Inference

Our final study looks closely at the question we raised earlier of content and the application of logical rules because the dependence of traditional adults on the content of verbally presented problems may have implications for the application of reasoning to a variety of situations met daily in Kpelle country at the present time.

For example, an entirely new contextual problem faces Kpelle people when they are asked to reason about the unfamiliar contrivances that are introduced as part of the "progress" that accompanies the advent of Western-style schools, business enterprises, and the government tax collector. Flashlights, hurricane lamps, can openers, locks, sewing machines, and a myriad of imported goods are finding their way into even the most remote Liberian villages. Very often the tribal people are not adept at working with such devices, which the European claims "even a child can handle."

As part of our experimental program, we introduced a problem familiar in the United States and sufficiently "gadgety" to offer us some insights into the difficulties that a traditional tribal person encounters when working with such foreign mechanisms. In these experiments, the subject was *required* to combine separate subproblems in order to obtain a goal. One of the general questions of interest is whether Kpelle subjects experience more difficulty than Americans in making such integrative responses.

The experimental situation we used for this study was borrowed from the work of Kendler and Kendler (1967). In this article the Kendler's summarized a large series of experiments on what they term "inferential" behavior in children. They mean by inferential behavior the spontaneous integration of two separately learned behavior segments to obtain a goal. Thus, inference in this situation has a somewhat more specific meaning than it did when we spoke earlier of "inferring" the dimensional basis of solution, which in that case meant roughly, "using evidence to reach a conclusion." The Kendlers' research findings and theoretical position were summarized as follows (p. 186):

> Inferential behavior can be analyzed into two components, an initiating response, and a response which integrates the two segments of the problem. Neither component is likely to occur in young children, but both become more likely in older children. It is assumed that integrating the two components requires that the subject recognize that the potential connector, the element common to the two segments, is the same thing, even though it is a part of different stimulus compounds in each segment. Young children do not integrate the two segments at the first opportunity because they treat the common element as separate *because* it appears in the different compounds. A necessary condition for integration is the abstraction of the relevant element.

It would appear from the Kendler's description that children improve in their ability to solve inference problems as they grow older. Moreover, the Kendlers believe that children learn to solve this problem along the same lines as in the discrimination learning task.

We have an interesting opportunity to test their theoretical position, as well as to gain information on inferential behavior among the Kpelle: young nonliterate children failed to use relevant dimensions to solve the discrimination-learning problem. Therefore, it might be expected, on the basis of the Kendlers' theory, that they would have trouble with this problem. If, as suggested by Kpelle performance in the complex reversal experiment, Kpelle children are capable of treating the subproblems as parts of a larger whole when the situation requires it, they should not have difficulty with the simple Kendler-type inference problem. We must also remember the fact that the Kendler apparatus is completely alien to Kpelle experience.

Replication of Basic Kendler and Kendler Procedures

As an initial experimental pilot study, we began by studying inferential behavior in five groups of rural Kpelle people from the Cuttington College area. Three of the groups were composed of nonliterate children aged five to six, ten to fourteen, and seventeen to twenty-two years. Two groups of educated subjects were run: ten to fourteen year olds (grades one to five) and seventeen to twenty-two year olds (grades four to nine). There were twenty subjects in each group. The groups were run in a mixed order so that we could eliminate systematic experimenter effects.

The apparatus for this study was borrowed from Professor T. S. Kendler. It had been used previously in one of Professor Kendler's experiments on inferential behavior in American children (T. S. Kendler, Kendler, and Carrick, 1966). The apparatus, as shown in Figure 6–1, was a metal box, the front of which was divided into three panels, each with its own door. The panel on the left is painted red. In the center of this panel is a button which the subject had to push in order to receive

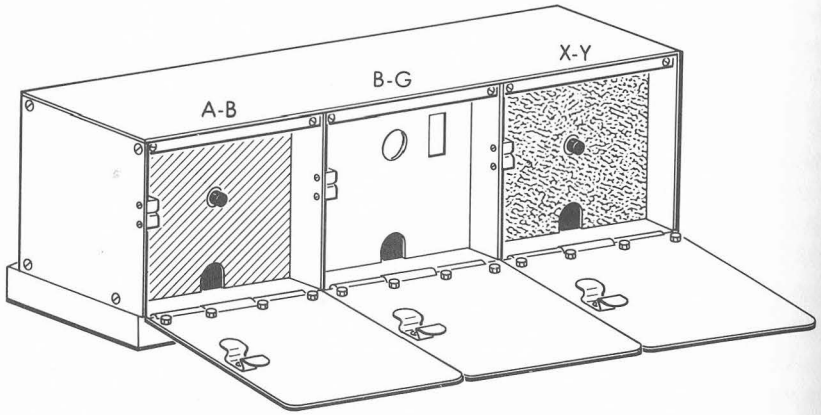

FIGURE 6–1 The Kendlers' Inference Apparatus. (Ball bearing and marble obtained from side panels; candy from the center panel.)

a ball bearing (or a marble, in half of the cases). On the right panel, which is painted blue, there is an identical button which yielded a marble (or a ball bearing) when pressed. The center panel was yellow; it had a small window through which the subject could see the reward, a metal charm. Just next to the window, through which the metal charm could be seen, was a hole into which the subject had to drop the correct object (either a marble or a ball bearing) in order to receive the final goal, the metal charm which dropped into a slot underneath the window. The subjects were paid ten to twenty cents for their participation in the experiment.

Our procedure in this initial experiment was modeled as closely as possible on that described in Kendler, Kendler, and Carrick (1966). We even used electricity to make the various parts of the apparatus work, which meant that we had to restrict our study to Kpelle towns that had electricity.

The general idea of the experiment is quite simple, although the details (given in Appendix J) can be quite complex. First, the subject was taught that he could get a marble from one of the side panels by pushing the button in the middle of the panel. Then he was taught that a ball bearing could be obtained from the opposite panel. Finally, he was taught how to obtain the metal charm by dropping one of these objects (say, the marble) into the hole in the center panel. We wished to know if the subject, seeing all three panels open for the first time, could combine the three separate learning sequences in order to choose the panel that

contains the marble and place the marble in the center panel to obtain the charm.

We needed several items of information about the subject's performance in order to answer this question. First, how readily does the subject begin the task: does he have to be prompted to make his first choice? Second, how accurately can he choose the correct subgoal? Can he identify the object that can be obtained from one of the side panels and that will ultimately produce the charm for him? Third, how efficiently does he begin with the correct response and go on to complete the full sequence of choices? Such integrative responses, when no intervening responses occur, will be labeled direct-correct responses, following Kendler, Kendler, and Carrick (1966). The subject, however, may make a correct response initially, but then make some intervening response, perhaps pushing the button on the second side panel prior to making the goal response. In a great many cases, moreover, subjects pushed both buttons simultaneously, but went on to make the correct goal response. If the subject gave either of these response sequences, they were called indirect-correct solutions.

Fourth, how strong is the subject's tendency to make a goal-directed response, regardless of correctness? Does he realize that the two subproblems "go together"? We will term such behavior "integrative." Integrative behavior in practice may consist of either direct-correct solutions or indirect-correct solutions. However, we found in our experience with Kpelle subjects that several other patterns also were possible. For example, a subject who has to be prompted all along the way may make correct choices without showing integrative behavior. The results of our initial experiment are shown in Table 6–5.

The column labeled Spontaneous First Choice shows us that only educated subjects were initially inclined to start working with our strange apparatus. In many cases, especially among the nonliterate subjects, there were overt signs of fear. Very often subjects would sit quietly and wait for the experimenter to ask him additional questions. Others would play with extraneous features of the apparatus.

None of the groups showed any marked tendency to make direct-correct inferential sequences. In large measure this is because so many subjects make an initial choice by pressing both side-panel buttons.

The columns marked Indirect-Correct and Total-Correct show that the subjects, especially the older, educated subjects, were fairly good at obtaining the ultimate goal. But such a conclusion probably overestimates the extent of real integrative behavior. When subjects failed spon-

TABLE 6-5

Performance on Inference Experiment 1

GROUP	SPONTANEOUS FIRST CHOICE	DIRECT CORRECT	INDIRECT CORRECT	TOTAL CORRECT	INTEGRATIVE BEHAVIOR
Five- to six-year-old nonliterates	35%	30%	30%	60%	60%
Nine- to twelve-year-old nonliterates	45	20	45	65	45
Nine- to twelve-year-old schoolchildren	80	30	50	80	80
Seventeen- to nineteen-year-old nonliterates	65	15	60	75	55
Seventeen- to nineteen-year-old students	90	30	50	80	75

taneously to put one of the subgoal objects into the goal to obtain the charm, they were asked, "Which ball should you use to get the charm"? Because of the strong initial tendency to push both side-panel buttons, the subject was likely to have both the marble and ball bearing in his hand. Consequently, a good deal of the indirect-correct responses were likely to be the result of chance selections.

