals, varying in such aspects as color, size, edibility, etc. He also picked ten different kinds of plants that could be classified in terms of size, edibility, location (near river or on top of hill), and other principles.

He asked the children to carry out two tasks with each of these sets of objects (he used small plastic dolls for most of the animals, except for a beetle and a fish). First, the child was asked to select those objects that belonged together and to tell why he did so. After each selection and grouping, the child was asked whether he could discover another way of grouping the objects. This procedure was continued until the child declared that there were no other ways to group the objects.

Price-Williams's approach produced two outstanding results. Even the youngest children studied (6 years old) could and did classify the objects. Furthermore, all the children reclassified the objects when asked to do so; the youngest children found three to four ways of grouping, while the 11-year-olds found about six. Price-Williams did *not* find any consistent difference between educated and noneducated children using these objects as stimuli.

One other result obtained by Price-Williams is of particular interest. When he scored the children's justifications for their groupings, he found that when *animals* were grouped, the children tended to justify the groups they made in terms of concrete attributes like their color, size, or the place where they are found. When grouping *plants*, these same children overwhelmingly justified their response in terms of the abstract feature of edibility. This result makes the very important point that we cannot speak of abstract and concrete thinking in general. Not only the familiarity and form of physical respresentation of the things classified, but the specific domains from which the items are drawn, appear to influence the abstractness of the responses given.

A similar message concerning the importance of the domain of objects being classified is illustrated in a recent study by Irwin and McLaughlin (1970). They used stimulus cards with pictures of triangles and squares much like those employed by Sharp and Cole (see Figure 5–3); in addition, they made up a task that was identical in *principle*, but different in material content. Some subjects in the study were asked to classify and reclassify eight bowls of rice: the bowls were large or small, the rice was polished or rough, and two kinds of rice were used. Working with Mano rice farmers and schoolchildren in central Liberia, Irwin and McLauglin wanted to see whether the farmers could find alternative ways of classifying the bowls of rice more easily than they could find alternative classification for the cards with triangles and squares. Consistent with the results of Sharp and Cole, Mano nonliterate adults were not as good as the schoolchildren at finding more than a single basis for classifying the cards. But they were about as good at classifying the rice bowls as the school-children were at classifying the cards! In this study the *content* of the material was not varied independently of the *form* of the material (rice bowls are *real* objects as contrasted with pictorial representations of triangles). Nevertheless, it is a very clear example of how our inferences about the effect of schooling are modified by our knowledge that with some materials, nonschooled people produce classifications that we might otherwise have concluded to be beyond their capacities.

Separating Education from Other Cultural Variations

Our inferences about the effects of schooling might also be modified if we took into account other life experiences that might modify the way traditional people approached a task of classification.

One difficulty with most of the research on culture and classification discussed so far is that comparisons almost always take the form of pitting "civilized" (educated) and "primitive" societies against each other; yet there are clearly wide variations in degree of exposure to modern influences even among nonliterate peoples. Scribner (in unpublished research) secured extensive data on sorting behavior of Kpelle tribal children and adults who had varying degrees of involvement in Western-style living as well as education. The materials to be sorted consisted of 25 very familiar and common objects belonging to categories of hunting implements, foods, cooking utensils, clothes, and sewing things.

Previous research had shown that these categories are part of a hierarchically organized system used by the Kpelle to divide things into subdivisions: utensils and food, for example, are categories or classes under a more general head of *household things*, which is part of a larger class of *working things*. We refer to these as *taxonomic* categories and sometimes, because of the use of the term in this line of psychological research, as *semantic* categories. When individuals group items on the basis of their taxonomic class membership, this is taken by some psychologists to be evidence of abstract thinking.

The particular categories used in this study were selected because they provided items that could be linked together by an action sequence across classes just as easily as by membership in a common class. (The needle, scissors, and shirt can be put together, for example, because you can use sewing items to make an article of clothing). As was true for one of the Greenfield studies described earlier, this dual possibility permitted Scribner to assess the relative probabilities of the two ways of sorting, instead of restricting subjects to the one "correct" way.

Subjects were asked to sort the objects into groups of things that "go together." They were constrained to have no less than three items in a group. Once a classification of the objects was obtained, they were given additional sorting trials until they achieved exactly the same grouping of all the items on two successive trials. This procedure made it possible to examine the *stable* bases used for grouping rather than those "first used."

Adult subject populations were high school students, nonliterate adults from a transitional-type village holding cash jobs (cash workers), nonliterate rice farmers from a traditional village on a road (road village), and nonliterate rice farmers from a traditional bush village five hours from the nearest road (bush village). In addition, there were matched groups of schoolchildren and nonschool children in the 10- to 14-year-old age group (fourth through sixth grades) and in the 6- to 8-year-old age group (first grade).

The groupings produced by subjects were scored on the basis of how many members of a given taxonomic category (food, clothes, etc.) appeared together in the subject's final groupings.

High-schoolers, as expected, almost uniformly grouped items by taxonomic category; cash workers and road villagers also predominantly made category groupings, although none of these men and women had any formal schooling and none could read or write. The use of category membership as a grouping principle dropped off sharply with the bush villagers, but analysis of the items they put together still showed some category influence. Now consider the child subjects. The young ones (6- to 8-year-olds) virtually ignored the categories when grouping, whether or not they were in school; their groups were frequently idiosyncratic, as the following examples illustrate: gun, peanut, and belt; net, headtie, knife, cap, and peanut; needle, potato, and shirt.

The 10- to 14-year-old nonschooled children were not much different from the 6- to 8-year olds, but their schooled counterparts made groups corresponding to some extent to the semantic categories. Here we would seem to have another piece of evidence of the effect of schooling on classifying behavior; we might be inclined, as was Greenfield, to attribute the observed change solely to education, except for one fact: adult village groups, none of whom had had any schooling whatsoever, performed on a par with, or above, the 10- to 14-year-old schoolchildren! This result not only suggests caution against too-easy acceptance of the notion of "arrested development" (on this task noneducated adults were *not* equivalent to noneducated children), but it also suggests that some experiential factors other than formal Western-type schooling may further the switch from nonsemantic to semantic bases of classification.

In addition to mapping the way in which these different Kpelle populations actually grouped the items, Scribner asked each individual to explain the reason why he put particular items together in one group. Here, differences among the adult populations became very marked. High-schoolers almost always gave a category label to their groups ("these are clothes") or expressed their category status by some statement referring to a common attribute of the group members ("you can hunt with these"). In sharp contrast, 70 percent of the bush villagers gave reasons that had nothing to do with the properties of the objects they were grouping; most of their explanations were arbitrary statements, such as "I like them this way" or "my sense told me to do it this way." The transitional village residents (cash workers and road villagers) gave fewer arbitrary reasons than the bush villagers, but fell well below the high-schoolers in citing a common attribute or giving a class name; a common mode of response was to link together items in the group through their different uses—for example, an explanation given for putting net, pot, pepper, okra, and peanut in one group was "the net is for fishing, the okra and peanut are cooked in the pot.