The same negative conclusion emerges from the column marked Integrative Behavior. Here we have included only those instances where the subject, once he had either the marble or the ball bearing in hand, went on to make the goal response. Subjects who have attended school most frequently show this behavior.

On the whole we were impressed by the great reticence of our subjects in this experiment. Our strange apparatus, and perhaps our strange procedures, made subjects very unwilling, and we were not at all sure that our data were really comparable with American data such as that collected by the Kendlers. In America it had been found (see Kendler and Kendler, 1967, for a review of these data) that by third grade approximately 50 percent of the children studied made direct-correct inferences. Moreover, American college students almost always made such direct inferences.

Up to this point our work provides a model of how *not* to do a cross-cultural experiment because we really have no way to decide

among various explanations for our findings. Is it fear of the electric apparatus that makes our subjects so slow to respond? Are the instructions unclear? Or is it some difficulty inherent in making arbitrary, although seemingly simple, inferences of the sort this experiment tries to elicit?

We leaned strongly toward the hypothesis that it was the way in which we had tried to study inference, not the inferential task itself, which had provided the difficulties. So, we set out to find a different task, embodying the same principles, which would permit us to make better judgments about inferential processes among the Kpelle.

An "Ethnic" Replication of Kendler and Kendler

In searching around for such a task, we finally selected the following problem, formally equivalent to the Kendler problem, but using materials familiar to the Kpelle. The subject was presented with two matchboxes, one of which was taped, the other of which was bare so that the boxes would be easily discriminable. A black key was placed in one of the matchboxes; a red key in the other. In the initial phase subjects learned, in a manner completely analogous to that in the experiment we just reported, to identify which box contained which of the keys. Once this had been learned, the matchboxes were put aside and a small box with a lock on it was brought out. The subject was told that one of the keys, red or black, would open the lock and that if he opened the box, he could have the piece of candy that he found inside. Subjects quickly learned that the red key (for example) opened the box. Then, the matchboxes were brought out again, so that both the matchboxes and the locked box were present together. The box was locked and the subject was told that if he did the right thing, he could get the candy. In this version of the problem, the matchboxes represented the side panels, the two different keys were the subgoals, and putting one of the keys in the lock solved the problem (just as putting the ball bearing or marble in the hole solved the problem in the previous experiment). Three groups of subjects were investigated using this procedure. The results are contained in Table 6–6. It is obvious from Table 6–6 that performance on the inference task is greatly enhanced by the use of the matchboxes and the locked box.

To begin with, there was a general and spontaneous willingness to engage in the task. First-choice probabilities were still at 50 percent for the youngest subjects, but performance for both the older school sub-

TABLE 6-6

Performance on Inference Experiment 2

GROUP	SPONTANEOUS FIRST CHOICE	CORRECT	DIRECT CORRECT	INDIRECT CORRECT	INTEGRATIVE BEHAVIOR
Seven- to twelve-year-old first graders	60%	80%	70%	20%	90%
Ten- to fourteen-year-old second to fourth graders	100	80	70	20	90
Nonliterate adults	70	90	80	10	90

jects and the older nonliterates was well above chance. Moreover, direct-correct solutions were now at a level superior to the performance of the American third graders reported in the earlier experiment. Similarly, the index of total integrated behavior indicates that virtually all of our Kpelle subjects showed integrated inferential behavior in this situation.

The problem now is to determine the critical difference between the two sets of experiments. One experiment suggests that the Kpelle had difficulty with inference problems of this kind. The other indicates that they did *not* experience such difficulties and in fact respond in a manner characteristic of American upper-grade schoolchildren.

In designing the matchbox–locked box procedure, our aim was anthropological. We were interested in devising a task that would be familiar and culturally appropriate to the Kpelle. However, it is quite possible that in our choice of components we stumbled upon a *genuinely* different way of doing the experiment, not just a difference in content. In particular, it could be argued that in the second experiment, the connection between the key and lock was highly overlearned prior to the time the subject began the experiment. All he really had to do was to learn which matchbox contained a key because he did not need to learn to open locks with keys. Everyone knows that keys open locks since such devices are quite common now in the Liberian interior. This interpretation would fit in quite well with the theoretical discussion offered by the Kendlers and presented above on pages 204–205.

Familiar and Unfamiliar Components

In order to determine which interpretation was correct (the familiarity hypothesis or the prelearned connection hypothesis), we constructed an experiment containing a series of conditions designed to separate the effects of different combinations of stages.

The general strategy in this experiment was quite simple. We wished to construct experimental conditions that represent all possible combinations of the features of the first two experiments in order to determine which features of the first two experiments are critical to good performance. We assumed that the first study consisted of unfamiliar components and that subjects had no knowledge of a link between subproblems. The second experiment represents familiar components and a prelearned link between subproblems. Among the experimental conditions we included problems with familiar first-phase components, combined with unfamiliar, unlearned second components (the Kendler box), and unfamiliar initial components, combined with a prelearned, familiar second phase (keys and the locked box). A number of conditions (seven in all), representing variations on this theme, were conducted with separate groups of twenty Kpelle schoolchildren aged ten to fourteen in grades one and two. Because the procedures we devised had not been used in America previously, groups of twenty first graders (aged approximately seven years) were run in America as well to give us a rough basis of comparison of the relative difficulty of the various conditions.

The results (shown in detail in Appendix K, Table K–1) rather convincingly demonstrate a cross-cultural *similarity* in the relation between problem structure and problem difficulty. Problems were easier if the initial link was familiar. However, a prelearned, familiar second stage seemed to have little effect on responding except to make the Kpelle respond a little more quickly overall. The fact that our American first graders showed general improvement when they began by dealing with matchboxes, instead of the specially built inference apparatus, suggests that their generally poor performance in the Kendlers' standard studies may be much less a matter of general deficits in "mediational" capacity than an ability to attend to relevant aspects of a problem involving a strange apparatus. Anthropological observation can be a two-way street. Our anthropological hypothesis appears to account for the results in *both* cultural groups!

Returning for a moment to one of the questions that motivated this set of studies, we can now conclude that where problem solution requires the subject to combine separately learned subproblems, neither Kpelle nor American subjects experience special difficulty in doing so, provided that the elements of the problem are not unfamiliar or do not induce fear. In situations where such combination is optional (the discrimination-learning studies in Chapter 5), concept-based learning may or may not occur, depending on factors that at present we cannot identify. Similarly, differences in the structure of logical rules (as in Ciborowski's work) may or may not influence learning (see Appendix I for details).

SEVEN : Conclusions

> Custom for most men is a substitute for thought.
>
> M. HODGEN, 1952, p. 73

In this last chapter we will first review the major issues raised in our discussion of the relation between culture and thought. We will then briefly survey our findings. Finally, we attempt to draw conclusions about the relation between culture and cognitive processes from the historical, observational, and experimental data we present in this book.

Two major points of controversy can be abstracted from our historical survey and discussion of methodology. First, is evidence from ethnographic analysis relevant to understanding individual psychological processes? Second, are observed differences in thinking to be interpreted as reflecting differing cognitive capabilities or differing applications of universal cognitive skills in specific contexts?

In the nineteenth and early twentieth centuries, the first question would have been answered in the affirmative. Traditional beliefs were the only source of evidence about "thinking," and the prevailing opinion was that "primitive beliefs imply primitive thinking." At issue was not the existence of different patterns of beliefs, such as those described so graphically by Levy-Bruhl (1910), but their interpretation. The first serious challenge to belief in the existence of a specifically primitive mentality came from Franz Boas (1911), who denied that everyday beliefs provide evidence about thought processes. Boas's position has, in the main, been supported by later generations of anthropologists, whose views are well summarized by M. Gluckman:

> Very many scholars writing on social problems like to begin their analyses with a statement of what primitive man thought or did; they use the comparison to highlight their analyses of our own ideas. As anthropologists see it, what they do is to give the stereotyped presentation of what they would think were they, savants and scientists of our civilisation, presented with the social beliefs of primitive society. But I hope this analysis has brought out

that the thinking processes of man in primitive society are more complex, and that neither his character nor the nature of his mind, nor his views of the universe can be simply derived from selected beliefs of his culture, particularly the myths and mystical beliefs. [1949, p. 87]

Although Gluckman's position is one to which most anthropologists and psychologists would subscribe, it has the unfortunate consequence of leaving classical anthropology without a theory of individual thinking. Recently, some anthropologists, notably Robin Horton (1967 *a,b*), have explored the functional similarities and differences that thinking fulfills in different societies. In so doing, Horton arrives at some predictions about individual psychological functioning which are empirically testable but which await confirmation.

Another approach to a theory of cognition in contemporary anthropology comes from the work of linguistically oriented anthropologists, who, in their desire to obtain unambiguous descriptions of native category systems, have left untested the relation between ways of classifying and ways of thinking. The relation between content and process has been assumed rather than demonstrated. Only in the speculative work of Claude Lévi-Strauss (1966) do we see an attempt to demonstrate that Western and primitive category systems lead to different ways for individuals to solve problems.