Practically no 6- to 8-year-old could explain his groupings; the overwhelming majority of the children responded to the experimenter's question by repeating the instructions ("you told me to group them") or citing personal authority ("I wanted to do it that way, so I did"). They showed no recognition of the fact that the properties of the materials themselves might provide a basis for dividing the items into groups. Little improvement was shown by the 10- to 14-year-olds who had not been to school, but nearly half of the older children who *had* been to school cited a common attribute of the items or the class name when giving their reason for grouping, and less than one out of five gave an arbitrary reason.

While nonliterate adult villagers and 10- to 14-year-old schoolchildren were quite similar in their *practical* classifying activities, they were very dissimilar in the verbal explanations they gave for these activities: younger people with schooling reflect the category nature of their groupings in the way they describe them; villagers without schooling do not. To make the generalization even stronger, we may say that the only two populations in Scribner's study who made explicit use of class names or common attributes as justification for the classifications were the educated populations. Since a substantial part of Greenfield's evidence for school–nonschool differences in classifying had to do with the way various groups *verbalized* their sorting activities, it may be useful to make a distinction, in the future, between the way individuals operate with things (their actual sorting operations) and the way they describe their own operations. In the study just reported, the most robust effects of education appeared to be on verbalization.

Summary

When we moved on from grand theory to a review of studies on classification processes among traditional people, we found that the terms frequently used in the psychological literature to classify thought processes are somewhat deficient. *Abstract* and *concrete* have been used in a rather loose manner to designate a number of different operations, which do not always co-vary: the particular attribute the individual selects as the basis for grouping; whether he uses this attribute consistently to form all groups in an experimental task; whether he switches from one basis of classification to another; and how he describes and explains the classes he makes. With these many meanings of the terms in mind, it is clear that experimental findings do not allow the conclusion that in general the thinking of any group of people is, or is not, abstract.

We have seen that the attribute selected as the basis for grouping is sensitive to the nature of the materials worked with: how familiar they are (rice versus geometric stimuli), the content domain from which they are drawn (animals versus plants), and the form in which they are presented (objects versus pictures). Although selection of taxonomic class membership as a grouping principle has traditionally (within psychology) been considered the hallmark of abstract thinking, we have seen that this is not an all-or-none affair—the degree to which taxonomic class properties control sorting behavior seems to vary with the saliency of other grouping principles (how items from different classes are functionally related to each other, for example). Does this leave us, then, with an unassimilable relativism? In other words, does it all depend on the materials and the situations? With the information now on hand, we would suggest that classifying operations do seem to change in certain ways with exposure to Western or modern living experiences. Taxonomic class membership seems to play a more dominating role as the basis for grouping items when people move from isolated village life to towns more affected by commerce and the exchange of people and things. Attendance at a Western-type school accentuates this switchover to taxonomic grouping principles. But schooling seems to affect even more than this: attendance at school apparently encourages an approach to classification tasks that incorporates a search for a rule—for a principle that can generate the answers. At the same time, schooling seems to promote an awareness of the fact that alternative rules are possible—one might call this a formal approach to the task in which the individual searches for and selects from the several possibilities a rule of solution. Finally, the one unambiguous finding in the studies to date is that schooling (and only schooling) contributes to the way in which people describe and explain their own mental operations. This last fact suggests an important distinction that should be made in future research—that is, a differentiation between what people *do* and what people *say* they do.

chapter 5 Culture and Conceptual Processes

Discussions of cultural variations in thought processes often emphasize that a major source of group differences is in the "ways of classifying the world" that characterize a given cultural group. "Ways of classifying" is also a useful bridge between the experiments on perceptual processes discussed in the previous chapter, and experiments on conceptual processes, which we will discuss in this chapter.

When we closely examine statements by psychologists about perception and conception, it becomes apparent that the data we previously discussed as a matter of perceptual preference may be viewed just as easily in terms of elementary conceptual groupings or classifications. All of these are pyschological processes* by which we treat as "similar" or "equivalent" phenomena that

*For present purposes, we will not make any distinctions among the terms *classification, concept* or *category*, although it should be understood by the reader that there are many different psychological concepts of a *concept*.

vary in some way among themselves. No two roses are identical, but they are commonly experienced as interchangable members of the class of roses; a rose and a dandelion are physically even more unlike, but are "similar" members of a class of flowers; and together with an oak tree, a frog, and an infant, roses and dandelions are "alike" with respect to their inclusion in a class of living things. As these examples illustrate, there is a whole multiplicity of processes by which we deal with environmental variability, reducing or holding differences constant and establishing similiarity or equivalence as a basis for action and thought. These processes may vary with the attributes of the things in question, the context in which the act of classifying occurs, and the skills and knowledge we possess.

When similarity among things is defined in terms of their physical attributes, the act of classifying may be considered close to perception. For example, when considering neighboring points on the color spectrum, it seems at least possible that true lack of discrimination in some sensory sense is occurring when subjects respond with a single term to two different colors. When a person says "red" to a set of color chips that we know to be discriminably different, it may still be possible to give a perceptual interpretation by arguing that the subject perceives all of the hues to be the same. But why speak of a perceptual process when one is dealing with a set of stimuli consisting of a black triangle, a red triangle, and a red square? Surely the subject can discriminate among these objects. A more appropriate method of characterizing the subject's choices when he says that two of the objects are the same is to consider them ways of classifying objects in the environment.

Bases for Classification

In studies of classification, both in developmental and cross-cultural psychology, a good deal of interest has centered on two aspects of the subject's performance: (1) the particular attribute the subject uses as the criterion of similarity (this is comparable to interest in the stimulus dimension in perceptual preference studies), and (2) whether or not he uses a single attribute consistently as the basis for grouping. Findings with respect to these questions have provided much of the empirical foundation for

theories of cognitive development that stress progression from a kind of thinking that is concrete and context-bound to thinking that is abstract and rule-governed. Results from cross-cultural studies of classification have led several authors to characterize the thinking of nonindustrialized people as concrete and deficient in the abstract attitude. In Chapter 2, we showed how scholars with such contrasting points of view as Claude Levi-Strauss, the structural anthropologist, and Heinz Werner, the developmental psychologist, share a common interest in analyzing the concepts and classifications employed in primitive cultures.

As the examples at the beginning of this chapter indicate, the notion of *class* or *concept* is used very broadly by psychologists to refer to a wide range of grouping operations. Theories that have been developed to explain classificatory behavior have usually been tied in closely to the particular set of operations an investigator has chosen to study. Jerome Bruner's theory of cognitive growth furnishes a useful framework for examining current research in this area. It has generated specific hypotheses about effects of cultural institutions on classification, and these hypotheses have been explored in cross-cultural settings. Conceptual development, according to Bruner, involves a shift in what features of the world the child uses as a basis for defining how things are alike (what we have called the criterial attribute). Very young American children tend to treat items as equivalent on the basis of *perceptual* qualities, such as color, size, shape, or position. With intellectual growth, the child breaks away from this perceptual dominance and bases his classifications on *functional* attributes—what things can do or what a person can do with things. He also increasingly comes to group items together under a common *class name.*

Bruner asserts further that along with the change in favored attribute, there is an orderly progression in the *operations* by which the child combines things. Initially, the child will form loose groupings or "collections"—in which he uses a variety of characteristics and associations among the items. Gradually the child works his way toward "true conceptual groupings based on the rule of the superordinate class"—that is, toward groupings based on some *single common* feature that characterizes all the items included within the group and none of the items excluded from it. To put it still another way, the child operates with a single rule governing admission of an item into the group.

While Bruner does not use the terms *concrete* or *abstract* in his discussion of these different aspects of grouping performance, these terms have classically been used to differentiate the young child's performance from that of the older child. A classification based on a perceptual characteristic is usually considered to be concrete. For some theorists, only a nonperceptual grouping based on a class name or nonphysical property (such as animate, edible, mammal) qualifies as "abstract." The term *abstract* has also been used to refer to the operation by which one common characteristic is singled out (i.e., abstracted) and used to unite the items being worked with. From this point of view, Bruner's superordinate, single-rule grouping indicates a more abstract level of thought than groupings making use of multiple criteria.

With these distinctions in mind, we will turn to consideration of an extensive investigation of the cultural influence on classifying conducted by Patricia Greenfield, a colleague of Bruner's (Bruner, Olver, and Greenfield, 1966). Data were gathered from children of the Wolof tribe in rural Senegal, using a sorting procedure similar to the preference studies described in the previous chapter, but with some important differences. Ten familiar objects were laid on a table in front of the child, who was asked to "pick those that belong together." The set contained four articles of clothing, four round objects, and four red objects (one of which was an article of clothing and one a round object), permitting the child to form groups according to function, form, or color.

If the items that were selected conformed to one of these classes (color, form, or function), the child was credited with applying a consistent classification rule. Figure 5–1 plots the percentage of nonschooled tribal children at each age level who consistently applied any of the possible classification rules. It can be seen from the graph that by the age of 15, virtually every Wolof child is making a systematic classification of the objects. A majority of these children based their classifications on color, and the authors conclude that "the change in grouping structure with age consists primarily, then, in learning to apply the color rule systematically" (p. 286). In terms of *preference,* these results fit in nicely with the findings on color dominance reviewed in the previous section, but the interpretation here is *con*ceptual, not *per*ceptual.

A further study by Greenfield among the Wolof used sets of

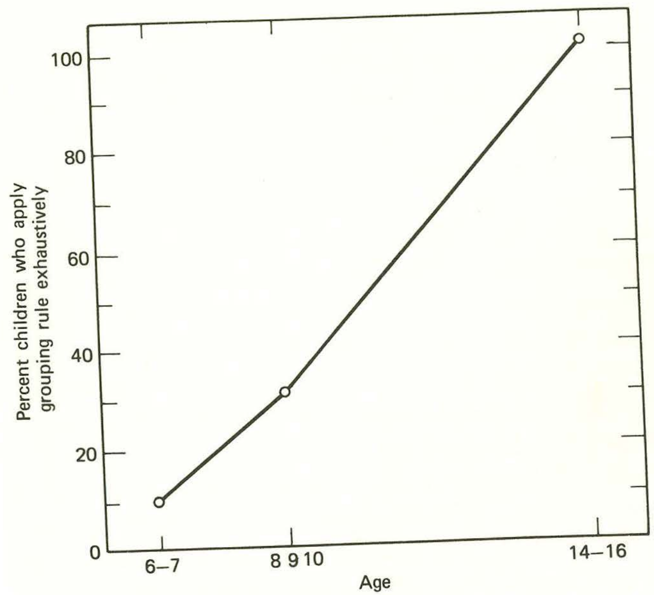

Figure 5-1. Percentage of unschooled Wolof village children who apply grouping rule exhaustively.

pictures mounted on cards. The cards were designed so that within each set it was possible to form pairs based on the color, form, or function of the object pictured on the card (see Figure 5–2). The child was first asked to show the experimenter which of the two pictures in a set were "most alike." He was then asked, "Why are they most alike?" Subjects were selected from three populations: (1) traditional people from the bush who had not attended school —ages 6 to 7, 8 to 9, 11 to 13, and adults; (2) schoolchildren from the same town, and (3) schoolchildren living in Dakar, the capital city of Senegal.

This experiment produced many interesting results. Among the most important for understanding the issue discussed here is that schooling apparently exerted a very strong influence on the way classifications were made and on the kinds of reasons subjects gave for the classes they formed. Children who had attended school, whether from the small bush village or the city, performed very much as American children did; preference for color decreased sharply with grade, while form and function preferences increased. Furthermore, an increasing proportion of the older children justified their classification in terms of a superordinate cate-

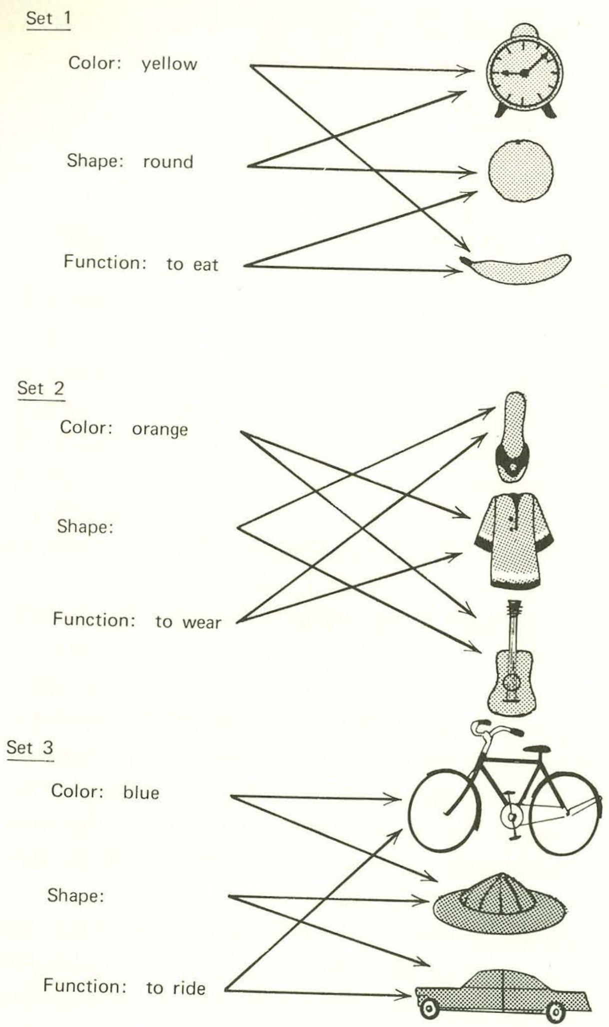

Figure 5-2. Three picture displays in Wolof classification study, with their attributes. *Set 1,* clock, orange, and banana; *Set 2,* sandal, *bubu* (Wolof robe), and guitar; *Set 3,* bicycle, helmet, and car.

gory ("it's the round ones"). The children who had not attended school and lived in the bush responded quite differently. Such children showed *greater* preference for color with increasing age and rarely justified their responses by noting the category to which the pictures belonged. The authors make the following comments about how the course of development of schoolchildren differed from that of children who were not in school:

> This perceptual development is basically a conceptual one. . . . By conceptual we mean that school is teaching European habits of perceptual *analysis*. An analysis into parts is plainly crucial to concepts based on the multi-dimensional attributes of form, whereas unitary global perception could suffice for color grouping (Bruner, Olver, and Greenfield, 1966, p. 316).