We have noted that their rejection of evidence from belief systems seems to leave anthropologists without a theory of the relation between culture and thought process. In fact, most anthropologists tacitly assume that *there are no fundamental differences in thought process among different human groups* whether these groups are differentiated along cultural or racial lines. This faith is summarized in the so-called doctrine of psychic unity (Boas, 1911), and reflected in current emphasis on category systems as alternative frameworks within which universal processes operate.

Twentieth-century psychologists have also rejected evidence from belief systems in testing theories of thinking. They claim not to be able to determine if differences in beliefs depend on different thought processes, or simply on different remembered responses to particular situations. For example, we no longer consider it logical to believe that the world is flat, but the process by which most of us come to believe that the earth is round is hardly scientific. Recognition of these difficulties has led to psychological definitions of cognition that emphasize the rearrangement of past experience or "going beyond the information given."

This is coupled with an insistence upon experimental methods that carefully control both "what is known" and "what must be found out."

The dominant method of contemporary psychologists is to use experiments and tests to yield information about the psychological processes of individuals and also, statistically, of groups. These processes are treated as individual properties that are "tapped" by the experimental or test procedure.

The stress of psychologists on thought as process provides one rationale for prior enthnographic study of the people with whom one wants to conduct psychological experiments. Certain kinds of differences among groups may "interfere" with the assessment of subjects' cognitive capacities. As an extreme example, it would be foolish to conduct one's experiments in English if the subject spoke only Kpelle, although in some places English IQ tests are still administered to Mexican-American children as they enter school.

By the same token, many investigators take great pains to make their instructions understood and to include culturally relevant materials, rather than materials manufactured ahead of time in the West. When adapting the test instrument leads to improved performance, the experimenter concludes that he has found a better measure of the underlying processes (Price-Williams et al, 1969). Thus, one object of prior ethnographic study has been to facilitate the adaptation of test instruments, which, in their modified form, can be treated as "culture-free" measures of psychological processes.

The almost universal outcome of the psychological study of culture and cognition has been the demonstration of large differences among cultural groups on a large variety of psychological tests and experiments. This has led to the widespread belief that different cultures produce different psychological (in the present case, cognitive) processes. Thus, we have cited several references to the concrete nature of traditional African thought (Cryns, 1962), to the inability of unschooled Africans to think abstractly (Greenfield and Bruner, 1966), and to cultural differences in psychological differentiation (Witkin, 1967).*

In the face of the experimental evidence of cultural differences offered by psychologists, how can the anthropologist maintain his belief in the psychic unity of all mankind? He does so by rejecting both the

* Since this book was completed, a rapprochement between the views put forth here and the approach adopted by Bruner has occurred (see Cole and Bruner, 1972).

psychologist's attitudes toward the people he studies and toward psychological tests.

We mentioned in Chapter 1 the linguist's caution that a person cannot be judged cognitively less competent than is necessary to master the complex rule system of his native language. In a like manner, the anthropologist *assumes* persons to be sufficiently competent to carry out the many complex functions required of them in even the most primitive societies. Societies, of course, vary in the kinds of tasks they pose for their members. Following the common-sense dictum that people will be skilled at tasks they have experienced often, cultural differences in the activities eliciting skilled performance are to be expected. But these are not "process" differences in the psychologist's sense, but are considered as specific adaptive skills that may or may not imply process differences. A fish seller will develop the mathematical techniques required for making a profit (H. Gladwin, 1970), a sailor will develop navigational skills (T. Gladwin, 1970), and the bard will master rules of story telling (Colby and Cole, 1972). Many such examples are familiar to the anthropologist.

Where a psychologist, on the basis of test results, concludes that the fish seller lacks the ability to think abstractly or the bard has a poor memory, the anthropologist is understandably skeptical of the psychologist's conclusion. Repeated examples of such clashing interpretations have left the anthropologist secure in his belief in psychic unity. The psychologist, convinced that tests (or experiments) measure process, and generally ignorant of the kinds of adaptive, intelligent performance cited by the anthropologist, remains confident in his own interpretation.

Our experience leads us to propose yet a third view of experiments, especially those involving cross-cultural cognitive comparisions. Instead of assuming a close relation between particular test situations and hypothetical cognitive processes or assuming that skills are only used in natural contexts, we view tests and experiments as specially contrived occasions for the manifestation of cognitive skills. It is true that we use the terms *process* and *skill* ambiguously in this context since we mean both underlying mental processes and specific material activities. We attempt, however, to make full use of this ambiguity by relating the outcome of experiments to relatively specific and identifiable ways of learning and solving problems. For example, we found that Kpelle people are skillful at measuring rice, but not at measuring distance. In like manner, expert navigators may use a complex natural compass, but fail

to perform like American high-school students on a standard psychological test (T. Gladwin, 1970).

If experiments are occasions to demonstrate the use of skills, then failure to apply the skills that we assume are used in natural contexts becomes, not an illustration of cultural inferiority, but rather a fact to be explained through study and further experimentation. We assume that in these cases, skills are available but for some reason the context does not trigger their use. *We thus make ethnographic analysis prior to experimentation in order to identify the kinds of activities that people often engage in and hence ought to be skillful at dealing with.*

In effect, we maintain that neither ethnography nor an experimental approach alone is by itself sufficient. Ethnography is unable to separate the traditional from the "reasoned," suggesting that experimentation is needed to complement the implications of ethnographic analysis. Conversely, we have argued that if experimentation leads to results incompatible with ethnographic analysis, the experiment was probably culturally inappropriate, and needs an ethnographic base both as a guarantee for the meaningfulness of the experiment to the subject, and as a standard against which to interpret the adequacy of the experimental conclusion.

The ethnographic standard sets a goal for experimental work. If, after exhaustive experimentation that ethnographic goal is not achieved, we question both the form of the experiment and the ethnography itself. Similarly, the ethnography gives powerful suggestions about the form in which experiments should be run, and some of the major contextual variables that should guide the formulation of a series of experimental investigations. Experimental work and ethnography must interact, each approach setting standards for the other to maintain.

If we relate cognitive skills to specific activities, then we ought to be able to use cultural variations in order to evaluate their cognitive consequences in at least two ways. First, we ought to be able to look at variations in common activities *within* a given cultural setting and on this basis make statements about variations in cognitive activities. This enterprise is basically *ethnographic*. Second, we could extend this analysis to cross-cultural comparisons when we compare differences in the patterns of cognitive performance within each of two different cultures to differences in the patterns of activity between these same two cultures.

Ideally, we ought to be able to use specific cross-cultural comparisons to provide us with "natural experiments." For example, contrasts be-

tween schooled and nonschooled children are a natural arena for the study of differences in cognition. This enterprise we can call *comparative anthropology,* or in the terminology of Chapter 1, experimental anthropology.

In the remainder of this chapter we will consider our success and failures in the light of these issues and our own experience. We will then attempt to draw some general conclusions about the relation between culture and thought.

Ethnographic Concerns

We began the presentation of our research with a description of selected aspects of contemporary Kpelle culture. Originally, we justified this ethnographic concern on methodological grounds. Cultures are organized in complex ways, and in order to understand any given cultural feature, it is necessary to know the relation of that feature to the culture as a whole.

We were also motivated by the general hypothesis, which we have just discussed, that different cultures provide for different learning experiences. The tasks that a culture frequently poses for its members will be the ones with which they deal effectively. This is by no means a new idea. It is implicit in A. F. Chamberlain's remark (p. 14) that "it is not the minds so much as the schools of the two stages of human evolution that differ."

On both methodological and theoretical grounds, then, we sought to understand the characteristic activities of people that could be expected to influence the way in which they engage in such cognitive activities as problem solving, remembering, and rule learning. We then hoped to study these activities in specific experimental situations.

The gap between these goals and our specific achievements in this regard appears to us very large. With very few exceptions our search for general characteristics of Kpelle daily life as it is related to specific cognitive processes has produced guesses about differences in the activities and thought processes of different subgroups, rather than a detailed documentation of those differences. One reason for our failure to demonstrate detailed relationships is that no comprehensive theory of the relation between mundane activities and cognitive processes has proved

acceptable, although there are many specific theories of the relation between particular activities and their cognitive consequences.

Some examples will clarify the problems we have in mind. The principle that says that people will be good at doing what is familiar to them led us to the study of measuring and estimating quantities of rice. In that case we seemed to describe a specific activity and its intellectual consequences. But what about rice farming? Farming is an activity that is technologically quite simple in the sense that only a few simple tools are required to grow upland rice. But a successful farmer has a great deal to learn. He must take into consideration many factors as he chooses his site and decides how big a farm to make, what additional crops to grow, when to plant them, and when to harvest them. To be sure, there are traditional prescriptions, but these do not specify most of the decisions which must be made. We understand only a few of the details of this decision-making process. Rice farming consumes a great deal of every Kpelle person's time. Yet we have almost no data on the intellectual components or consequences of rice farming.