Bruner and his colleagues feel that their results are also pertinent to observations made by various anthropologists and psychologists to the effect that the early cognitive development of primitive peoples is quite rapid, but that primitive children's development stops much earlier than that of European children. European children develop more slowly at first, but their development continues through adolescence. In the experiment just presented, the evidence for this idea is that nonschooled children fail to develop a form preference and fail to provide categorial justifications for their choices. Taken together with the fact that children who attend school do show the shift from color to form preference, these findings suggested to Greenfield and Bruner that leveling off of cognitive development occurs because children lack the experiences provided by the school. In this view, African children who have attended school are "European" in their development. Although no one can be sure how schooling exerts its effect, Bruner and his colleagues speculate that the school makes complex demands on the growing child, forcing him to develop new intellectual tools in order to keep up. One of these tools is the kind of perceptual analysis that underlies form classification.

Many questions are raised by this interpretation. One that immediately comes to mind is what significance should be attached to the subject's selection of a particular attribute when he is given only one opportunity to make a choice. If a child chooses color, does this mean that he does not have the capacity to group by form or only that he *prefers* to group by color? We might also ask a prior question. When a set of stimuli allows for several bases of classification, the choice of a classification rule is often arbitrary (color, form, and function are all logically consistent classification schemes). Do people realize this fact? When a person groups a set of cards or objects on, say, the basis of color, is he expressing a preference among a set of alternatives, or is he performing what he considers to be *the* (one and only) correct classification? In short, does he recognize that there are other possible ways of classifying the items? (An analogy here would be the ways in which members of a family could be grouped: as males and females, as parents and children, or as members of the nuclear family and members of the extended family).

Classification and Reclassification

Sharp and Cole (in an unpublished experiment) attempted to get at these questions. Working in Yucatan, Mexico, where the educational experience of Mayan people is quite variable, they presented to people of various ages and educational backgrounds the set of cards depicted in Figure 5–3. The cards were laid out in a haphazard arrangement on a small table in front of the subject, and he was asked to place them into piles so that the cards in each pile were alike in some way. He was not told what was meant by the term *alike.* No restriction was placed on the number of piles a subject could make, but the stimuli were clearly divisible along the dimensions of color, form, and number. On all but a few occasions, subjects placed the cards in two piles. But it was by no means the case that the two piles were chosen in a manner consistent with one of the three preselected dimensions.

For subjects who did sort the cards into two piles in terms of color, form, or number, the cards were then shuffled and the person was asked to find a different way to form piles that were alike.

The subjects in this experiment were children and young adults living in rural towns. The youngest children were 6 to 8 years old and were enrolled in the first grade. In addition, there was a group of 9- to 10-year-olds (in the third grade), a group of 12- to 13-year-olds (sixth grade), and a group of teenagers (15 to 20 years old) who had attended no more than three years of school.

To begin with, it was found that not everyone was successful in arriving at a partition of the cards according to one of the three specified stimulus dimensions (using a single rule). The percentage of successful initial classifications for the first-, third-, and sixth-graders was 17, 47, and 84 percent, respectively. These data indicate a reliable increase in the likelihood of a dimensional classification as school children grow older. But the results from the teenagers indicated that sorting of these materials was con-

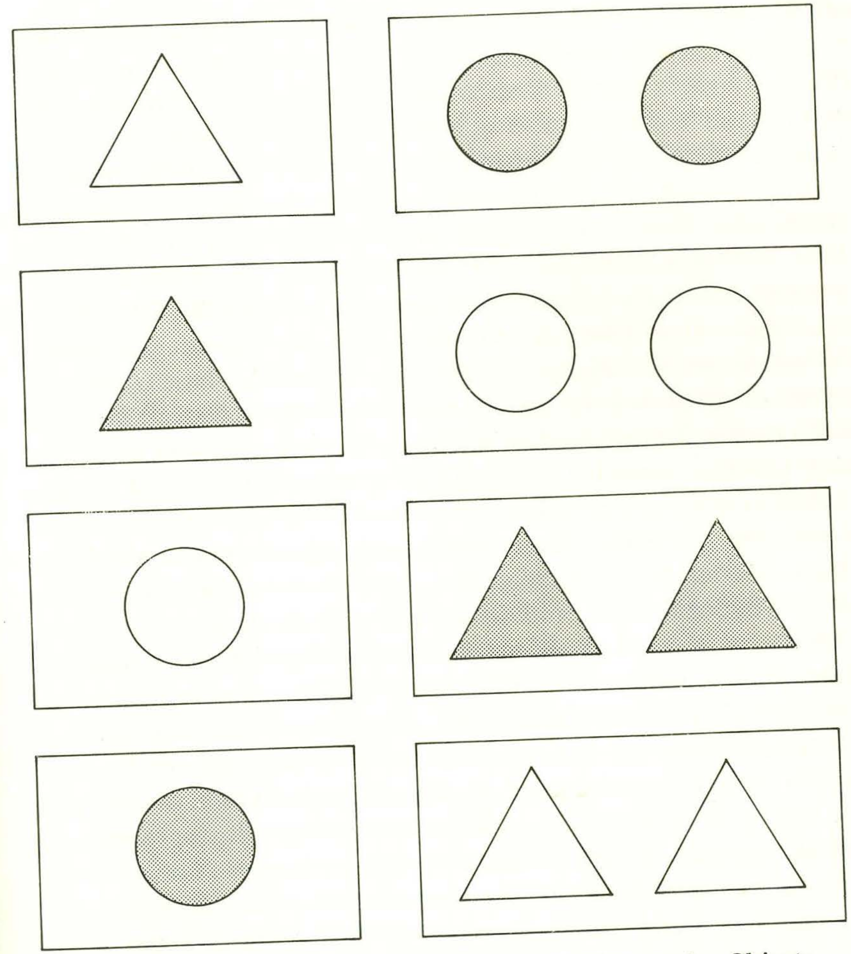

Figure 5-3. Cards used in Mexican reclassification study. Objects portrayed vary in color (black and red), form (circle and triangle), and number (one and two).

ditioned much more by educational experience than by age alone. The teenagers averaged 37 percent correct sorts. This is between the levels for the first- and third-graders, and is consistent with the average educational level of 1.4 years for the teenagers. The relation between education and classification is even more striking when the performance of the teenagers is calculated separately for those who had never attended school or had attended only one year and for those who had attended two or three years. For the relatively uneducated group of teenagers, there were 25 percent correct sorts, while the more educated teenagers sorted correctly 52 percent of the time.