Consider a second example. Time and again we have been impressed by the seeming subtlety of Kpelle social relations. We have provided data on the importance of speaking well, of debating, and of learning proper social roles. We have seen in the sample court case how people will try to use evidence and tradition to their advantage in arguments. We have followed in detail a complex intellectual game. Yet we have only the scantiest data relating these activities to the intellectual tasks that we experimentally set for our subjects.

A really major gap in our research involves the learning environment of the young child. Unfortunately, we have had to rely on rather superficial observation on our own part, as well as the scanty anthropological evidence provided by Sibley and Westermann and Gibbs. We have often relied on such anthropological observers as M. Fortes (1938) to inform us of the kinds of experiences met by children in other traditional African societies, and we have extrapolated to the comparison between the Kpelle and Western children.

The most important generalization on which we have failed to obtain concrete data is that children in nontechnological societies do a great deal of learning by observation and imitation. This failure was not from lack of interest on our part. Early in our work we began to collect data on children's activities, particularly when they were interacting with adults. But we were not satisfied with the data we obtained; it soon became clear that a really comprehensive field study using techniques such

as those developed by J. W. M. Whiting and B. Whiting (B. Whiting, 1963) in anthropology and R. D. Hess and V. C. Shipman (1965) in psychology would be necessary. Lacking the resources and time for such an effort, we had to depend on asking hypothetically what the consequences would be if learning were generally imitative.

Such reasoning led us to note the difficulty subjects had in verbalizing the solutions to experimental problems and the comparable difficulties in explaining the principles of house building and rice farming. But the observation that learning seems to take place by observation and imitation does not allow us to predict specific cognitive difficulties. On this point we have virtually no data. Although we carried out some pilot studies of what we thought might produce imitative learning, none of these produced results systematic enough to warrant reporting.

Happily, cross-cultural research aimed directly at these questions is being undertaken by the Whitings and their colleagues (Whiting and Whiting, 1970). It remains, however, for us to apply this line of research among the Kpelle.

What is badly needed is a far-reaching extension of the thinking that motivated our ethnographic work. The literature on cognitive processes and cognitive development is filled with problem-solving and learning tasks. Many of these have analogues in everyday activity. These analogies must be systematically exploited in order to determine how the learning experiences provided by different cultures relate to the logical structure and content of specific cognitive problems.

For example, it is our impression that many social situations encountered by the Kpelle are analogous in form to various experimental situations. Examples of the learning of rules, as well as learning to use these rules in a contingent way, are suggested by much ethnographic data describing social situations. Yet we have no tools for distinguishing social and nonsocial problem-solving situations in an analytic fashion. In fact, almost all experimental situations are *nonsocial* in the sense that their successful solution requires manipulations of objects or words abstracted from context, rather than relations with people. Is it possible that were we to find the social analogues of these experimental situations, our informants would experience less difficulty and might even show themselves to be quite clever?

It seems suggestive to us in this regard that among the Kpelle the adjective *clever* does not apply to such technological operations as rice farming, house building, and car repairing. A farmer may be considered lazy or hard-working, but the term *clever* is restricted to the social

sphere. A related fact is that the same kinds of people who found it difficult to explain the principles of good house building found it easy to tell us how their children should be raised.

Although it does not entirely fit our prescription of how things ought to be done, the data we gathered on the organization of Kpelle noun classes represents an extensive, if not exhaustive, description of one kind of Kpelle language behavior. Despite the serious problems that arose in classifying objects that could be fit into more than one taxonomic scheme, the organization of nouns represented by the *seŋ* chart (Table 3–1) was found to have implications beyond the rather structured situation in which it was elicited. We can have no doubt, based on the evidence from the sentence-substitution, free-association, and sorting studies, that the semantic groupings contained in the chart can serve to organize other linguistic as well as nonlinguistic classification. The relations of subordination and class inclusion we characterized as "horizontal" and "vertical" distance were reflected in the rate at which different categories were discriminated verbally. Having established that the relations among nouns described by the *seŋ* chart can describe the way the nouns are used in various verbal and nonverbal situations, we now want to ask, "what are the rules governing *when* they are used?" Here we can offer neither experimental nor ethnographic evidence.

In this, as in our other, work we believe our ethnographic concerns are justified. However, we must acknowledge that we have hardly begun to study the interrelation of cognitive and other activities within a particular cultural setting.

Experimental Anthropology

We not only searched for significant *intra*group variations in everyday activities that could be related to variations in cognitive activity. We also studied contrasts between significant subgroups of the Kpelle themselves as well as between the Kpelle and other cultural groups.

In Chapter 1 we discussed two drawbacks to a comparative experimental approach. First, it is considered dubious strategy to draw inferences from experiments that are alien to the culture concerned because it is believed that cultures are complex wholes, which cannot be picked apart in this manner. Second, the experiments confound a number of hopefully independent variables because the contrasts chosen are vir-

tually certain to involve simultaneous changes in many aspects of the culture.

Nonetheless, comparative statements are commonly made, generally in terms of a theory of general cultural advancement as cultures become more Westernized. Rarely are the cultural institutions and cultures compared viewed as "different but equal." Schooling (Greenfield and Bruner, 1966), literacy (Goody and Watt, 1962), and acculturation (Doob, 1960) are all seen as providing people with new cognitive processes, new abilities, and new intellectual tools. The authorities claim that without extensive training, the mind is only capable of concrete thought; without writing, analytic thinking is not possible; without new technical challenges, culture and thought are stagnant.

One consequence of such a view is that the "deprived" groups (who lack formal schooling, who have not learned to write, and who lack Western technology), are seen as uniformly lacking in particular, "developed" skills. Another consequence is that the cultural transition to the educated, literate, technological world is often conceived of as causing a *transformation* in cognitive processes. According to this position, we can no more think like a savage than he can think like us.

It is possible that cultural changes lead in some ways to transformations in cognitive processes. However, we think that our data argue at least for a modification of the viewpoints expressed above. To begin with, let us consider how each of the major variables, age and education, affected the performance of Kpelle subjects. We will refer to some but not all of our experiments in so doing.

With respect to age we find, along with many other observers, little differences in the experimental performance of younger and older nonliterates. There is a slight improvement in the number of items recalled as a function of age in our early free-recall experiments, but no qualitative change in the structure of recall. There is also a slight tendency for older subjects (ten to fourteen years) to reverse a discrimination, or transfer a discrimination faster than six to eight years olds.

The really large differences, as in past research (Gay and Cole, 1967; Greenfield and Bruner, 1966), are produced by exposure to Western-style education. But the consequences of education are by no means uniform. Table 7–1 contains a rough schema of the various experiments involving educational contrasts and the degree of schooling at which differences in performances were observed. Table 7–1 makes it clear that we can make no simple generalization about which tasks (or processes) are affected by various degrees of education.

TABLE 7-1

Summary of Effects of Different Levels of Education on Performance

EDUCATIONAL LEVEL	TASK AFFECTED	HYPOTHETICAL MECHANISMS AFFECTED
2 to 6 years.	Pseudoreversal: spontaneous shifting (Ch. 5)	Combining instances
	Discrimination transfer (Ch. 5)	Combining instances: stimulus-specific versus dimensional learning
	Inference (Ch. 5)	Combining instances: initiating the problem
	Transposition (Ch. 5)	Dimensional control
	Verbal logical problems (Ch. 6)	Use of Hypothetical mode
	Concept discrimination	Combining instances via semantic class
	Color/form preferences (Appendix I)	Unknown
High School	Similarities mediation (Ch. 3)	Imposition of taxonomic grouping
	Free recall (Ch. 4)	Production of structure
Unaffected	Free association (Ch. 3)	Exclusive use of definitional mode
	Rule learning (Ch. 6)	Unknown

Certain tasks are performed better when the child has had a few years of schooling. With the exception of the verbal logical problems, all these tasks contain elements of a discrimination-learning procedure. Two sets of experiments are affected only if the subject has attended high school; namely, the constrained-classification task we called similarity mediation and the free-recall tasks. In the similarity-mediation study only the high-school students base their classifications on static, taxonomic categories. In free recall, although there was some indication of a change in the basic recall process for ten- to fourteen-year-old fourth to sixth graders (Appendix F), really striking effects are obtained only in the case of the high-school students who alone showed significant semantic clustering, pronounced serial-position effects, and clear-cut improvement over trials. Finally, the free-association study and the experiment on conjunctive and disjunctive problem solving revealed no striking differences in the performances of high-school students and their nonliterate age mates.

This patchwork of education-related changes in Kpelleland contrasts quite strongly with the results of comparable American studies for

which data are available. In free association, free recall, the learning of conjunctive and disjunctive rules, inference problems, discrimination-transfer problems, and similarity mediation, performance improves from kindergarten on.