When subjects were asked to classify the cards in a new way, very little reclassification was observed among the first-graders. Only one of the 32 children in this age group successfully re-sorted the cards consistent with a new dimension. Third-graders (44 percent) were more successful in finding a new, consistent sorting scheme, and a majority of the sixth-graders (60 percent) were successful. Again the performance of more poorly educated among the teenagers implicates education in the development of skilled performance in this classification task. Only two teenagers with one year of education or less (8 percent of those tested) reclassified the cards. Those teenagers with two or three years of education responded similarly to the third-graders (28 percent correct re-sorts).

These results from rural Yucatan support and extend the analysis offered by Greenfield and Bruner on the basis of their studies in Senegal. Two points stand out. First, success in classifying arbitrary sets of multi-attribute stimuli like those used in these studies is much more influenced by years of education than chronological age *per se*. This result should make us very cautious about the interpretation of developmental changes in similar classification behaviors observed in the United States or Europe, where age and educational experience co-vary almost perfectly. Secondly, we can see that classification and reclassification are not necessarily the result of the same process—many subjects who could make a single classification could not reclassify the set of cards along another dimension. It seems quite possible that one consequence of educational experience is to instill the notion that any set of objects can be treated (classified) in a varity of ways—there is no "one correct way," regardless of the task at hand. There has been relatively little work done on the problem of reclassification, either intra-culturally or cross-culturally (see, however, Goldstein and Scheerer, 1941).

Generalizing Rules of Classification

The study just described illustrates the problems that arise when uneducated people are asked to change the classification rule that they have been using in sorting a set of material. The study to be described in this section turns the question around and

asks what problems may be involved in carrying over the *same* classification rule from one problem to another. If someone is taught a particular classification rule, will he apply this rule to other problems of the same kind? Does the fact that someone learns to make "correct" classifications imply that he has learned a general rule applying to classification?

To answer some of these questions, Sharp (1971) conducted a study in which he taught Kpelle children to classify material according to attributes the experimenter defined as correct.

Sharp's stimuli were figures on cards which differed in form (triangle, circle, square), color (red, blue, black), number (two, three, four). Subjects were not presented the cards all at once but were shown pairs of cards differing along all three dimensions (for example, two red triangles on one and four black circles on the other). The subject's task was to say which of the cards the experimenter was thinking of, and he was informed after each decision whether or not he was correct. For example, the correct cards for the first problem might be the blue ones, regardless of the forms depicted or the number of figures on the card. Subjects continued responding until they were correct 9 trials in a row or until 40 trials had been presented. Then they were given a second and a third problem, in which the task remained the same but the attribute that defined the correct cards changed for each problem.

Sharp was interested in learning whether children would show improvement on this task as a result of practice: Would they solve the second and third problems faster than the first if the dimension of solution (color in our example) remained unchanged?

Two kinds of practice were studied. (a) Three problems were presented, all involving the dimension of color, but a different color was correct on each. (b) Three problems were presented on which the correct dimension was different each time (color on the first, form on the second, number on the third, for example). These two kinds of repeated practice allowed Sharp to distinguish between two kinds of improvement—generalized transfer resulting from practice in learning this type of problem, and specific transfer resulting from learning about particular dimensions.

Sharp's children were selected from three groups: a group of 6- to 8-year-olds who did not attend school, a group of 12- to 14-

year-olds who did not attend school, and 12- to 14-year-olds in the fourth to sixth grades. This selection allowed comparisons of performance as a function of age and education.

Figure 5–4 shows the results for each of the groups given three problems in which the same dimension remained correct. The figure is divided into three graphs, one for each group. The data points in each graph represent the average number of trials needed to learn a given problem. For example, the 6- to 8-year-old non-educated children learned their first color problem in an average of 8.5 trials, their second in 7.2 trials, and their third in 6.9. The other graphs are to be interpreted in the same way.

The influence of stimulus preference is very clearly evident: for all three groups, color is learned in fewer trials than number, and form is most difficult of all. Moreover, older children learn more rapidly than younger ones, and the educated children learn more rapidly than the noneducated children.

The second important feature of these data is that the older children seem to *improve* from one problem to the next, but for the 6- to 8-year-olds there is little improvement from problem to problem.

The source of problem-to-problem improvement was investigated by looking at the performance of the children for whom the correct dimension was changed from one problem to the next. (These data are not shown.) If the problem-to-problem improvement was the result of some general factor (such as increased familiarity with the task), we should expect improvement even when the particular dimension changed. However, no problem-to-problem improvement was observed; it took just as long to learn the third problem as it did to learn the first.

Taken together, these results strongly suggest that for the amount of practice given (three problems is by no means a lot of practice), improvement from one problem to the next (often termed *learning to learn*) occurs only if subjects learn to attend to a particular dimension. There is no generalized learning to learn. It appears that the older subjects must be doing something like saying to themselves, "if red was correct last time, one of the colors must be correct this time." This strategy works only if the correct dimension remains the same from problem to problem.

This plausible analysis leaves an unanswered question: How do the younger, noneducated children learn these problems if they do not select out a particular dimension and then learn what