Using these facts as background, we will attempt to give a detailed answer to this basic question: what are the cognitive consequences of the cultural change induced by Western-style education in Kpelleland? We suggest that two closely related factors are affected by schooling. First, as many authors have suggested, the new cultural institution leads to the acquisition of new intellectual skills. This sounds like a recapitulation of the position we were criticizing earlier, but as we shall see, our view is more restricted. Second, the new cultural institution leads to a change in the situations to which skills are applied.

These two abstract propositions find support in many different aspects of our data. Let us begin by considering the discrimination-learning experiments discussed in Chapter 5. The major finding (summarized in Table 7–1) was that moderate levels of education led to performance that American research has found to be characteristic of a higher developmental level. For example, schoolchildren reverse faster in the pseudoreversal problems; they learn faster and acquire more skill at learning in the discrimination-transfer study.

If our analysis in Chapter 5 was correct, the education-related changes in discrimination learning occur for two reasons. First, educated subjects are more likely to treat the individual stimulus presentations as subproblems (or examples) from which the answer to *the* problem can be induced, while noneducated subjects are more likely to treat each presentation pair as a separate problem. Second, there is a greater tendency on the part of educated subjects to use a stimulus dimension such as color or size in solving the problem. In practice these two factors are closely related, because using a dimension-based method of solution requires that subproblems be seen as related. But the data from the pseudoreversal study indicated that the two processes are in fact at work separately. Even in the absence of a common dimension, older educated subjects treat the two problems as "instances" of a supposed general problem.

But we cannot conclude from these data that the observed differences in performance reflect differences in the cognitive skills possessed by the two groups. We cannot do this because our data also indicate that (1) under some conditions nonliterate subjects will combine subproblems, and (2) under some conditions nonliterate subjects use a common stimulus dimension to guide their responding.

Although the discrimination-transfer analysis strongly suggested that the nonliterate six to eight year old learned item by item, data from certain of the discrimination-reversal and transposition studies indicate that these children can use more generalized learning procedures. Dimension-based learning is seen most clearly in the transposition study. Children trained to choose the larger of two square blocks did not choose that block when given a choice between it and a still larger block; they chose the new larger one. The child who attends only to specific stimuli would choose the previously correct block.

Similarly, nonliterate children showed some tendency to use dimensional information in the discrimination-reversal studies, but only if they were required to make a reversal shift. They responded as if subproblems were independent if required to make a nonreversal shift. (Figure 5–3).

Finally, in a study on reversal learning conducted some years ago, we found that nonliterate Kpelle learned a reversal shift more rapidly than a nonreversal shift in a problem requiring the subject to sort sixteen stimuli (Cole, Gay, and Glick, 1968). Having shown that faster reversal learning requires something more than learning specific stimuli, the results of the latter study strongly suggest that under some conditions, ten to fourteen year olds will treat the discrimination-learning situation in a "conceptual" manner.

If we restrict our attention for the moment to these discrimination-learning tasks, what can we say about the cognitive differences that arise in conjunction with the cultural difference between educated and noneducated Kpelle children? We suggest that there is a different likelihood that a given situation will evoke a general, as opposed to a specific, mode of problem solving. It is *not* the case that the noneducated African is incapable of concept-based thinking nor that he never combines subinstances to obtain a general solution to a problem. Instead, we have to conclude that the situations in which he applies general, concept-based modes of solution are different and perhaps more restricted than the situations in which his educated age mate will apply such solutions.

It is common for psychologists to use discrimination tasks such as these to test hypotheses about mediating processes (Kendler and Kendler, 1968) or about the ability to switch the focus of attention (Zeaman

and House, 1963). In particular, they infer the degree of use of general processes from discrimination-learning performance. Our data indicate that the relation between discrimination-learning performance and hypothetical underlying processes will be very difficult to establish, since our subjects sometimes seem to use the general process and sometimes do not.

At the very least, theories concerning any general process must contain statements that indicate when the process will be brought to bear on the problem and when it will not. This is the issue we were raising when we said that cultural differences in cognition may more nearly reflect changes in the situations to which various cognitive skills are applied, than they do general processes. According to the results summarized in Table 7–1, the noneducated Kpelle can use mediating processes: he can learn in a dimension-based fashion; he can combine subproblems. But the conditions under which he does so are different than the conditions that evoke such behavior in the educated Kpelle or Americans. The noneducated Kpelle subject more frequently learns in a stimulus-specific way on the experimental tasks we set him. The educated Kpelle, and particularly the older American child, only rarely learn in such a fashion.

The tendency for the American schoolchild to learn things according to some general scheme is very, very strong. In fact, in some cases the subject's assumption that he had to follow some particular unstated rule interfered with proper performance. For example, American children, more commonly than noneducated Kpelle children, used taxonomic categories as the basis for completing the similarities-mediation task (Chapter 3). The use of such categories is ordinarily considered by Western psychologists to represent a higher level of cognitive development than the use of functional categories. Yet so strong was this tendency that where the conditions of the problem made taxonomic classification difficult, or even impossible (as, for instance, when the child had to choose an item to place between a file and an orange), the American children would violate the instructions in order to maintain taxonomic classification. Instead of choosing an item that went with both of the constraint items, they would choose an item that was part of the same taxonomic class as *one* of the constraint items and ignore the other. The Kpelle subjects, even the high school subjects who used taxonomic classification widely, would not violate the conditions of the problem in this manner. Their performance indicated that they were capable of taxonomic classification, but they used the taxonomic mode under a narrower range of circumstances.

Another interesting difference between Kpelle and American use of general dimensions occurs in the concept-discrimination studies of Chapter 4. We found clear evidence that learning among the Kpelle was concept-based (because two semantic categories could be discriminated faster than two randomly formed classes). However, there was no transfer of training from one class to a closely related class. That is, the control of the concept was specific to the particular words being discriminated. It is truly unfortunate that our initial motivations for conducting those studies did not lead us to use educated comparison groups, because it is our strong impression that the educated groups would show not only a larger difference between rule and random classes, but positive transfer to closely related classes. That is, control of the rule should be stronger for educated subjects and should be applied more widely.

The pilot concept-discrimination data from American subjects reported in Chapter 4 indicate a reliance on concept-based learning so strong that it can actually interfere with learning if no obvious concept is involved. The American subjects are more likely to use class distinctions to guide learning, because the differences between rule and random classes are generally large, even for distinctions based on linguistic classes. But the evidence suggested that the greater difference between rule and random classes for the American subjects was largely the result of slow learning of the *random* classes, even though there were only eight pairs to learn. When these subjects were asked about their performance following the experiment, they indicated that they had gone to great lengths to discover a rule where in fact there was none. So intent were they on identifying the distinctive feature of each of the classes that they neglected, as it were, to learn what the class members were. Only after abandoning this strategy did they turn to simply recalling the correct instances, after which the criterion of learning was reached. Thus the relatively greater ease in discriminating semantic classes by these subjects seems to depend on a negative element. The greater difference between rule and random classes may have occurred because the subjects failed to treat the random classes in the way that would lead to most rapid learning.

In general, it appears that many of the experiments in which education affects performance or in which American subjects perform differently than their Kpelle counterparts are under the control of situational

factors of which we had only a dim awareness at the start of our research and which we only poorly understand at present. It does not seem helpful to invoke a generalized change in cognitive processes to account for this pattern of results. At best we have identified specific ways of learning, which members of all groups we have studied *can* use under some circumstances, but which members of different groups use in different situations. This is not to deny the usefulness of general psychological constructs (mediating response, rote learning, attentional mechanism) for describing the results of many experimental situations. It simply does not seem appropriate to say that our groups differ because of the presence or absence of these processes.

Are there any results from our work that seem to *require* us to invoke differences in basic processes to explain group differences? This is a difficult question to answer as our discussion in this chapter has made clear. Failure to demonstrate identity of process between two groups may reflect either the absence of that process in one group, or our failure to determine the situations required to elicit it. For example, if we had relied on data from the discrimination-transfer studies to tell us about the way in which nonliterate Kpelle children learn discrimination problems, we might have concluded that they possess only "rote processes." However, we found concept-based learning in the transposition and reversal-shift studies. Similarly, the pseudoreversal studies suggested that nonliterate Kpelle fail to combine subproblems, but the inference data show this not to be generally true. Consequently, whenever we want to use an explanation that requires us to assume that one group "has a process" while another does not, our interpretation is open to question. It is always possible that further experimentation would turn up evidence of the hypothetical process under the proper circumstances.