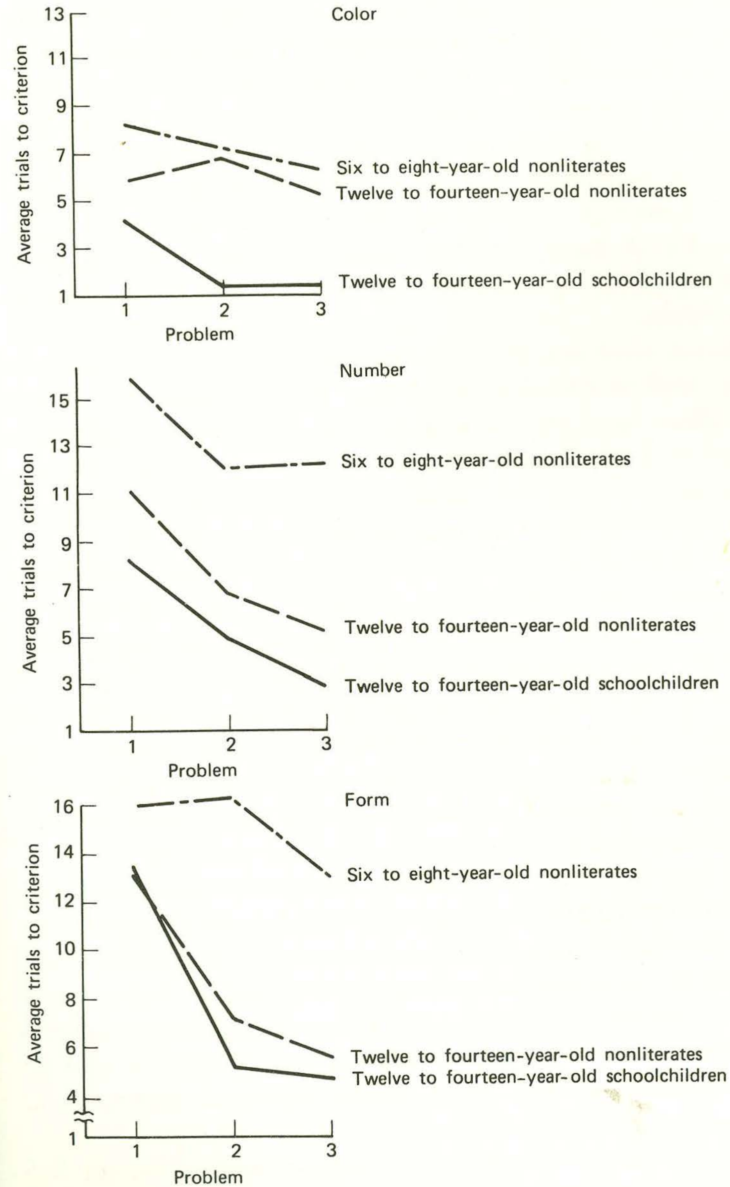

Figure 5-4. Problem-to-problem improvement in classification among Kpelle children. Each panel of the figure shows learning scores for children trained to classify on a different dimension (color, number, or form).

the correct value on that dimension is? These children learn more slowly than their educated brethren, but *how* do they learn?

A major alternative to learning about dimensions was to learn which particular cards were called "correct."

Instead of learning "it's the red ones," the younger children may have been learning to choose four specific cards (one red circle, one red square, two red circles, two red squares). If so, there would be no basis for improvement in performance from one problem to the next, since the particular cards were changed for each problem.

To determine whether this was actually the case, we need to examine the trial-by-trial learning rate. We can begin by asking ourselves: What kind of data would be produced if subjects learned to solve these classification problems by searching for the correct attribute ("two" or "black," for example)? Since the correct attribute is present on exactly half the cards, the subject ought to have a 50–50 chance of identifying it on any trial. Once he has identified it, he ought to be correct 100 percent of the time.

However, what if the subject learned by remembering specific "correct cards"? At first he, too, would be guessing with a 50–50 chance of being right. But when a card reappeared, he would not have to guess if he remembered it. He would only guess at the unlearned cards. Thus, his performance on the set of cards, taken as a whole, would improve gradually from trial to trial until all the cards were learned.

With this in mind, let us examine the performances of the younger and older Kpelle children, looking for evidence of two patterns of performance *prior* to *solution* of the problem. We expect to find the performance of the older children at a chance level prior to solution, at which point correct answers will jump to 100 percent; but the performance of the younger children should show gradual improvement, beginning at 50 percent and slowly approaching 100 percent.*

This is exactly the pattern of performance obtained. Figure 5–5 shows examples of the *pre-solution* performances of noneducated 6- to 8-year-olds and groups of educated and noneducated 12- to 14-year-olds solving a form problem. Consistent with our analysis, performance of the 6- to 8-year-old children improves gradually

*See Cole et al., 1971, chap. 5, for a full account of the techniques of data analysis used in this evaluation.

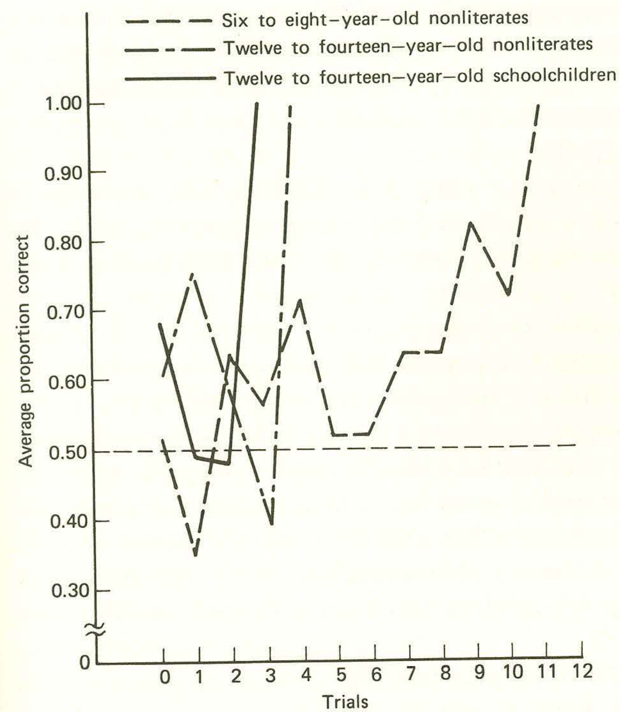

Figure 5-5. Presolution performance of children learning to classify on the basis of form.

prior to solution, while the two groups of older children respond at random until the point of solution.

We find these data interesting for a variety of reasons. In the first place, they illustrate the need to consider stimulus *preferences* when making comparative judgments about issues like the rate of learning. They isolate the basis of improvement in learning to classify, in those cases where improvement occurs. And, third, they suggest that the source of the difference between older and younger children is the tendency of the latter to learn these problems as a set of specific instances, while the older children learn by selecting out the relevant attribute.

These results bear on the larger issue of cultural differences in learning, because, among other reasons, the performance of the younger children is a classic case of rote learning (i.e., memorizing specific instances) in a problem the older children treat conceptually.

But is this rote learning, which is so often castigated in discussions of education and so often attributed to African children, a poor way to learn this problem (poor in the sense of inefficient)? Is it the only way these children *can* learn a classification problem? Almost certainly not.

To begin with, learning by rote is an efficient way to learn if there are only a few instances. In such cases, searching for the correct attribute may require more trials than committing four instances to memory.

There are also studies of classification learning among these same groups of uneducated people that give clear evidence of conceptual learning. For example, Gay and Cole (1967) presented children problems similar to Sharp's except that there were many examples, so that a particular example was rarely, if ever, repeated. Since the examples were not repeated, the children obviously could not be responding correctly on the basis of rote learning of specific instances. We therefore must conclude that young uneducated Kpelle children *can* learn pictorial classification problems *conceptually.*

This brings us back to a reoccurring theme: how a thing is learned or perceived depends not only on the past experience of the subject (which is certainly a factor), but also on the demands of the task presented him. In this case we can expect simple rote learning by certain subjects in some circumstances, but not in others. American school children tend to abandon the rote strategy even for simple problems, while the young Liberian nonschooled child maintains it unless the conditions of the problem make it too difficult.

Influence of Content on Classification

One problem that arises in connection with all of the studies described is to determine how specialized the results are. Can we safely generalize from experiments with pictures on cards to the larger domain of real-life classification? To raise only a few questions: We know that nonschooled traditional Africans have difficulty in the perception of two-dimensional pictures. Does this difficulty affect the attributes that they choose for classification? Would the same classifications occur if we *said* the names of the objects instead of showing pictures of them? How does the way

in which the pictures are classified relate to natural-language categories? For example, we suspect that an anlysis of the Wolof language would almost certainly reveal that cow, tree trunk, and mud are *not* classified together, although these things might well be classified together under the color category brown, if shown on picture cards. Almost certainly cow is part of a semantic category containing goat, sheep, and pig whereas tree, bush, vine, and grass might be part of another class. Exactly the same remarks apply to the Mayans in Yucatan or to any other cultural group.