With this caution in mind, we can consider the pattern of results produced by the series of studies on free recall. Our analysis of these data in Chapter 4 made use of the notions of storage and retrieval processes, two memory skills that appear to differ among high-school and noneducated Kpelle groups. At the end of Chapter 4 we offered a process interpretation of the effects of education. The nonliterate Kpelle have not learned to produce a structure for themselves that they can use for efficient storage and retrieval of information, while the high-school subjects routinely construct such structures. At this juncture, we would like to suggest the way in which this "production deficiency" (to use the term applied by Flavell, 1970) of the noneducated subjects is related to ob-

servations such as those made by Bartlett, Bowen, and many anthropologists about the keen memory capacities of nonliterate peoples.

In Bartlett's terms the to-be-recalled materials in our experiment are not reflective of a "persistent social tendency." Consequently, the subject cannot "fit" them into any pre-existing scheme of things. According to our present thinking, "persistent social tendencies" represent a ready-made organization that is habitually evoked by certain situations and used to structure recall. In the course of normal events, things are remembered because their natural contexts are organized in ways which are socially real for the individual. Presumably, our experiment in which to-be-recalled items were embedded in traditional-style folk stores provided the kind of structure that ordinarily serves to organize remembering, and in that situation we found the structure of recall matching the structure of the story.

But the more typical of our free-recall tasks failed to evoke any such natural structure. At least intuitively, one can see why this might be the case. Unlike most common memory situations, our experimental version of free recall uses grammatically disconnected material. The items named are familiar, but the motivation to remember them comes from an arbitrary source, such as the desire to earn money or appear clever. Recall is requested almost immediately.

In this sort of situation, there is good evidence that the typical American high-school student imposes his own structure on the to-be-remembered items. E. Tulving (1968) has shown that given sufficient practice, subjects will arrive at their own "subjective organizations," even when materials are explicitly designed to preclude obvious semantic connections. When semantic similarities are involved, they are quickly adopted, and significant semantic clustering is observed on the first trial of recall for children with five or six years of education (Cole, Frankel, and Sharp, 1971).

Nonliterate Kpelle, as well as elementary school children, show no evidence that they are imposing structure of the sort familiar among American schoolchildren. Over a wide variety of presentation conditions, the recall of our pre-high-school Kpelle subjects failed to improve markedly with practice or to show any marked organizational structure, despite a repeated search for organization in terms of order properties of the list or semantic categories. We even tried to apply measures that are sensitive to idiosyncratic organizations characteristic of individual subjects from one recall trial to the next, but had no success. Although

we cannot logically *prove* the absence of some organizing principle, we have to conclude that there exists no organization that contemporary methods of analysis can detect.

Our interpretation of these results, as already stated, is that the nonliterate Kpelle do not respond to the request to remember our lists of words (or objects) by producing a structure that can organize the material for effective recall a few moments later. This negative conclusion is supported by the experiment on constrained recall. In that study subjects in one group were asked to recall the items category by category for four trials. On the very first trial, recall was far better than in control groups without these constraints. And when recall was no longer evoked in a constrained manner on Trial 5, performance was still excellent, and very marked semantic organization occurred. (The only comparable result came in studies that used external cues to recall [chairs], but in this latter instance, the facilitative effect was fleeting, coming and going for reasons that we very poorly understand, although the same principles are presumably involved.) The combination of good recall on Trial 1 and maintained recall on Trial 5 suggests two conclusions: First, difficulty in the typical free-recall task occurs because subjects do not retrieve material they have stored. Second, effective retrieval skills can be learned.

Clearly, a good deal of additional research is required to pinpoint the cultural differences in memory that underlie performance on our free-recall tasks. We need to determine in what cases persons will learn to retrieve as in this constrained-recall experiment. Will subjects who have learned to retrieve items from one list also be able to recall a new list, or is the effect list-specific? Are there situations, other than the story context, that will produce highly structured recall? Are those differences in recall skills associated with various traditional Kpelle specialties? For example, do renowned story tellers remember in measurably different ways than people who rarely tell stories? Recent evidence from B. N. Colby (Colby and Cole, 1971) suggests that Guatamalan Indian story tellers are accomplished at using structural features to organize story elements, while novices are not. Is this skill content-specific, or would the accomplished story teller be able to produce his own structure in situations such as those upon which we have concentrated?

Until future research uncovers the natural situations for the display of memory skills, we must conclude that the skills necessary for effective short-term recall differ among cultures. Specifically, it appears that people who attend Western-style schools learn to provide structures,

which organize their recall of arbitrary material, while noneducated people do not.

In reviewing the remaining experimental results described in previous chapters, it appears that at least some suggest changes in basic cognitive processes for their explanation. For example, the responses to verbal syllogistic problems in Chapter 6 can be interpreted as reflecting "situation-bound" rather than hypothetical thinking. Possible support for this interpretation comes, for instance, from the experiment in Chapter 4 where subjects were asked to classify leaves using arbitrary group names (Sumo and Togba in place of tree leaves and vine leaves).

At present we are not willing to accept this inference. We prefer to pursue the hypothesis that members of the nonliterate groups studied in those experiments can reason hypothetically, but that they fail to see the applicability of such reasoning in our experimental tasks. Our preference in this case is based on ethonographic and experimental data, some of which are presented in earlier chapters of this book. For example, our discussion of secrecy in Chapter 2 (*ifa mo* "do not say it") and the paramount chief's summary of the court case in Chapter 6 both seem to require explanations in terms of an ability to entertain hypothetical states of affairs as preliminaries to action. In the case of the paramount chief, this process is made quite explicit. Similarly, our pilot work in which subjects were required to choose between two hypothetical offers of bride-wealth indicated that the premises of the problem could be made an important part of its solution.

There is no doubt, however, that in our experimental situation, such skills as the use of arbitrary labels to designate class membership or the use of hypothetical reasoning to solve a verbal puzzle are not manifested in ways we could consider obvious. Perhaps it is because the problems are in some sense counterfactual; perhaps it is because the experimental situation leads subjects to expect something different from the experimenters. Our task is to check alternative interpretations with a special eye toward the naturally occurring situations in which we think such reasoning is present. Is there an analogue in the use of the hypothetical mode to our recall study where the words were embedded in stories? If not, after we have exhaustively studied the use of arbitrary labels and hypothetical situations by the noneducated Kpelle and the changes in response that are caused by education, we may be in a position to specify the processes that underlie such performance and the factors that transform such processes. The pursuit of this question, and analogous questions having to do with other presumed cognitive pro-

cesses, is not an empty chase after "proof" of a theory. It is experimental anthropology, the process by which we can come to understand the cultural determinants of cognition.

"Cultural Deprivation"— Culture and Cognition American Style

It should be clear from all that has gone before that the study of culture and cognition need not (and we believe should not) be relegated to the status of an esoteric inquiry, best carried out in exotic surroundings. On the contrary, we hope that the principles that have evolved in the course of our research will have direct implications for the study of cognitive processes in a wide variety of cultural settings, particularly the study of subcultural differences as they are manifested in the United States today.

As we noted above, in studying cultural change, the cultures being compared are rarely considered different but equal. Nowhere is this more clearly the case than in the theories of psychologists and educators on the cognitive development of minority groups in the United States.

In surveying the major summaries of research on the "culturally disadvantaged" (Deutsch, 1969; Hellmuth, 1967; and many others), it soon becomes clear that various minority groups (blacks, Latin Americans, Appalachians, Indians, and so forth) are viewed as "victims" in what S. S. Baratz and J. Baratz (1970) have termed a "social-pathology" model of cognitive development. On the basis of test results (heavy reliance has been placed on IQ testing, but data from discrimination-learning, memory, and problem-solving studies are also used), the conclusion is reached that minority-group membership results in stunted cognitive development. At present the social-pathology view of minority inadequacy is dominant in the United States; prominently featured in such explanations are the failure to use language as a tool of thought, inability to delay gratification or work for long-term rewards, lack of concentration, and a list of other "deficits."

As Baratz and Baratz (1970) point out, the logic of this position leads to emphasis on earlier and earlier intervention in the lives of minority-group children to make sure that the deficit never develops.

It is only a short step from the social-pathology point of view to the adoption of the hypothesis that the deficit is present at birth or even ge-

netically based. The leading champion of this viewpoint at the present time is A. Jensen (1969), who began with the hypothesis that early environmental factors caused the inadequacies he measured in his experiments, but came later to believe that the difficulty was caused by inherited learning skills. Jensen's major thesis is that learning tasks can be categorized into two types on the basis of the kinds of skills required for their successful solution. Type 1 he calls "associative learning," a kind of learning that requires little transformation of the learning material. According to Jensen, groups do not differ with respect to their use of Type 1 learning. Type 2 learning, conceptual learning, requires transformation of the material for its successful completion. Jensen believes that whites possess this ability to a greater extent than blacks and thus show superior performance on certain tasks.

A third point of view, which is quite close to our own view, denies the existence of a general deficit, denies the existence of a social pathology (in the sense intended by psychologists and educators), and relies on observational and linguistic evidence to claim that the poor *performance* of minority groups on psychological tests is the result of various situational factors. A primary champion of this viewpoint is Labov (1970), who dramatically and effectively demonstrates the folly of concluding that substandard English implies substandard thinking and who goes on to demonstrate the existence of supposedly absent cognitive skills in naturally occurring situations.