Several investigations in recent years have been concerned with exactly these kinds of problems. Dominant in this research has been the question: To what extent is the classifying behavior specific to the materials being classified?

Some investigators have been very concerned with the *kind of materials* to be sorted. In Greenfield's work it did not seem to make much difference whether children were presented objects or pictures; nonschooled children still chose color. But this has not usually been the case.

For example, Deregowski and Serpell (1971) conducted a study using photographs and real objects in a comparison of the classifications of Zambian and Scottish school children and found that the pictures and objects were *not* identically classified. Their subjects were third grade students from the Scottish city of Aberdeen and the Zambian city of Lusaka.

Each subject population was divided into three groups. The first group was asked to name and classify eight toy objects consisting of four vehicles and four animals. Within each of these two main subclasses, the objects could be grouped into pairs. For the vehicles the subgroupings could be in terms of color or function (do they carry people or cargo). For the animals the pairing could be based on color or domesticity (domestic or wild). The second group of subjects was asked to name and classify color photographs of these toys, and the third group was asked to name and classify black-and-white photographs.

Since the two major classifications could be broken down into pair subclasses, Deregowski and Serpell asked each subject who produced groupings of three or more stimuli to further subdivide them. They also asked for the reason underlying the subject's final classification.

When the task was sorting pictures, the Scottish children showed a marked superiority. They spontaneously formed four subclasses without prompting, while many of the Zambian children produced subclasses only after they had explicitly been asked to break down their larger classes. However, when the task was sorting models, there were no differences in this regard between the children from the two populations—both groups spontaneously sorted the objects into two main groups with two subgroups in each. These results emphasize the fact that pictures and the objects they depict cannot be considered equivalent stimuli for the Zambian children, although they are roughly equivalent for the Scottish children.

Other differences between the two populations were observed, in addition to the number of subclasses the children produced. For one thing, the subgroups produced by the Zambian children were much more likely to be based on color than were the Scottish children's subgroups. The Zambian children were also less likely to give an adequate verbal explanation for the principle underlying the sorting they arrived at. For example, only 29 percent of the Zambian children adequately explained their separation of vehicles into passenger and cargo vehicles, while 95 percent of the Scottish children did so.

Deregowski and Serpell's research points out the relevance of the physical representation of the material (photograph or object) used in the classification task. A closely related problem is one of *familiarity*. The best-known study of this problem was conducted by Price-Williams (1962) among educated and noneducated children in Nigeria.

Price-Williams was unhappy with the fact that many studies of classification among African children employed stimuli such as those in Figure 5–3—triangles, squares, and other idealized forms that were unfamiliar and of no revelance to the children being tested. So he decided to carry out his work on classification using two familiar and easily identified domains—animals and plants that every Tiv child was familiar with. For this purpose, he picked ten different kinds of animals, varying in such aspects as color, size, edibility, etc. He also picked ten different kinds of plants that could be classified in terms of size, edibility, location (near river or on top of hill), and other principles.

He asked the children to carry out two tasks with each of these sets of objects (he used small plastic dolls for most of the animals, except for a beetle and a fish). First, the child was asked to select those objects that belonged together and to tell why he did so. After each selection and grouping, the child was asked whether he could discover another way of grouping the objects. This procedure was continued until the child declared that there were no other ways to group the objects.

Price-Williams's approach produced two outstanding results. Even the youngest children studied (6 years old) could and did classify the objects. Furthermore, all the children reclassified the objects when asked to do so; the youngest children found three to four ways of grouping, while the 11-year-olds found about six. Price-Williams did *not* find any consistent difference between educated and noneducated children using these objects as stimuli.

One other result obtained by Price-Williams is of particular interest. When he scored the children's justifications for their groupings, he found that when *animals* were grouped, the children tended to justify the groups they made in terms of concrete attributes like their color, size, or the place where they are found. When grouping *plants*, these same children overwhelmingly justified their response in terms of the abstract feature of edibility. This result makes the very important point that we cannot speak of abstract and concrete thinking in general. Not only the familiarity and form of physical respresentation of the things classified, but the specific domains from which the items are drawn, appear to influence the abstractness of the responses given.

A similar message concerning the importance of the domain of objects being classified is illustrated in a recent study by Irwin and McLaughlin (1970). They used stimulus cards with pictures of triangles and squares much like those employed by Sharp and Cole (see Figure 5–3); in addition, they made up a task that was identical in *principle*, but different in material content. Some subjects in the study were asked to classify and reclassify eight bowls of rice: the bowls were large or small, the rice was polished or rough, and two kinds of rice were used. Working with Mano rice farmers and schoolchildren in central Liberia, Irwin and McLauglin wanted to see whether the farmers could find alternative ways of classifying the bowls of rice more easily than they could find alternative classification for the cards with triangles and squares. Consistent with the results of Sharp and Cole, Mano nonliterate adults were not as good as the schoolchildren at finding more than a single basis for classifying the cards. But they were about as good at classifying the rice bowls as the school–children were at classifying the cards! In this study the *content* of the material was not varied independently of the *form* of the material (rice bowls are *real* objects as contrasted with pictorial representations of triangles). Nevertheless, it is a very clear example of how our inferences about the effect of schooling are modified by our knowledge that with some materials, nonschooled people produce classifications that we might otherwise have concluded to be beyond their capacities.

Separating Education from Other Cultural Variations

Our inferences about the effects of schooling might also be modified if we took into account other life experiences that might modify the way traditional people approached a task of classification.

One difficulty with most of the research on culture and classification discussed so far is that comparisons almost always take the form of pitting "civilized" (educated) and "primitive" societies against each other; yet there are clearly wide variations in degree of exposure to modern influences even among nonliterate peoples. Scribner (in unpublished research) secured extensive data on sorting behavior of Kpelle tribal children and adults who had varying degrees of involvement in Western-style living as well as education. The materials to be sorted consisted of 25 very familiar and common objects belonging to categories of hunting implements, foods, cooking utensils, clothes, and sewing things.

Previous research had shown that these categories are part of a hierarchically organized system used by the Kpelle to divide things into subdivisions: utensils and food, for example, are categories or classes under a more general head of *household things*, which is part of a larger class of *working things*. We refer to these as *taxonomic* categories and sometimes, because of the use of the term in this line of psychological research, as *semantic* categories. When individuals group items on the basis of their taxonomic class membership, this is taken by some psychologists to be evidence of abstract thinking.

The particular categories used in this study were selected because they provided items that could be linked together by an action sequence across classes just as easily as by membership in a common class. (The needle, scissors, and shirt can be put together, for example, because you can use sewing items to make an article of clothing). As was true for one of the Greenfield studies described earlier, this dual possibility permitted Scribner to assess the relative probabilities of the two ways of sorting, instead of restricting subjects to the one "correct" way.