We would like to suggest that the approach that we have used in this book can fruitfully be applied to the problem of subcultural differences in cognitive behavior in the United States. In particular, we want to emphasize our major conclusion that *cultural differences in cognition reside more in the situations to which particular cognitive processes are applied than in the existence of a process in one cultural group and its absence in another.* Assuming that our goal is to provide an effective education for everyone (and remembering that much of the trouble is caused by economic and political, not psychological, deprivation), our task must be to determine the conditions under which various processes are manifested and to develop techniques for seeing that these conditions occur in the appropriate educational setting. An important domestic step in this direction has recently been taken by Cazden (1970).

In reviewing contemporary thinking about minority-group deficits from this viewpoint, let us first consider Jensen's claim that non-whites inherit less Type 2 conceptual ability. Examples of situations said to reflect Type 2 learning which we have discussed in this book are transpo-

sition, discrimination reversal, and free recall. In each of these cases we found that all of our groups would, under some circumstances, show conceptual learning. Moreover, the rules describing the situations under which each kind of learning is evoked are by no means clear. Why should subjects use conceptual (relational) learning when transposing on the basis of size but not on the basis of brightness? Why should conceptual learning be manifested if the subject is given a reversal shift or many instances, but not if there is a nonreversal shift or only a few instances? Why should stories or chairs presented as part of a recall task produce conceptual-type learning, while presenting objects or telling people about the categories in the list fails to do so? How can brief training or exposure to the school experience so rapidly change the kind of process inherited by a person?

Although it is impossible to prove the absence of genetic influence on performance, what is required of a genetic theory is that it specify not only the processes, but the situations to which they will be applied. We find this prospect so unlikely that in the absence of some positive indication of its truth (and we have seen none so far), we suggest that it will be infinitely more fruitful to study the environmental-social factors that lead to changes in the application of skills that seem very widespread, if not universal, in their distribution across ethnic groups.

By this same token, we find ourselves very much in agreement with Labov and others who criticize the psychologist's and educator's view of cultural deprivation. However, we are also concerned with the fact that, for whatever cause, minority-group performance in a wide variety of educational settings is such as to insure their continued low position in American society. Assuming a willingness on the part of society as a whole to provide minority-group children with a first-class education (an assumption that is by no means clearly justified), we need to combine Labov's insights with a systematic study of why problem solving and learning skills are not applied in the classroom. Some of these causes, as Labov and others have suggested, are motivational. Since it does not pay off for a black child to work hard in school, he does not try. But as our data and common observation suggest, even when he tries, the member of the "minority" culture is likely to have trouble in school because he is learning in inappropriate ways. The problem of transferring skills applied on the streets to the classroom is not solved by demonstrating the existence of the skill on the streets. The child must be taught how to apply those skills in the classroom. But before

we can do this, we must understand the nature of street and school activity. In short, we must combine ethnography and experimental psychology in the service of understanding the relation between culture and thinking.

APPENDIX A : A Description of the Major Subclasses of the Seŋ Chart

Consider things of the town as the first major subdivision of the *seŋ* chart. They are divided into four classes, namely, *people, playing things, structures,* and *town animals.*

The class of *people* is further subdivided in seven ways. These classes are not mutually exclusive, but cut across each other, depending on the basis of classification, as the labels in the subgroups indicate. *People* are classified into *children, adults, good persons, evil persons, workmen,* and *persons' appearance* and *status. Children* are subdivided in ways implying a theory of physical and social maturation. *Adults* are classed both according to age and increasing responsibility and according to wealth and power. *Good persons* are those who are respectful, helpful, clever, and capable of wise counsel, as well as those who are physically beautiful. *Evil persons,* on the other hand, are those who commit what the culture defines as a crime, or else those who are physically ugly. The tasks that define the class of *workmen* are first those that everyone in the society must be able to perform and, second, those performed only by skilled specialists. The final two subdivisions consider the ways in which a person can be beautiful or ugly, and a person's status, whether he is rich or poor, healthy or sick, tribesman or stranger. Shifting bases of classification within this domain are clearly indicated in this description.

Playing things are those that are used within the town for entertainment. They are in five groups: *masked dancers,* the *equipment* these dancers require, *musical instruments that are beaten, musical instruments that are blown,* and *games.* The first four classes have ties to the activities of the secret societies, but do not in fact include the important

secret figures of those societies, which are classified as *forest things*.

Structures, literally called "town-works," are all those buildings in the town that are fixed in one place, as opposed to man-made objects that are movable. *Structures* are of five main types: *houses,* which have both roofs and walls; *sheds* (called in Liberia "kitchens"), which have roofs, but no walls; *fences,* which have walls but no roofs; *looms;* and *benches.*

Town animals are animals domesticated by man, which live in the town. The town is fenced in order to keep them in, since they can do great damage to farms and also can be caught and eaten by wild predators. *Town animals* are of two types: *birds,* including *chickens, guinea fowls,* and *pigeons;* and *walking animals,* including *sheep, goats, cows, dogs, cats, hogs, rabbits,* and *guinea pigs.*

Those things that are unambiguously identified as *forest things* are of four types. They include *trees, vines, shrubs,* and nonhuman spiritual beings called *evil things. Trees, vines,* and *shrubs* are classified according to their method of growth. *Trees* are plants (to use an English term in a non-Kpelle way, since for the Kpelle plants are specifically those things that are planted by man) that have a main stem and that are capable of standing by themselves. *Vines* are plants that have a main stem, but that cannot stand by themselves, requiring a host tree around which to wrap themselves. *Shrubs* are low leafy plants without a main stem. Each of these classes was subdivided by Kellemu's informants into *forest* and *planted* groups, but of those subdivisions only those that grow wild were strictly called *forest things.*

The class of *evil things* has seven subgroups. The first two are *namu* and *zele,* who are the supposedly supernatural leaders of the male and female secret societies, called *Poro* and *Sande.* These beings are not supposed to be human; they have the power to eat uninitiated boys and girls and then bring them back to life at the end of their training in bush school. The third class of *evil things* consists of *supernatural beings* that frighten persons at night by the roadside. The fourth class can be glossed as *witches,* usually people who transform themselves into animals in order to do evil deeds. Fifth are the *genii,* so called because they somewhat resemble the spirits of Muslim mythology. Sixth are *dwarfs* who inhabit the deep forest and can bring either evil or good fortune. And seventh are *spirits of the dead,* whose relation to the members of their family depends on the respect paid to them.

These two classes—*town things* and *forest things*—do not exhaust

the universe of *seŋ.* There are objects that belong simultaneously to the town and the forest. Some things within the vine that marks the borders of the town belong to the world of growing plants, and some things within the forest are manufactured and controlled by man.

The first such shared subclass is the *earth,* which is the material substratum for both town and forest. The earth is of four types—*dirt, stone, sand* and *mud.*

Other classes that are found as subclasses of both *town* and *forest* are *planted trees, planted vines,* and *planted shrubs.* These are classed by the Kpelle with the *wild trees, vines,* and *shrubs,* but are also classed with *town things.* There was a substantial debate among the elders consulted by John Kellemu concerning the proper classification of these *planted things.* The conclusions reached by the debaters show clearly the shifting bases of classification. Some said that they are *forest things* both because they originated in the forest, and because they are only cultivated in the forest. Other elders said that *planted trees, vines,* and *shrubs* are town things since they are necessary to life and since they are taken from the town in seed form and planted in the forest. Moreover, some of these things are actually planted in gardens within the town boundaries.

The third shared class consists of *working things,* which form a kind of bridge between the things of the town and the things of the forest. Its members are in most cases made by man and in the remaining cases are things found by man in the forest and then put to use. *Working things* are subdivided into four major subgroups: *medicines, vehicles, traps,* and *household things.* Each of these subgroups consists of objects made by men from forest raw materials to achieve some specific goal. *Medicines* give man power over the life of the spirit and the afflictions that can come to man through uncontrolled spiritual activity. *Vehicles* are all objects that are hollow in form. Traps enable man to capture animals in the forest. And *household things* make possible the ordinary round of daily activity and life.

Medicines are divided into six subgroups. The first consists of *herbs* used for the prevention and cure of common diseases. The second consists of *charms* and *amulets,* which aid in such enterprises as hunting, traveling, gaining vines, raising good crops, identifying thieves, and exposing witches. The third category includes specialized *secret societies* (other than the principal tribal secret societies), which deal with witches, spirits, lightning, snakes, hunting, and water animals. The

fourth group is *evil medicine,* including *poisoning* and *sorcery*. The fifth group consists of a series of *methods for divining reasons for events*. Finally, *western medicines* compose the sixth subgroup.