Subjects were asked to sort the objects into groups of things that "go together." They were constrained to have no less than three items in a group. Once a classification of the objects was obtained, they were given additional sorting trials until they achieved exactly the same grouping of all the items on two successive trials. This procedure made it possible to examine the *stable* bases used for grouping rather than those "first used."

Adult subject populations were high school students, nonliterate adults from a transitional-type village holding cash jobs (cash workers), nonliterate rice farmers from a traditional village on a road (road village), and nonliterate rice farmers from a traditional bush village five hours from the nearest road (bush village). In addition, there were matched groups of schoolchildren and nonschool children in the 10- to 14-year-old age group (fourth through sixth grades) and in the 6- to 8-year-old age group (first grade).

The groupings produced by subjects were scored on the basis of how many members of a given taxonomic category (food, clothes, etc.) appeared together in the subject's final groupings.

High-schoolers, as expected, almost uniformly grouped items by taxonomic category; cash workers and road villagers also predominantly made category groupings, although none of these men and women had any formal schooling and none could read or write. The use of category membership as a grouping principle dropped off sharply with the bush villagers, but analysis of the items they put together still showed some category influence. Now consider the child subjects. The young ones (6- to 8-year-olds) virtually ignored the categories when grouping, whether or not they were in school; their groups were frequently idiosyncratic, as the following examples illustrate: gun, peanut, and belt; net, headtie, knife, cap, and peanut; needle, potato, and shirt.

The 10- to 14-year-old nonschooled children were not much different from the 6- to 8-year olds, but their schooled counterparts made groups corresponding to some extent to the semantic categories. Here we would seem to have another piece of evidence of the effect of schooling on classifying behavior; we might be inclined, as was Greenfield, to attribute the observed change solely to education, except for one fact: adult village groups, none of whom had had any schooling whatsoever, performed on a par with, or above, the 10- to 14-year-old schoolchildren! This result not only suggests caution against too-easy acceptance of the notion of "arrested development" (on this task noneducated adults were *not* equivalent to noneducated children), but it also suggests that some experiential factors other than formal Western-type schooling may further the switch from nonsemantic to semantic bases of classification.

In addition to mapping the way in which these different Kpelle populations actually grouped the items, Scribner asked each individual to explain the reason why he put particular items together in one group. Here, differences among the adult populations became very marked. High-schoolers almost always gave a category label to their groups ("these are clothes") or expressed their category status by some statement referring to a common attribute of the group members ("you can hunt with these"). In sharp contrast, 70 percent of the bush villagers gave reasons that had nothing to do with the properties of the objects they were grouping; most of their explanations were arbitrary statements, such as "I like them this way" or "my sense told me to do it this way." The transitional village residents (cash workers and road villagers) gave fewer arbitrary reasons than the bush villagers, but fell well below the high-schoolers in citing a common attribute or giving a class name; a common mode of response was to link together items in the group through their different uses—for example, an explanation given for putting net, pot, pepper, okra, and peanut in one group was "the net is for fishing, the okra and peanut are cooked in the pot.

Practically no 6- to 8-year-old could explain his groupings; the overwhelming majority of the children responded to the experimenter's question by repeating the instructions ("you told me to group them") or citing personal authority ("I wanted to do it that way, so I did"). They showed no recognition of the fact that the properties of the materials themselves might provide a basis for dividing the items into groups. Little improvement was shown by the 10- to 14-year-olds who had not been to school, but nearly half of the older children who *had* been to school cited a common attribute of the items or the class name when giving their reason for grouping, and less than one out of five gave an arbitrary reason.

While nonliterate adult villagers and 10- to 14-year-old schoolchildren were quite similar in their *practical* classifying activities, they were very dissimilar in the verbal explanations they gave for these activities: younger people with schooling reflect the category nature of their groupings in the way they describe them; villagers without schooling do not. To make the generalization even stronger, we may say that the only two populations in Scribner's study who made explicit use of class names or common attributes as justification for the classifications were the educated populations. Since a substantial part of Greenfield's evidence for school–nonschool differences in classifying had to do with the way various groups *verbalized* their sorting activities, it may be useful to make a distinction, in the future, between the way individuals operate with things (their actual sorting operations) and the way they describe their own operations. In the study just reported, the most robust effects of education appeared to be on verbalization.

Summary

When we moved on from grand theory to a review of studies on classification processes among traditional people, we found that the terms frequently used in the psychological literature to classify thought processes are somewhat deficient. *Abstract* and *concrete* have been used in a rather loose manner to designate a number of different operations, which do not always co-vary: the particular attribute the individual selects as the basis for grouping; whether he uses this attribute consistently to form all groups in an experimental task; whether he switches from one basis of classification to another; and how he describes and explains the classes he makes. With these many meanings of the terms in mind, it is clear that experimental findings do not allow the conclusion that in general the thinking of any group of people is, or is not, abstract.

We have seen that the attribute selected as the basis for grouping is sensitive to the nature of the materials worked with: how familiar they are (rice versus geometric stimuli), the content domain from which they are drawn (animals versus plants), and the form in which they are presented (objects versus pictures). Although selection of taxonomic class membership as a grouping principle has traditionally (within psychology) been considered the hallmark of abstract thinking, we have seen that this is not an all-or-none affair—the degree to which taxonomic class properties control sorting behavior seems to vary with the saliency of other grouping principles (how items from different classes are functionally related to each other, for example). Does this leave us, then, with an unassimilable relativism? In other words, does it all depend on the materials and the situations? With the information now on hand, we would suggest that classifying operations do seem to change in certain ways with exposure to Western or modern living experiences. Taxonomic class membership seems to play a more dominating role as the basis for grouping items when people move from isolated village life to towns more affected by commerce and the exchange of people and things. Attendance at a Western-type school accentuates this switchover to taxonomic grouping principles. But schooling seems to affect even more than this: attendance at school apparently encourages an approach to classification tasks that incorporates a search for a rule—for a principle that can generate the answers. At the same time, schooling seems to promote an awareness of the fact that alternative rules are possible—one might call this a formal approach to the task in which the individual searches for and selects from the several possibilities a rule of solution. Finally, the one unambiguous finding in the studies to date is that schooling (and only schooling) contributes to the way in which people describe and explain their own mental operations. This last fact suggests an important distinction that should be made in future research—that is, a differentiation between what people *do* and what people *say* they do.

chapter 6 Culture, Learning, and Memory

A great deal of cross-cultural psychological research is based on notions and theories about non-Western thinking that are centered about a *deficiency hypothesis.* This line of thinking typically engenders generalizations such as the following: "In respect to such-and-such a cognitive skill, X tribe fails to perform as well as (American) (Genevan) (English) groups." But when we turn to the area of memory, the picture is reversed. The severest critics of "primitive mentality" unite in extolling the superlative quality of primitive *memory,* and find Europeans wanting in comparison.

An early seventeenth-century observer (Evreux, 1613) of the Tupinamba tribe in Brazil reported admiringly that "they have excellent memories and they always remember what they have seen or heard and they can tell you all the circumstances of place, time and persons, the things said or done." Three centuries later the same point was made by Elizabeth Bowen (1954), who re-