The translation *vehicle* is a lame approximation to the Kpelle concept. This class includes canoes, airplanes, and trucks. It also, however, includes the hollowed log in which palm oil is prepared as well as that in which raw rum is fermented. Finally, it includes drums used by certain secret societies as well as by cooperative work groups. The implication seems to be that these objects are all hollow, and all participate in an activity causing a change of state or position of some object or material.

The Kpelle are familiar with *traps* for animals ranging from mice to leopards to fish. The techniques of trapping are diverse and technically clever, including nooses that are sprung by the animal and enclosures to which access is easy but from which escape is almost impossible.

The fourth subgroup of *working things* consists of things useful to the daily life of the household. These are of four kinds, including *sleeping things, clothing, tools* and *things used for cooking* (*foods*). *Sleeping things* are of three kinds: *beds, mats,* and *sleeping clothes*. *Clothing* is divided into two basic groups, consisting of *men's clothes* and *women's clothes*. Both men and women's clothing include cloth, iron, wooden and leather items, while women's clothing includes also cosmetics and beads. A wide variety of *tools,* ranging from needles to spears, is used in Kpelle life. These tools are literally "iron things," since all are made by the blacksmith out of iron. Things used for cooking are of two types, *utensils* (literally "empty things") and *foods*. The *utensils* are all hollow objects used for preparing food, while the *foods* themselves are all the things the Kpelle eat.

Foods form a complex subclass of the Kpelle world. The basic division is into those foods that are clearly *town things,* kept in the house and used as needed, and those *foods* that are taken from the forest as needed. *Town foods* include condiments, such as oil, salt, and pepper, and prepared foods, such as greens, dried meat, and cleaned rice. *Forest foods* are divided into six groups, which overlap to some extent with the plants of the forest. They include *root crops, tree fruits, vine fruits, water foods, mushrooms,* and *meat*. The first three are divided into crops that are planted by man and those that grow wild. *Liquid foods* include *drinking water, oils,* and *honey*. The Kpelle name at least twenty-four different varieties of edible mushroom, in addition to many that are not edible.

The most complex subset of foods is that named by a term that can be translated either *animal* or *meat*. *Animals* of the forest are classified according to their foot structure. their mode of locomotion, and their habitat. These groups overlap considerably, so that the same animal may appear in two or three categories. *Animals* are classed according to whether they have two-part or four-part hoofs or claws; according to whether they drag themselves (for example snakes, fish, and worms), crawl, leap, fly, or burrow; and according to whether they live in trees or in the water. For instance, the tree squirrel is an animal with claws that lives in trees and that burrows to make its home. In the West we might prefer to make, for instance, the mode of locomotion the principal characteristic, and use the other classifications as subheadings, but the Kpelle informants do not choose to operate this way.

APPENDIX B : The Application of the Similarity - Distribution Technique

The similarity-distribution procedure is applied as follows: a subject is verbally presented a set of items (in our case, nouns drawn from the *seŋ* chart) one at a time and asked to make up a sentence using each word. When each word in the set has been used in a sentence, the sentences become frames and the subject is asked to judge the appropriateness of using each word in each sentence according to a fixed criterion. The criterion that our subjects were asked to use was, does this sentence make good Kpelle sense?

A matrix with items (words) across the columns and sentences across the rows (see the example in Figure B–1) is made up, and the subject is interrogated concerning the entire set of sentences and words. Whenever a subject accepts a sentence using a particular word, a one is placed in the matrix at the intersect of the particular word-sentence combination. If the subject disagrees, a zero is entered in the intersect. Proceeding in such a manner, a symmetrical "frames-by-items" matrix is generated with each intersect containing either a one or a zero. The matrix is then subjected to computer analysis and the items rearranged such that items that show similar patterns of ones and zeros are placed next to each other, while those that show dissimilar patterns are placed further apart (Stefflre, 1963). For example, the informant might be given the following set of items: pot, orange, banana, hoe, hammer, pan, and cutlass. Figure B–1 represents the matrix elicited from an informant. When this matrix is subject to analysis, rearranging items according to similar pat-

	Items	Pot	Orange	Banana	Hoe	Hammer	Pan	Cutlass
Frames	A ___ is used for cooking	1	0	0	0	0	1	0
	An ___ is a fruit	0	1	1	0	0	0	0
	I ate a ___	0	1	1	0	0	0	0
	A ___ is used in farming	0	0	0	1	0	0	1
	A ___ is used in building	0	0	0	0	1	0	1
	There is milk in the ___	1	0	0	0	0	1	0
	A ___ can be used for clearing	0	0	0	1	0	0	1

FIGURE B–1 Input Matrix for Hypothetical Distributional Similarity Data

terns of ones and zeros, a rearranged matrix is the result (see Figure B–2). As can be readily seen in Figure B–2, three groups, or clumps of items, appear to emerge according to the similarity of their patterns of ones and zeros. This technique is applicable either to matrices obtained from individual informants or to a group of matrices summed over individual informants. In our use of the procedure only the lexical items were common to informants, and rearranged orders of the columns were the data of primary interest.

The first study described in Chapter 3 employed the thirty-five major subheadings of the *seŋ* chart as presented in Table 3–1, while the later studies looked more closely at the relation between and within subordinate classes.

Two additional similarity-distribution studies were run to evaluate relations within the two major *seŋ* groups, *town* and *forest*. All proce-

		Utensils		Tree Fruit		Tools		
		Pot	Pan	Orange	Banana	Cutlass	Hoe	Hammer
Frames	A pot is used for cooking	1	1	0	0	0	0	0
	A pan can contain milk	1	1	0	0	0	0	0
	An orange is a fruit	0	0	1	1	0	0	0
	A banana is sweet	0	0	1	1	0	0	0
	A cutlass can be used...	0	0	0	0	1	1	0
	A hoe is used in farming	0	0	0	0	1	1	0
	A hammer is used for building	0	0	0	0	1	0	1

FIGURE B–2 Rearranged Matrix for Hypothetical Distributional Similarity Data

dures were the same as those described in Chapter 3 except that (1) the terms used in one of the elicitations were all from the set of *town things,* while the other set was made up of *forest things;* and (2) the items used were all subordinate to the things named by the terms in the previous elicitation—in short, we selected more concrete items.

Once again we observed ordering of the stimulus terms that was consistent with the ordering in the *seŋ* chart (see Tables B–1 and B–2), although secondary inconsistencies again appear.

Some of these inconsistencies undoubtedly reflect ambiguities in the *seŋ* chart. Others probably reflect insensitivity of the similarity-distribution technique applied so that subjects choose their own sentence frames. Where subjects choose very general frames (as our subjects often did), lack of discrimination results.

TABLE B-1

Seŋ Chart Rearranged Town Items

ITEM	SUBHEADING	HEADING
hunting medicine farm and hunting charm hunting-society charm witch protection	medicine .629	work
.478		
water for drinking 1.00	liquid foods	food
.412		
town birds (subheading) chicken with fuzzy feathers domesticated pigeon duck guinea fowl	town birds .715	town animals .658
.641		
goat sheep cow walking animals (subheading) dog cat	walking animals .670	
.476		
palm oil palm nut oil honey	liquid foods .792	foods
.585		
shirtlike dress dancing calabash dancing whip blacksmith charm hunting shells dancing bell	dancing equipment .644	play .612
.544		
cow horn harmonica bugle military dance band wooden horn band	things that are blown .771	
.264		

(continued)

TABLE B-1

(continued)

ITEM	SUBHEADING	HEADING
body burier skilled worker farm worker	workers .842	people .902
.881		
wise person shame person one who loves others	good way people .940	
.927		
lazy person 1.00	bad way people	
.926		
light-skinned person short person medium-skinned person dark-skinned person	people as made .949	
.931		
son of the soil 1.00	people's mode of being	
.908		
bad way person (subheading) liar	bad way people .939	
.942		
adviser 1.00	good way people	
.960		
vagabond 1.00	bad way people	
.963		
story teller good way people (subheading)	good way people .955	
.905		
thief 1.00	bad way people	
.871		
medium-height person 1.00	people as made	
.888		
trader 1.00	workers	
.889		

(continued)

TABLE B-1

(continued)

ITEM	SUBHEADING	HEADING
stranger westernized person	people's mode of being .846	people (continued)
.659		
stupid person 1.00	bad way people	
.457		
Gola masquerade Sande masquerade Gbande masquerade small boy's masquerade small girl's masquerade	things that dance .855	play
.141		
night dew 1.00	liquid foods	foods

TABLE B-2

Seŋ Chart Rearranged Forest Items

ITEM	SUBHEADING	HEADING
large flat rock stone mud dirt sand		the Earth .407
.245		
alligator 1.00	crawling animals	Forest animals 1 .466
.282		
leech black swamp worm grey swamp worm large snakelike worm	worms .588	
.285		
thorn-covered vine rubber vine medium-sized vine	wild vines .556	
.232		

(continued)